

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIII.—No. 17.
(NEW SERIES.)

NEW YORK, OCTOBER 23, 1875.

[\$3.20 per Annum.
(POSTAGE PREPAID.)]

MODERN SUSPENSION BRIDGES.

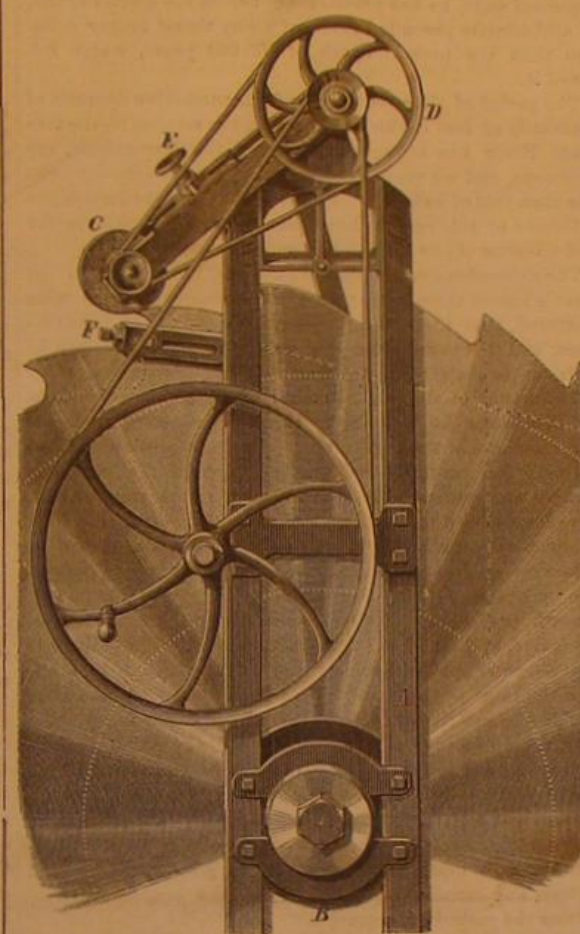
At Kiev, one of the most ancient towns in European Russia, and for centuries the recognized capital of the whole empire, is one of the most graceful and solid bridges ever erected. The roadway is perfectly level, being suspended from catenary chains of great strength which hang between the piers, of which latter there are five. Although the dimensions of these spans have been far exceeded in many bridges in the country, it will be admitted that the architect of the Kiev bridge has united, to a form of construction exceedingly difficult to treat with any artistic effect, a picturesque and imposing appearance.

Although we are accustomed to consider the suspension bridge as one of the triumphs of modern engineering skill, it is really one of the oldest forms of bridge construction in existence. In the year A.D. 65, Ming, the Emperor of China, built one in the province of Yun-nan; it was 330 feet long, and the road bed was laid directly on chains suspended across the river and drawn comparatively taut. In the time of the Incas of Peru, suspension bridges across the defiles of the Andes were made of ropes of the bark of trees; a roadway was in some places constructed, and in others a basket was drawn to and fro. The latter plan is in use in that country in this day. The iron suspension bridge was not brought into use till the year 1819, the first being the bridge at Berwick-on-Tweed, England. The roadway was hung to 12 cables, and the span was 449 feet, a considerable distance for a first attempt. Telford's bridge over the Menai Strait has a span of 580 feet. The Conway bridge by the same engineer, 327 feet, and Tierney Clark's bridge over the Thames at Hammersmith, London, 423 feet, were considered marvels of engineering in their day; but the wire bridge at Fribourg, Switzerland, with a span of 870 feet, eclipsed all previous achievements. But of late years, suspension bridges have been numerous constructed, and we have ceased to marvel at the dimensions they assume. The Cincinnati bridge has a clear span of 1,057 feet; and the most remarkable of all the suspension bridges yet designed, the New York and Brooklyn, is to have a span of 1,595 feet, the whole bridge being 3,475 feet long.

It must be considered that the bridges of the future, for long spans, will be constructed on the suspension plan. The great superiority of the iron and steel of the present day, and the improved facilities for turning out large masses of these metals, make it impossible to limit the capability of bridge constructors to defy the difficulties which Nature has placed in their way; and every year shows us fresh achievements in the art of engineering the way over crevasse, canons, and defiles.

J. AND J. A. CROOK'S SAW SHARPENER.

The annexed illustration represents a new saw sharpener, consisting of emery wheels adapted for dressing both sides



of the teeth and gumming the saw. It is claimed that by the use of the device the saw is kept perfectly circular, and the teeth equidistant and of similar shape. The saw, it is further stated, will last longer, since no more metal is used than is necessary (see dotted lines in the engraving). The employment of files is obviated, the teeth are cut square

across, and the work is done in one half the time usually required.

The radius bar, A, is provided with adjustable bearing pieces, B, which fit on the saw collar. At the outer end of the bar, a frame is pivoted which carries the grinding disk, C, and also, on the same mandrel, not shown, a smaller disk. These are turned by the belt from the pulley, D, which is actuated by the driving pulley on the radius bar. The pivoted frame swings toward and from the teeth, and has a spring which tends to keep it away from the latter. It has also a gage screw, E, which touches a stop when the teeth are dressed off sufficiently, and thus gages them to uniform sizes. Another gage, F, regulates the depth of the notches when gummed out by the small grinder. Both of these gages are adjustable to adapt the machine to different saws.

The large emery wheel, C, serves for dressing the teeth on the top, and the small one dresses the under or concave side of the teeth and gums the saw plate. Said wheels are adjustable lengthwise on their axis to adapt each for being located in the desired position relative to the saw. They are clamped in place by means of collars which are screwed along the mandrel. When the small wheel is used, the gage screw, E, is screwed back sufficiently to let the wheel drop into the notches, to the required extent. The stop for the gage screw is contrived so that the frame may be shifted over to the opposite side of the axis, as may be sometimes required for saws having the teeth arranged reversely to the direction of the same shown in the engraving. The driving wheel, gage, F, and a spring cam lever—which swings down on the opposite side of the saw and over a cam to hold the radius bar to the side and on the collar—are also arranged to shift in the above manner and for like purposes. The grinders are pressed on the teeth, and the radius bar is moved forward and backward along the teeth by one hand, while the crank is turned by the other hand.

Patented through the Scientific American Patent Agency, January 5, 1875. For further particulars regarding sale of State rights, etc., address the inventors, Messrs. J. and J. A. Crook, Augusta, Carroll county, Ohio.

PREVENTING SUFFOCATION IN THE EARTH.—M. A. G. suggests that, in cases of men being accidentally buried in the earth, who frequently survive some time before completely suffocated, iron pipes, of the sort used for drive wells, should be driven down just at the edge of the soft earth until the proper depth is reached: when, by the application of a pump at the top, an abundance of fresh air could be forced down to sustain life until the men could be rescued by digging.



SUSPENSION BRIDGE OVER THE DNIEPER AT KIEV RUSSIA

Scientific American.

MUNN & CO., Editors and Proprietors.
PUBLISHED WEEKLY AT
NO. 87 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included.....\$3 20
One copy, six months, postage included.....1 60

Club Rates.

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included.....2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXIII, No. 17. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, OCTOBER 23, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

Alum, crystallizing (35).....	268
American Institute fair, the.....	268
American inventions in Europe.....	268
Amusements, outdoor.....	268
Aniline colors (31).....	268
Animals, infusorial (19).....	268
Answers to correspondents.....	268
Ants, caterpillars (22).....	268
Batteries, positive elements of (21).....	268
Bitters, about.....	268
Boiler phenomena, steam.....	268
Boilers as fertilizers (6).....	268
Bones as fertilizers (6).....	268
Brass, melting (26).....	268
Bridge over the Dnieper, Russia.....	268
Burner, solid flame Bunsen.....	268
Burglar alarms.....	268
Business and personal.....	268
Cane juice, clarifying (13).....	268
Carnivorous plants.....	268
Chemist's escape, an amateur.....	268
Cloth, a fire and water proof (28).....	268
Coal tar colors, determining.....	268
Coal, the origin of.....	268
Crocodile, a lion.....	268
Cuts, liquid styptic for (32).....	268
Dandruff in the hair (11).....	268
Diamonds, veneered.....	268
Diffraction, lines of.....	268
Electrical phenomena, etc.....	268
Electric force, etc.....	268
Electricity, atmospheric.....	268
Electroplating with tin (25).....	268
Engine counter and tell-tale.....	268
Engines, steam, portable.....	268
Epizootic in horses, the.....	268
Fire escape, a new.....	268
Flat surfaces.....	268
Printing apparatus, new.....	268
Fluxing silver (9).....	268
Furniture, combination.....	268
Galvanized iron, finishing (34).....	268
Galvanometer, lightning rod (19).....	268
Gas, coal, absorption of (12).....	268
Gas from petroleum.....	268
Gas regulator, new.....	268
Geology of the West, the.....	268
Glue, hardening (37).....	268
Heater, ventilating.....	268
Horse feeder, automatic.....	268
Industry, a new.....	268
Ink, acid-proof (23).....	268

THE GEOLOGICAL IMPORTANCE OF OUR WESTERN EXPLORATIONS.

In no period of the world's history has there been a greater activity displayed in enterprises to increase the knowledge of our globe and its history than at the present day: as instances of which may be cited the explorations in Central Africa, those of the ruins of the cities of antiquity, such as Nineveh, the expeditions to the north pole, intended for settling the mystery of an open polar sea, the deep sea soundings in the Pacific Ocean, proving the existence of a sunken continent, and, last but not least, American explorations in the Great West, now in progress, which have already contributed to our knowledge of geology facts of greater importance than any obtained during the previous half century. It is especially in the region of the Yellowstone River, abounding as it does with hot springs and geysers, and in the valley of the Colorado, that the most instructive features have been discovered. While, in the last few decades, the importance and universality of slow upheavals have been demonstrated, the explorations have shown that a second agent, namely, erosion, is of the utmost importance, and results in a variety of features, varying with the nature of the soil, the climate (wet, dry, or rainless), presence or absence of winter frosts, etc.

In Colorado, the erosion by the rivers produces cañons in the comparatively easily worn-out rock of thousands of feet in depth; while the aridity of the climate prevents the rain from destroying the results of the erosion, as is the case in countries where rainfall is of ordinary occurrence. If is evident, therefore, that the arid regions around the Colorado river give specially favorable opportunities for studying the effects of erosion, and the recent researches in that country have resulted in classification of these effects, as 1, the erosion of water gaps, 2, the cliff erosion of cañons, 3, hogback erosion, and 4, hill and mountain erosion. The second and third classes are due to the undermining action of water in arid climates; while in the first and last, this action is modified by surface washings in rainy or moist climates.

When another topographical feature is added, namely, the eruption and outpouring of molten matter from below, its overflow covering the eroded lands, and its subsequent erosion in its turn, a new field of investigation is opened, especially instructive in arid climates, where surface washings do not destroy the prominent points of interest. This makes the region of the Colorado particularly rich in peculiar features, such as cañons and cañon valleys, volcanic caves and volcanic mountains, cliffs and hogbacks, buttes and plateaux, naked rocks and drifting sand, bluffs, valleys, etc. All the mountain forms of this region are due to erosion, being

carved out by the running waters; but notwithstanding the aridity of the climate in many localities, beds hundreds of feet in thickness and hundreds of thousands of square miles in extent, beds of schist, granite, limestone, sandstone, shale, and lava, have slowly yielded to the unseen powers of the air, crumbled away into dust, and been washed away by the rivers. It is an illustration on a gigantic scale of the return of the lands to the ocean depths from which they once arose.

It appears, however, that the climate there has not always been so arid as it is now; so the basin of the Great Salt Lake, which is now so depressed that its waters have no outlet to the sea and are entirely disposed of by evaporation, leaving all dissolved matter behind, had once a moist climate and so much rain that the valley was filled with water to its brim, forming a large and deep fresh water lake, which had its outlet into the Columbia River. Mr. G. K. Gilbert, who studied the features of this outlet, considers its epoch identical with the glacial period; and from a further study of the deposited soils, he has proved that, before the glacial epoch, an arid climate prevailed there of many times longer duration than the present epoch of 100,000 years, which followed it.

The period of time required to form successive deposits of thousands of feet in thickness, which the erosion of the Colorado River has brought to light, in its deep cañons, are enormous, and we cannot suppose that here the erosion was less than that of other rivers, although in moist climates the evidences of this erosion have been destroyed; while in the arid climates of our West, they were preserved.

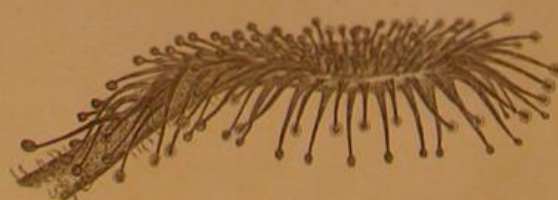
The evidences are that that region was lifted up from the ocean's bosom three times; that three times the rocks were fractured, that three times the lava poured out of the crevasses, and that three times the water carved out valleys in their course seawards. The first of these periods was after the formation of the granite rocks; the second succeeded the red sandstone formation; the third period is the present. The remnants of the first and second periods are buried; but we know that, unnumbered centuries ago in the past, the granites and schists, now on the bottom of the grand cañon, were formed as a sedimentary bed beneath the sea, that then an upheaval took place, after which thousands of feet of beds were washed away in the sea by rains; then a depression took place, sinking the whole region some 20,000 feet beneath the ocean's surface, and allowing the formation of sandstone, at least 10,000 feet in thickness, as a sediment; then a second upheaval came, changing it again into dry land; then the rains washed away channels in the sandstone 10,000 feet deep, requiring countless years of gentle but unrelenting energy. Again the sea rolled over the land, which became its bottom, and received a new deposit of more than 10,000 feet of rocky bed; and lastly, this ocean bed was again upheaved, and for 100,000 years the atmospheric influences and the running streams, gathered from the clouds in the highest mountain tops, have been making gorges, cañons, and valleys, and carrying the debris back to the sea, from whose bottom the material all came.

We ask: Will the sea, at some future period, invade that land, by the sinking down of the latter, and will coral reefs be formed, and serve perhaps for the burial of the bones of the beings which shall then exist? Will the surrounding continents or islands be washed into that sea and form new beds of rock, which, when again upheaved, will form a new land, and cañons again be formed, and reveal in their walls, to another race of intelligent beings, some of the features of the time in which we live at present?

CARNIVOROUS PLANTS.

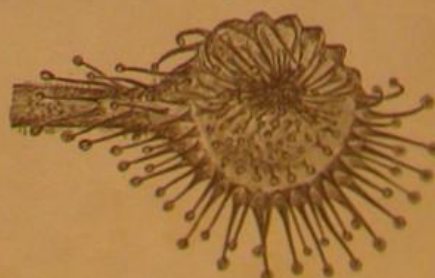
Mr. Darwin has recently added to the literature of modern botanical discovery a valuable work on "Insectivorous Plants." Without reciting the history of the researches into

Fig. 1.



this interesting subject, which has already been fully treated in our columns, we will simply state the author's broad proposition, which, coming from such an undoubted authority, must be considered as a final settlement of theories which were, till recently, still undergoing investigation. This proposition is that certain plants, chiefly the *Drosera* or sundews, devour insects in the ordinary acceptance

Fig. 2.



of the term, that is, they kill, swallow, digest them, and absorb and assimilate their juices. Some (such as the *Drosera*) secrete and exude a viscid fluid, to which insects adhere as they do to the buds of the horse chestnut and the corollas of the Caps heaths; but these are not insectivorous.

But the *Drosera rotundifolia* shows a higher organization, being endowed with sensitive tentacles, of which we give a representation in Fig. 1. Each of these tentacles terminates in a knob, from which issues a glittering secretion, on account of which the plant has been called the sundew; and each tentacle can bend over towards its prey, either independently of or conjointly with the adjacent tentacles. Fig. 2 shows one half of the tentacles bent over and the other half erect. Almost any kind of interference with the tentacles, such as lightly touching them, placing inorganic substances upon them, or especially putting organic matters (particularly such as are nitrogenous) on them, will set the sundew in motion; and the more soluble the matter enfolded by the tentacles, the longer do they remain inflected over it.

In our third engraving are shown the magnified cells of the tentacles, exhibiting the various forms assumed by the

Fig. 3.



protoplasm. Mr. Darwin says: "If a tentacle is examined some hours after the gland has been excited by repeated touches or by inorganic or organic particles placed on it, or by the absorption of certain fluids, it presents a wholly changed appearance. The cells, instead of being filled with homogeneous purple fluid, now contain various shaped masses of purple matter, suspended in a colorless or almost colorless fluid; and shortly after the tentacles have re-expanded, the little masses of protoplasm are all re-dissolved, and the purple fluid within the cells becomes as homogeneous and transparent as it was at first."

Mr. Darwin's investigation also comprised an elaborate study of the digestive apparatus of the plants, and of the secreted fluids, which, beyond any doubt, perform the functions of the gastric juice and of a kind of pepsin, the latter being necessary to the complete direct assimilation of animal matter to a vegetable body.

THE FAIR OF THE AMERICAN INSTITUTE.

There is an ingenious device in a rather out-of-the-way corner of the fair, which will prove interesting to owners of horses, inasmuch as its object is to benefit the animals in a variety of ways, and principally by protecting them from negligence on the part of stable men. It is

AN AUTOMATIC HORSE FEEDER.

consisting of a simple clock, the works of which are connected by a cord with the hinged bottom of a grain hopper or water receptacle. At certain hours to which the clock mechanism is adjusted, the cord is slackened, and the bottom of the hopper or water vessel falls, allowing of the escape of the contents into the manger. This escape takes place for a certain quantity of material is measured out, and then the bottom shuts, preventing a further supply. The horse is thus fed at exact hours and given a previously determined amount of food and water, without the intervention of the stable people, or requiring any other care than the timely winding of the clock.

BURGLAR ALARMS.

in great variety are exhibited. The simplest is one which travelers can carry in their trunks or even pockets, and which will be found an excellent protection against the entry of thieves into an hotel room. It is a small wedge-shaped case of metal, containing a gong, the hammer of which is actuated by clockwork. The latter is wound, and the device is placed on the floor with the edge of the wedge just in front of the door. When the door is opened, however gently, from the outside, it strikes against the wedge, and suitable mechanism therein frees the spring of the clock train so that the gong is loudly and continuously sounded. The noise is sufficient to arouse the soundest sleeper. The invention might easily be adapted for windows as well as doors.

A NEW INDUSTRY.

bids fair to be set on foot, through the utilization of the fir and pine tree leaves. Mr. Charles Fulton has devised a process by which the coherent parts, such as resin, wood, tannin, etc., from the fibers of the needles or acicular leaves, are dissolved and removed by boiling in suitable chemicals. The result is a substance resembling cotton, or perhaps more nearly wool, of a dark greenish brown color. It is prepared in four qualities, adapted for stuffing mattresses, pillows, etc., and for weaving. For the latter purpose, the fibers of the material are separated and treated in machines similar to fulling mills. Other processes follow, which result in the production of an excellent thread, which can be woven alone or mixed with wool, cotton, silk, or other fibers. Cloth of very close and fine texture is exhibited, made of the thread. It is soft and pliable, and resembles a fair quality of flannel. There is an enormous amount of raw material for this manufacture in the country, which now is of no value, and which can be obtained at simply the cost of transportation. By the process above described, it is rendered available both for textile and for paper industries, and hence may form a new and valuable supply.

The needs of dwellers in the narrow quarters of our city flats must be uppermost in the minds of inventors, if we may judge from the quantity of

COMBINATION FURNITURE.

that is displayed. We spent an amused half hour in watching agile exhibitors put bedsteads and couches through astonishing transmutations, and departed as much entertained

as if we had witnessed the wonderful performances of the impossible furniture of the average pantomime. At one instant, we observed an individual stretched upon a bed; we looked again, and the bed had vanished and its occupant was calmly sitting by a table. Another person launched himself at an inoffensive couch and dragged fiercely on handles and pulled on strings, and behold, a bookcase developed itself. Then there are pieces of furniture which are riddles in themselves; one never knows when he is through finding things in them. For instance, there is an affair which looks like an overgrown book case. On each side you discover a swinging rack of paper files; then you lift up a flap and pull out some legs, and there is a writing desk with a pivoted inkstand swung in it. You pull aside the flaps, and a series of closets and drawers appear. At the ends you discover more writing desks, with sunken inkstands and receptacles for pencils, more doors and pigeon holes, more cupboards underneath, until you depart, lost in admiration at ingenuity which leaves such simple affairs as Chinese puzzles far in the shade.

A PUFFING MACHINE

is something new for the ladies. There is a corrugated bed piece, and a kind of hand iron having a bottom similarly corrugated to fit into the indentations of the bed. The bottom of the iron is, however, V-shaped in section, the apex of the V being in line parallel with the direction of the handle, which resembles that of the common flat iron. Both bed piece and iron are heated, and the gathered material is dampened and pressed between the two until dry. The work is very neatly accomplished. The same machine may also be used, for fluting, in which case a corrugated comb not heated is substituted for the iron.

A NEW FIRE ESCAPE

is exhibited, which seems to us one of the best of the many similar inventions which have appeared. It consists of a swing ladder, with hickory rounds and wrought iron links. Between each pair of rounds is a light frame of iron which keeps the ladder out from the building. A hook on the upper end sustains the whole, when in use. It can be folded into a very small parcel, and weighs about one pound to the foot.

We defer reference to the

MACHINERY DEPARTMENT

for a time, until further novelties appear; as the present contents, though numerous, are almost entirely composed of machines already well known to our readers.

SCIENTIFIC AND PRACTICAL INFORMATION.

PROGRESS OF THE MILLION DOLLAR TELESCOPE.

Mr. Lick has fixed on Mount Hamilton, in Santa Clara county, Cal., as the most eligible site for the establishment of the observatory in which the great telescope is to be located, and he has notified the county supervisors that he will begin the erection at once, if they will construct a road to the summit of the mountain. As Mr. Lick offers to advance the necessary money to begin work on the road, and accept its bonds in payment, it is probable that his proposals will be adopted, and hence there is an excellent prospect of the much-talked-of telescope becoming ere long an accomplished fact.

Mount Hamilton is 4,448 feet high. The summit is higher than any land within 50 miles, and consequently below the level of the plane of the observatory, which, in an astronomical point of view, is the desideratum sought. The beautiful valley of San José, the snowy ridge of the Sierra Nevada, and a boundless area of mountain scenery are in the scope of vision, and the elevation is so high as to be above the fogs of summer, and is not so high as to be much disturbed by the storms of winter.

ABOUT BITTERS.

The Board of Health of the city of Boston, Mass., not long ago appointed Professor W. R. Nichols, a celebrated chemist of that city, to examine into the various concoctions enormously advertised and sold to an unsuspecting public under the mild name of "bitters." Mr. Nichols is continuing his investigations, and up to the present time has elicited enough to warrant a wholesale condemnation, certainly, of the most popular of these disguised drinks. He says that, out of twenty samples, only one did not contain alcohol, and that had the least sale.

IMPROVED SUGAR MACHINERY.

Messrs. Morris, Tasker & Co., of Philadelphia, are now shipping a large amount of machinery to be used in Louisiana in a new process of manufacturing cane sugar. The method is what is known as the diffusion process, as distinguished from the maceration process, which is that of all previously constructed sugar machinery. The cane is passed between rollers by the old method and the juice squeezed out. In the new, the cane is sliced and the saccharine matter is dissolved out of it.

PARLOR MAGIC.

The following beautiful experiment in instantaneous crystallization is given by Péligot in *La Nature*: Dissolve 150 parts, by weight, of hyposulphite of soda in 15 parts boiling water, and gently pour it into a tall test glass so as to half fill it, keeping the solution warm by placing the glass in hot water. Dissolve 100 parts by weight sodic acetate in 15 parts hot water, and carefully pour it into the same glass; the latter will form an overlying layer on the surface of the former, and will not mix with it. When cool there will be two supersaturated solutions. If a crystal of sodic hyposulphite be attached to a thread and carefully passed into the glass, it will traverse the acetate solution without disturbing it, but, on reaching the hyposulphite solution, will cause the latter to crystallize instantaneously in large rhomboidal prisms

with oblique terminal faces. When the lower solution is completely crystallized, a crystal of sodic acetate, similarly lowered into the upper solution, will cause it to crystallize in oblique rhombic prisms. The appearance of the two different kinds of crystals will not fail to astonish those not acquainted with this class of experiments.

FLAT SURFACES.

The following rules, for determining the thickness of boiler heads, cylinder covers, and other flat surfaces, are taken from *Des Ingenieur's Taschenbuch*, being adapted to English measures, and the constants being chosen so that the working pressure is one eighth as much as the breaking strain. These rules have never before been published in English, so far as we know, and we judge that they will be of interest to the engineering profession. They were deduced by Dr. R. Grashof, and the reasoning on which they are based will be found in *Die Festigkeitslehre*, von Dr. F. Grashof, Berlin, 1866. Being purely theoretical deductions, which have not, we believe, been verified by experiment, it is possible that they may be somewhat incomplete; but we are confident that, with the constants we have chosen, they will give proportions that are at least as safe as those determined by the empirical methods in common use. It is worthy of notice, in this connection, that so high an authority as Professor De Volson Wood remarks in a recent publication (as we understand him) that, in the present state of our knowledge of the strength of materials, it is impossible to solve the problems under consideration without additional experimental data. We believe, however, that the results of Dr. Grashof's investigations are generally accepted by German engineers—certainly they are by the distinguished editors of *Des Ingenieur's Taschenbuch*.

A. To find the necessary thickness for a flat plate exposed to a given pressure in lbs. per square inch (all dimensions in inches):

1. A circular plate, supported at the edges: Multiply the product of the square root of the pressure, and radius of the plate, by 0.018257, for a cast iron plate; by 0.11785, for a wrought iron plate; and by 0.0091287, for a steel plate.

2. A circular plate, secured at the edges, such as a boiler head, or cylinder cover: Multiply the product of the square root of the pressure, and radius of the plate, by 0.01633, for a cast iron plate; by 0.010541, for a wrought iron plate; and by 0.0081649, for a steel plate.

3. A flat plate, supported by stays, at a given distance from center to center: Multiply the product of the square root of the pressure, and distance between stays, by 0.0094281, for a cast iron plate; by 0.0060858, for a wrought iron plate; and by 0.0047141, for a steel plate.

4. A rectangular plate, secured at the edges:

(1) Divide the pressure by the sum of the fourth powers of the two adjacent sides of the rectangle.

(2) Take the square root of the quantity obtained by (1).

(3) Multiply the product of the square of the long side of the rectangle, the short side, and the quantity obtained by (2), by 0.014142, for a cast iron plate; by 0.0091287, for a wrought iron plate; and by 0.0070711, for a steel plate.

5. A square plate, secured at the edges: Multiply the product of the square root of the pressure, and the side of the square, by 0.01, for a cast iron plate; by 0.006455, for a wrought iron plate; and by 0.005, for a steel plate.

B. To find the working pressure, in lbs. per square inch, for a flat plate of given thickness (all dimensions in inches):

1. A circular plate, supported at the edges: Divide the square of the thickness by the square of the radius of the plate, and multiply the quotient by 3,000 for a cast iron plate; by 7,200, for a wrought iron plate; and by 12,000, for a steel plate.

2. A circular plate, secured at the edges: Divide the square of the thickness by the square of the radius of the plate, and multiply the quotient by 3,750, for a cast iron plate; by 9,000, for a wrought iron plate; and by 15,000, for a steel plate.

3. A flat plate, supported by stays: Divide the square of the thickness of the plate by the square of the distance between centers of stays, and multiply the quotient by 11,250, for a cast iron plate; by 27,000, for a wrought iron plate; and by 45,000, for a steel plate.

4. A rectangular plate, secured at the edges:

(1) Take the sum of the fourth powers of the adjacent sides of the rectangle.

(2) Multiply the quantity obtained by (1) by the square of the thickness of the plate.

(3) Multiply the fourth power of the long side of the rectangle by the square of the short side.

(4) Divide the quantity obtained by (2) by the quantity obtained by (3), and multiply the quotient by 5,000, for a cast iron plate; by 12,000, for a wrought iron plate; and by 20,000, for a steel plate.

5. A square plate, secured at the edges: Divide the square of the thickness of the plate by the square of the side of the plate, and multiply the quotient by 10,000, for a cast iron plate; by 24,000, for a wrought iron plate; and by 40,000, for a steel plate.

A few examples are added, to illustrate the foregoing rules.

1. What is the proper thickness for a steel boiler head, the pressure of the steam being 60 lbs. per square inch, and the diameter of the boiler 24 inches?

The product of 7.746 (the square root of 60), 12, and 0.0081649 is 0.78, or $\frac{3}{4}$ of an inch, nearly, the thickness required.

2. Required the thickness for the sides of a cast iron box 20 inches long, 15 inches high, exposed to a pressure of 20 lbs. per square inch.

Dividing 20 by 210,625 (the sum of the fourth power of 20 and 15), and extracting the square root of the quotient, we obtain 0.0097445. The product of 400, 15, and 0.0097445 is 0.83, or about $\frac{4}{5}$ of an inch.

3. What is the safe pressure for a flat plate, supported by stays, 10 inches from center to center, the plate being of wrought iron, $\frac{1}{2}$ of an inch in thickness?

Dividing 0.140625 (the square of $\frac{1}{2}$) by 100, and multiplying the quotient by 27,000, we obtain the pressure, about 38 lbs. per square inch.

4. The side of a rectangular box, 25 inches long, 20 inches high, is of steel, $\frac{1}{2}$ of an inch thick. What is the working pressure?

The sum of the fourth powers of 25 and 20 is 550,625. The product of 550,625 and 0.0025 (the square of $\frac{1}{2}$) is 6,882,812,700. The product of 390,625 (the fourth power of 25) and 400 is 156,250,000. Dividing 6,882,812,700 by 156,250,000, we obtain the working pressure, 44 lbs. per square inch. Below will be found the analytical expressions for the rules given in this article.

Thickness (T) in inches for a plate exposed to a uniform pressure (p) per square inch.

Form of the plate. (Dimensions in inches.)	Thickness (T) in inches.		
	Cast iron.	Wrought iron.	Steel.
Circular plate, of radius R, supported at the edges.	$0.018257R \times \sqrt{p}$	$0.011785R \times \sqrt{p}$	$0.0091287R \times \sqrt{p}$
Circular plate, of radius R, secured at the edges.	$0.01633R \times \sqrt{p}$	$0.010541R \times \sqrt{p}$	$0.0081649R \times \sqrt{p}$
Plate strengthened by stays, a inches from center to center.	$0.0094781a \times \sqrt{p}$	$0.0060858a \times \sqrt{p}$	$0.0047141a \times \sqrt{p}$
Rectangular plate, sides a and b, (a > b), secured at the edges.	$0.014142a^2 \times b \times \sqrt{\frac{p}{a^4 + b^4}}$	$0.0091287a^2 \times b \times \sqrt{\frac{p}{a^4 + b^4}}$	$0.0070711a^2 \times b \times \sqrt{\frac{p}{a^4 + b^4}}$
Square plate, side a secured at the edges.	$0.01a \times \sqrt{p}$	$0.006455a \times \sqrt{p}$	$0.005a \times \sqrt{p}$

Safe pressure (p) in pounds per square inch for a plate of given thickness (T) in inches.

Form of the plate. (Dimensions in inches.)	Safe pressure (p) in pounds per square inch.		
	Cast iron.	Wrought iron.	Steel.
Circular plate of radius R, supported at the edges.	$3,000 \times \frac{T^2}{R^2}$	$7,200 \times \frac{T^2}{R^2}$	$12,000 \times \frac{T^2}{R^2}$
Circular plate, of radius R, secured at the edges.	$3,750 \times \frac{T^2}{R^2}$	$9,000 \times \frac{T^2}{R^2}$	$15,000 \times \frac{T^2}{R^2}$
Plate strengthened by stays, a inches from center to center.	$11,250 \times \frac{T^2}{a^2}$	$27,000 \times \frac{T^2}{a^2}$	$45,000 \times \frac{T^2}{a^2}$
Rectangular plate, sides a and b (a > b), secured at the edges.	$5,000 \times \frac{T^2 \times (a^4 + b^4)}{a^4 \times b^4}$	$12,000 \times \frac{T^2 \times (a^4 + b^4)}{a^4 \times b^4}$	$20,000 \times \frac{T^2 \times (a^4 + b^4)}{a^4 \times b^4}$
Square plate, side a, secured at the edges.	$10,000 \times \frac{T^2}{a^2}$	$24,000 \times \frac{T^2}{a^2}$	$40,000 \times \frac{T^2}{a^2}$

MAKING GAS FROM PETROLEUM.

Mr. John McClarty, of Racine, Wis., treats petroleum or naphtha under the admission of steam in a preparatory retort, and conveys the semi-fixed gas produced therein by connecting pipes to the common retorts of gas benches, from which the thoroughly fixed gas is conveyed for further treatment, in the usual manner.

In the engraving, A is a small tank, to which the petroleum or naphtha is fed by a hand pump. The oil is conveyed by a pipe, *a*, to the first retort, B, made of cast iron, of round shape, and suitable width and length, and heated to a bright red previous to the admission of the oil. The nozzle of a steam pipe, *b*, is inserted about one and a half inches into the oil pipe, as shown in Fig. 3, for the purpose of imparting force to the oil. The steam is obtained from a boiler, C, and the inlet of oil and steam, in pipes *a* and *b*, is governed by valves, *d*. The oil and steam pass together to the inside of the retort, B, through a pipe, *e*, passing to the back end of the retort, then to the front, and finally to the back end again, as shown in Fig. 2, being discharged in a highly heated spray, and forming, by the heat of the retort, a semi-fixed gas. This gas then passes through the outlet pipe, *f*, to a bench connecting pipe, *g*, and through drop pipes, *g'*, to the lids of the several retorts of the gas bench. The pipes, *g'*, enter the retorts, and extend to a point about twenty inches from the back end of the same, discharging there the gas, and converting it, by passing forward in the retorts to the stand pipes, into a thoroughly fixed gas. Each of the drop pipes, *g'*, on the benches is provided with a valve and union coupling, so that the flow of prepared gas into the retorts can be governed at pleasure.

Fig. 2

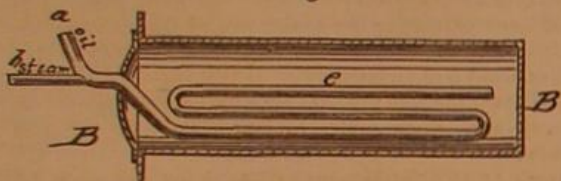
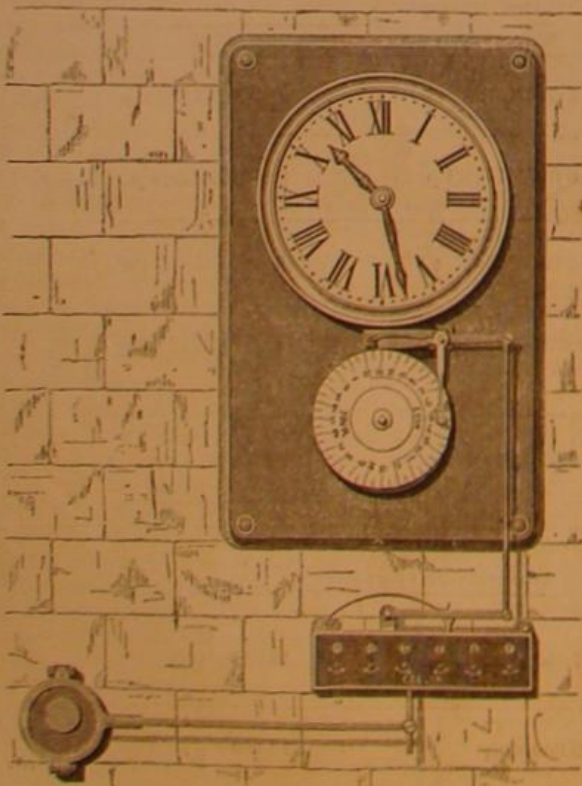


Fig. 3

The retorts are fed subject to a pressure gage placed on the stand pipe of retort, B. The inventor claims that, should the supply of petroleum fail, by accident or otherwise, no interruption of the works is necessary, as they can be instantly employed for the common coal process.

NOVEL ENGINE COUNTER AND TELL-TALE.

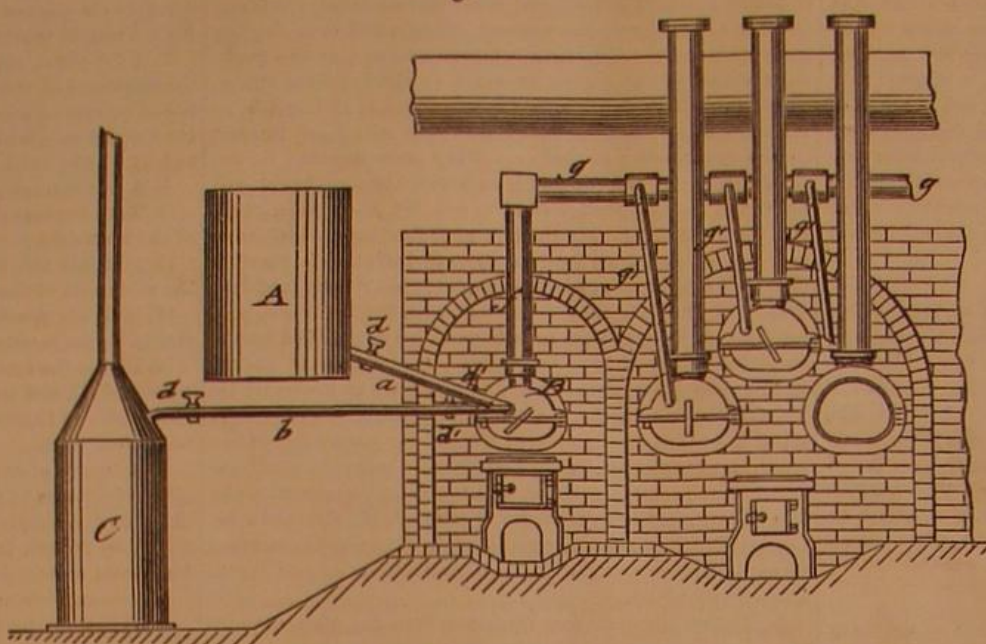
We extract from *La Nature* the annexed illustration of a new tell-tale for counting the strokes of an engine, indicating the speed, and also showing any variations in the work-



ing or stoppages of the machine. The mechanism, contained in this clock shown, causes the rotation of a disk placed below the clock face, on which disk a piece of paper, divided into divisions for 24 hours and fractions, is adjusted, the night hours being denoted by a line, drawn from 12 to 12, and nearer the center of the circle than the other marks. Above the disk is a lever which moves a pencil holder in front of the disk, and which receives motion from an arm which is connected with a counter. The latter is placed in

communication with the engine by the eccentric and rod shown. The construction is such that, when the engine has made 100 turns, a rod, extending through the upper side of the counter and connected with the pencil-moving mechanism, rises one tenth of its entire course, causing the pencil to make a mark parallel to the scale divisions. During the time elapsing before the completion of the suc-

Fig. 1



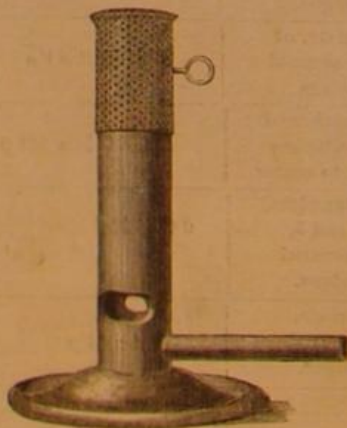
McCLARTY'S METHOD OF MAKING GAS FROM PETROLEUM.

ceeding hundred turns, the disk continues its rotation, so that the pencil, pressing against the paper, leaves a circular line. This is again broken by a cross mark of the pencil when the hundred turns are finished, and so on, until ten indications are made, showing that 1,000 turns have been accomplished. The rod in the counter has then completed its upward motion, and falls instantly back to its lowest position, causing the pencil to make a cross or nearly radial line ten times as long as that made to indicate the hundred turns.

It will be seen from this that the circular line, or rather that portion of it included between any two hundred turn marks, passing as it does over the time divisions inscribed on the paper, shows exactly how long a period was occupied by the engine in making the above number of rotations. By comparing these sections of the line together, the fact of all being exactly the same length shows the regularity of the machine, while the stoppage or irregularity of the same will at once be indicated by the circular line continuing unbroken. The length of the line between the 100 turn divisions also shows the speed of the engine; and the same may, besides, be used to indicate whether or not the machine was started or stopped according to orders at any predetermined hours. The interior mechanism is securely inclosed in locked cases, so as not to be accessible to the engineer.

A SOLID FLAME BUNSEN BURNER.

The accompanying engraving represents a new form of Bunsen's burner, described in a paper recently read by Mr. John Wallace before the Newcastle-on Tyne Chemical Society. Its chief peculiarity is an adjustable cap of perforated metallic plate, which enables it to burn a much more in-



flammable mixture of air and gas than is possible with the ordinary burner. The tendency to light within is also completely prevented, whatever may be the pressure, quality, or quantity of gas passing. By raising the cap to the necessary height a perfectly solid flame is obtained—a novel and valuable feature, since it allows any substance to be heated to be put much nearer than usual to the center of the flame without interfering with combustion. It can be made from one inch to two inches in diameter, and is capable of burning as much as 40 cubic feet of gas per hour.

Origin of Atmospheric Electricity.

According to M. Bécquerel, solar spots, which are sometimes 16,000 leagues in extent, appear to be cavities by which hydrogen and various substances escape from the sun's photosphere. But hydrogen, which appears here to be only the result of decomposition, takes with it positive electricity, which spreads into planetary space even to the earth's atmosphere and to the earth itself, always diminishing in in-

tensity because of the bad conducting power of the successive denser layers of air and of the crust of the earth. That would then only be negative, as being less positive than the air. The diffusion of electricity through planetary space would be limited by the diffusion of matter, since it cannot spread in a vacuum.

That gaseous matter extends further through space than the distance which is generally assigned to the earth's atmosphere will be proved by the fact that auroras, which are due to electric discharges, are produced at heights of 100,000 and 200,000 yards, where some gaseous matter must exist.

M. De la Rive agrees with M. Bécquerel as to the electrical origin of the aurora, but considers that the earth is charged with negative electricity, and is the source of the positive atmospheric electricity, the atmosphere becoming charged by the aqueous vapor rising in tropical seas. The action of the sun, he considers, is an indirect action which varies with the state of the sun's surface, as shown by the coincidence in the periods of aurora and sun spots.

In the accounts of travelers in Norway, we often read of their being enveloped in the aurora, and perceiving a strong smell of sulphur, which must be attributed to the presence of ozone. M. Paul Rollier, the aeronaut, who descended on a mountain in Norway 4,328 feet high, saw brilliant rays of aurora across a thin mist which glowed with a remarkable light. To his astonishment an incomprehensible muttering

caught his ear; when this ceased he perceived a very strong smell of sulphur, almost suffocating him.—*Manual of the Natural History, Geology, and Physics of Greenland.*

LLOYD'S FLOATING APPARATUS.

Mr. Lloyd's apparatus has claims which are worthy of far more consideration than those of the Boyton dress. First perhaps in utility is an air mattress of the ordinary shape, which is inflated in three compartments, and by the aid of which Mr. Lloyd lately crossed the Solent. This mattress, says *The Field*, is available as an ordinary bed, either on board ship or under canvas. "With the middle compartment empty, Mr. Lloyd showed us that its buoyant powers are sufficient to enable him to jump into the water without sinking below his armpits, while it affords protection from mechanical injury by wreck or rock. After entering the water in this way, he inflates the middle compartment, and it then forms a raft, which he is able to propel with the paddle at the rate of between two and three miles an hour. Emigrants may therefore, without any extra outlay, provide themselves at the above rate with a floating apparatus which may be propelled to shore from a wreck. Another useful means of flotation is his swimming waistcoat, by the aid of which a bather can float without the possibility of its shifting. It is unsightly, no doubt, but this ought not to weigh against its utility in avoiding the risk of sinking when learning to swim. Its price is only \$3.75, gold."

The most noteworthy, however, of Mr. Lloyd's inventions is his canoe, which can be folded into the compass of a small



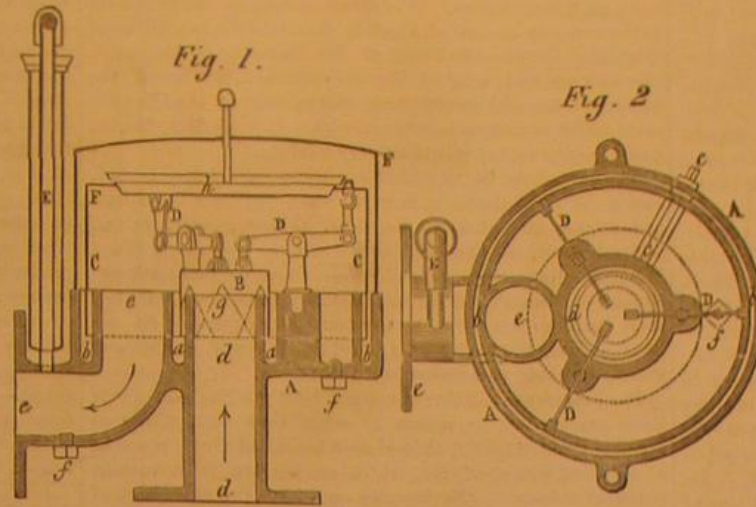
portmanteau or carpet bag when empty. It is made in two divisions, buckled firmly round the waist after inflation, and kept in position by a strap passing between the legs from the front to the back. A waterproof dress is first drawn on made of the ordinary twilled material used for coats, etc. and buckled over the shoulders, with the arms quite free. Having first encased himself in this way, Mr. Lloyd jumped into the water, and, with his paddle in his hands, sinking only to the level of his armpits, easily paddled with the tide at the rate of 3 miles an hour.

NEW GAS REGULATOR.

The annexed illustration, extracted from the *Bulletin du Musée*, represents a novel gas regulator recently devised by M. Liebda. A cast iron vessel, A, is provided with circular channels, *a* and *b*, which are filled with mercury. *c* is a conduit for emptying them. The gas enters by tube, *d*, and escapes by tube, *e*; and at *f* are screw plugs which close the apertures from which the water which accumulates in the apparatus is removed.

The entry of the gas is regulated by a valve or cover, B, the edges of which, as shown at *g*, are triangularly indented, and are plunged into the mercury in the channel, *a*. A large cover, C, is provided, the edges of which enter the mercury in channel, *b*, and at *h* access may be had to the interior. The covers, B and C, are connected together by the three double levers, D. E is a water manometer for indicating the gas pressure, and finally, F is the envelope which encloses all the working parts.

The gas, on entering *d*, passes under B, and through the triangular indentation in the edges of that valve. It then presses upon the larger cover, C, and, by raising or lowering the same, causes the reverse effect upon B, through the levers, as already noted. As the pressure increases, cover C rises and A falls, and *vice versa*, thus causing the apertures in B to widen and close just so as to admit a uniform flow of gas. To increase the pressure, weights may be disposed upon the cover, C. An economy of from 25 to 30 per cent is claimed to be gained, in the consumption of gas, through the use of this device.



LIEBDA'S GAS REGULATOR.

short of usefulness and pecuniary profit to all parties concerned.

The new perfecting press which is illustrated in the above engraving seems to belong to the last mentioned class of inventions, a careful examination of which will present nothing unfamiliar to the modern pressman. It is simply a union of the rotary and drum cylinder presses, preserving the features of both with the greatest simplicity. Take off, in imagination, the type and impression cylinders and the second feed boards and piling apparatus, and we have the Cottrell improved four-roller printing machine remaining, without variation or modification. We shall proceed to describe the complete machine in a manner that will be understood by the craft for which it is designed, avoiding shop terms and speaking in the language of the pressroom.

Its foundation is the latest Cottrell and Babcock drum cylinder press, embracing the Cottrell improved air spring and governor, the whole so substantially built as to sustain the new rotary attachment without vibration, even when running at its highest rate of speed.

The patent rotary attachment consists of two cylinders—one for curved stereotype plates of the matter to be printed, the other to give the impression. These cylinders are supplied with a feed board, and revolve in harmony by the instrumentality of the usual gear wheel attachment, making two revolutions while the drum cylinder of the main press makes one, and yielding the sheet, when printed on one side from the curved stereotype plates, to a supplementary set of grippers on the drum cylinder, in perfect register, when it

passes to the flat form on the bed of the main press, and is printed on the other side and piled in the usual manner.

The type cylinder is supplied with an ordinary distributing apparatus for three form rollers; and as it revolves twice before printing, the form is necessarily rolled twice also, with a fresh supply of distributed ink each time—an excellent feature in itself. There are four vibrating rollers, which thoroughly break up and distribute the ink before it is contributed to the form rollers. The space on the type cylinder not occupied by the curved plates serves for the ink table; and a simple device raises and drops the vibrators at the right times and places, thus avoiding all contact on their part with the stereotype plates.

At each alternate revolution of the impression cylinder the impression is thrown off by a simple and reliable mechanical device, by which means the complete rotary attachment (as it gives the impression on its second revolution) works in harmony with the drum cylinder of the main press.

The great difficulty that most perfecting presses have to contend with is their tendency to set off. This difficulty is thoroughly overcome in the press under consideration by the introduction of slip sheets, which are fed to the drum cylinder, the grippers which carry the slip sheets being so manipulated as to hold each sheet for two impressions before yielding it to the piling apparatus, where it is smoothly and evenly piled for future use.

These presses being designed particularly for illustrated periodicals of large circulation, the plain forms are printed by the new rotary attachment, and the cut forms on the flat bed of the main press by the drum cylinder. The superiority of the Cottrell air spring and governor attachment over the old coiled wire springs enables a press of the printing magnitude of 42 x 60 inches to keep up a durable speed of over 1,200 impressions per hour. After allowing for the time consumed in making ready forms of long numbers, and the stoppages incident to removing printed paper and supplying fresh piles to the feed boards, the manufacturers assert that an average of over 10,000 sheets per day, printed on both sides, will pass through the machine. The new patent rotary attachment accomplishes its share of the work independently, and in proper season to pass the half printed sheet to the drum cylinder to be perfected without interfering in any way with the time of the main press; so that we thus have a clear issue of more than 20,000 single impressions per day of ten hours.

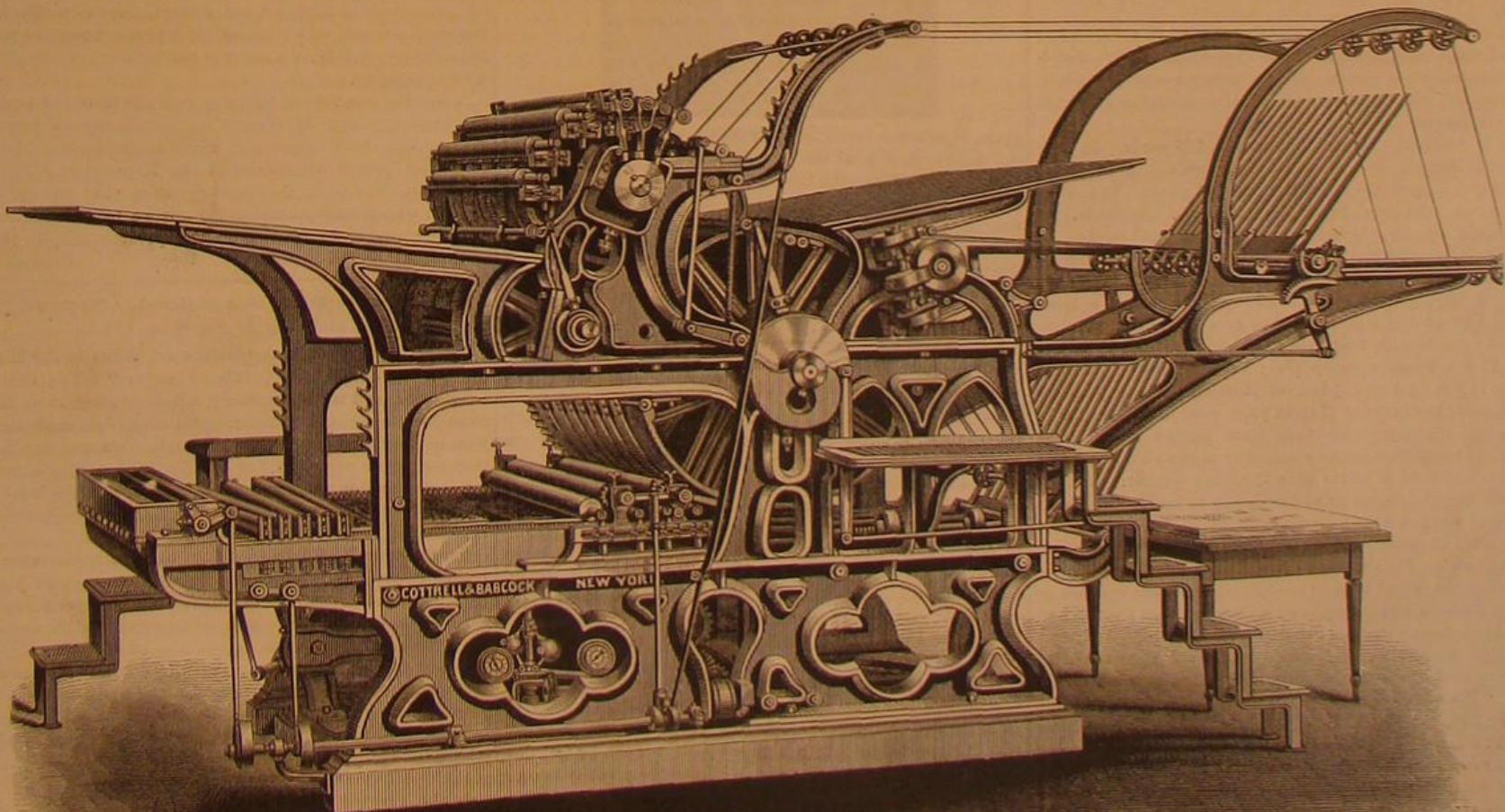
The usual method of making ready this class of illustrated work is by hard packing, the overlays of the cuts being made from certain cardboard, well known to the practical cylinder press printer, and the whole finally covered by a blanket of well worn billiard cloth. On the drum cylinder of the main press, of course, the *modus operandi* is the same as on the ordinary drum cylinder machine; while the rotary attachment is supplied with the necessary conveniences for the same class of make-ready.

We have thus, we believe, given an intelligible description of this new perfecting press, from which it will be under-

COTTRELL AND BABCOCK'S PERFECTING PRESS FOR WOODCUT PRINTING—FIRM'S ROTARY ATTACHMENT.

Two features are necessary to obtain a patent: First, the invention must be novel; second, it must be useful; and when these features are clearly demonstrated to the examiners, the exclusive right, for seventeen years, to manufacture, lease, sell, or otherwise dispose of it, is awarded under letters patent.

But there is another feature of importance to the patentee or his assigns, namely, the propriety of his keeping as near as may be within the beaten track of mechanical appliance in his inventions or improvements, in order that the workman, when he takes hold of the new machine, may feel a certain degree of familiarity with its mechanical principles, and thus be enabled to prosecute his labor with equal confidence as formerly, when engaged on the old and superseded machinery. During nearly half a century of careful and patient observation, we have noticed several really valuable inventions fall stillborn to the world because of a non-observance of this common sense theory. The inventor may feel satisfied that he sees clearly his means to an end, irrespective of the reasonable convenience of those for whose uses the invention is designed; but the workman cannot appreciate the value of an improvement which compels him to learn his trade over again. In such cases, it will necessarily be uphill work with the inventor to introduce his machine;



COTTRELL AND BABCOCK'S PERFECTING PRESS FOR WOODCUT PRINTING

stood that the invention, according to the manufacturers' statement, doubles the capacity of the drum cylinder machine, without detracting from the finished quality of the presswork.

The first of these machines is now in successful operation in one of Frank Leslie's pressrooms in this city. Messrs. Cottrell and Babcock's office is at No. 8 Spruce street, New York.

Correspondence.

Life-Saving Apparatus.

To the Editor of the Scientific American:

I am pleased to see the illustration of Mr. J. B. Rogers' life-saving apparatus in your issue of September 25. At this time, when so much is being attempted by the United States government and so much is done by foreign powers, in perfecting the means of communicating with stranded vessels, any new device, so well illustrated, commands respect. It is to be hoped that at our grand Centennial Exposition there will be ample space allotted and ample means provided for practical experiments with all known devices for rescuing shipwrecked persons.

Allow me to quote (from a pamphlet published by me in 1872) some of the results of experiments in casting lines by projectiles: "The Manby mortar was fully illustrated in a pamphlet published in 1826, and was for some time the popular means for getting communication with a wreck. Its weight, with its bed, was about 3 cwt., and it carried a line of 1 1/2 inches 200 yards, by a 24 lbs. shot, and a deep sea line 270 yards against a strong wind. I give a quotation of value from Manby's pamphlet. 'It is of the first importance for a lifeboat to resemble as much as possible those which the beach men are accustomed to and have confidence in, not only because it is necessary to humor the prejudices of such men, but whatever tends to increase their confidence must increase the chance of saving life.' Whatever may be said of Manby's antiquated notions, the above advice is sound. The Boxer accelerating rocket has entirely superseded the Manby mortar in England. The effect is that, when the first charge is expended, when the rocket has attained a certain elevation or range, a second charge is fired. The line used is made of Italian hemp, 500 yards length and weighing 46 lbs. After getting the line on board a vessel, other, larger lines are hauled off, and finally a hawser is set up, and communication is established by means similar to those in your illustration. The principal objections to the general use of the Boxer rocket by the United States stations, and by humane societies, lies in the fact that it is costly, and that the inventor has given the right to use it into the hands of parties who naturally desire to profit by its sale. Could we have the privilege of manufacturing it in our laboratories, the cause of humanity would be greatly advanced.

I have been informed that the German government has in use a rocket which has a range of 800 yards, which is nearly double the range of the Boxer rocket. It has also another advantage over it by reason of the staff being attached in a direct line with the body of the rocket, which insures more accurate aim, the staff of the Boxer being attached to the side of the rocket. Measures should be taken to make rockets of our own, and if possible beat our transatlantic humanitarians.

In a report by Commander Jerningham, when Comptroller of the Coast Guard, he says: "The experiment at Woolwich gives the following results: Manby mortar, caliber 5 1/2 inches, elevation 33°, charge 10 ounces. The mean distance carried in 20 rounds was:

In fine weather, 6 thread Russia line, 245 yards. In fine weather, Manilla line, same size 285 yards. In moderate weather, with fresh breeze, hemp line, 237 yards. In moderate weather, with fresh breeze, Manilla line, 279 yards. In strong gale, squally, elevation 28°, hemp line, 211 yards. In strong gale, squally, elevation 28°, Manilla line, 243 yards. A strong wind requires less elevation than a moderate wind. A cross wind reduces the range more than a head wind. The quality and amount of powder is of much importance. A Manilla line, laid up slack, will stand 16 ounces when 12 will break a hemp line; 120 fathoms of Manilla weighs 11 lbs. against 15 1/2 lbs. of Russian. Lines properly balled, after the manner of spun yarn, were found less liable to foul and more portable than lines carried on racks in boxes. Manilla rope becketts attached to the shot are best; one shot was fired 27 times with the same becket. Manilla line will absorb less water and be liable to less injury from being put away wet than hemp."

For want of space I cannot more fully quote this paper of Jerningham's. He alluded to firing off a block and double line when the wreck is near enough, in the same manner as Rogers does. He also speaks of an anchor shot that he had fired, in moderate weather 210 yards, in a gale 150.

In 1870 my attention was called to Rogers' apparatus. A report of trials made by the Admiralty states, in brief, as follows: "His anchor weighing 134 lbs., with a block and line making 200, was thrown 134 yards from an 8 inch mortar with 12 ounces powder. In another experiment the anchor was thrown from a common howitzer."

And again Captain Boys, of the Excellent training ship, fired an anchor weighing 128 lbs., with a block and line of 1 inch, 156 yards with 8 ounces powder, once 152 yards, once 163 yards, and in the fourth shot, with 12 ounces, 217 yards. Experiments were made with Rogers' anchor at Liverpool, throwing a 1 inch line 200 yards, and a smaller one 400; but in this last case, the line broke. In November, 1870, the Royal Naval Reserve Club resolved that "this meeting strongly recommended its adoption by the Royal National Lifeboat Institution." The Royal National Lifeboat Institu-

tion, through its executive agent Captain Ward, R. N., expressed the opinion in a letter to me that Rogers' apparatus would not take the place of the Boxer rocket, as he thought the anchor shot would be likely to attach itself to the wrong place; at the same time he said that Rogers had succeeded in throwing his anchor much farther than he expected. Notwithstanding the opinion of Captain Ward, I hope that the Rogers apparatus may be utilized in this country, where we have no Boxer rockets. If adopted, it may be made useful in throwing an anchor off shore to facilitate the launching of lifeboats. In cases like that of the Italian bark Giovanni, lost on Cape Cod, with all her crew save one, last March, the distance being 400 or 500 yards, the mortar of the government failed to carry a line far enough. In a case like this, the new German rocket would be very useful.

The cost of the Boxer rocket apparatus, as I learn from I. and A. W. Burt, London, is \$625, which includes 24 rockets and sticks, 20 lights, 20 portfires, primers, lines, boxes, whip, hawser, tally boards, blocks, slings, triangle, 2 Ward belts, life lines, flags, tubes, fuzes, diagrams, and packing. Formerly Denner's rockets were used by our society, but they were found to deteriorate by the necessary exposure on sea beaches; and they sometimes burst prematurely, so that our society has long ago discontinued their use.

The French use a different method from the English. Their lines are thrown by means of what they call *flèches* or arrows; more properly, they should be called clubs or sticks of wood, as well as of iron, which are thrown from various pieces of ordnance. The wooden ones have the advantage of floating sometimes within reach of the wreck.

A full detail of these means was given in a pamphlet published by me in 1872, to which I refer. Could we exercise as much ingenuity in devising means for saving life as we do for killing, many lives might be saved.

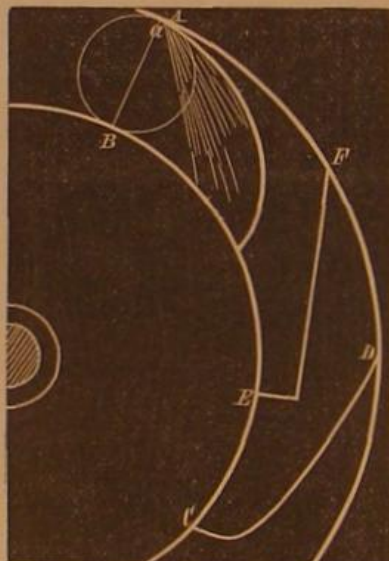
Boston, Mass. R. B. FORBES,
Chairman of Standing Committee of the Massachusetts Humane Society.

Water Wheel Buckets.

To the Editor of the Scientific American:

I give you a rule for the construction of the buckets of overshot water wheels, which I have never seen in print:

Make the inner face of the buckets in the form of an epicycloid, generated by a circle (whose diameter, *a* B, see dia-



gram, equals the depth, *A B*, of the rim of the wheel, minus the thickness, *a A*, of the buckets) revolved upon the circle, *B E C*, which forms the back of the buckets. Then the outer corner, *A*, will be flush with the rim. As may be seen by rotating the diagram, this form of bucket retains its water better than either of the forms, *C D* and *E F*, in common use, but does not carry any too far, that is past, the lowest point of the wheel.

TOWNSEND WOLCOTT.
New York city.

American Inventions in Europe.

To the Editor of the Scientific American:

One characteristic of American exhibits, in the world's fairs held in Europe, is that they do not consist of products so much as the agents for producing. Our tools, machines, and inventions are exposed before the world in a manner that conduces much to our credit as ingenious and persevering, but with a corresponding loss to our material interests, as any one who has examined the matter carefully must know. I am fully convinced that not one in a thousand among our implement makers knows to what extent and with what success our American products become models in Europe, and it is to call some attention to the matter that this is written.

Every circumstance in our country tends to promote this exposure of our tools and processes. Our isolated position from the rest of the manufacturing world, and the prohibition of imported tools by a high tariff, prevents a knowledge of what is done by others; and while we rely solely on our own resources in devising machines and processes, other countries not only employ their own skill, but draw on us for all that is of use to them. Our skill is the base of any success we have had or can hope for, in creating a foreign market for American manufactured products. This every one knows; and yet we throw open our workshops to the inspection of every one, with a recklessness which is astonishing to people in Europe; and we seem to have no secrets worth preserving. A German, Swede, Pole, Russian, or other foreigner has, as a rule, only to present a card at the

doors of our workshops to be admitted and have every process pointed out and explained. This is not so in other countries, especially in those from which we can hope to draw useful suggestions as to commercial policy.

Without ignoring in any way the influence for good which may come from the reputation gained by exhibiting our handicraft, I would beg our engineers and manufacturers to consider that such influence is a weak one compared to price when it is desired to influence a buyer. The money cost of a product is the only sure base upon which a market for it can be made; and while foreign orders may be, as they now and then are, secured, such orders will not be repeated unless we produce the article at less cost than it can be copied for in Europe. I repeat that our only power and hope of a foreign market, now so much needed, lies in two things: skill in producing superior to, and labor more effective than, those of Europe. Our boundless natural resources may be balanced against three or four thousand miles of sea carriage, if we only keep our processes to ourselves, and show finished products instead. To go to America to learn to manipulate processes in working iron and wood is becoming part of the education of young mechanics and engineers from North Europe. I could at this time give names of many who are making, or have made, this kind of tour through our workshops. Hundreds, yes thousands, come to America to become skilled, and then return home to astonish their friends with what has been learned, and to reap the result in higher wages, which for a time will be paid for their services.

I may be asked: How is this to be prevented? The answer is simple enough. Shut up the shops, admit no one not supplied with proper reference, and not then, if the object is to acquire special information. This is done in England, thoroughly and completely, and nearly as well on the continent. Why cannot it be done in America? It may be said that our tools and machines must be shown in order to sell them, and that they must be exhibited next year at Philadelphia. This is true; but there is a wide difference between showing completed tools, implements, and machines, and in exhibiting the mode and processes of constructing them. Suppose the Waltham Watch Company, who have just occupied their magnificent new premises in London, were to send over some of the Clerkenwell manufacturers' skilled men to examine the operations at Waltham, and then furnish to these men a set of machines and tools like those in use at Waltham. How long would the business of exporting watches last? Yet this is what is continually done in many branches of our manufactures. Those operations of manufacture which do not find their way into our scientific journals—little things, not scientific and seemingly unimportant—very often determine the cost of products, in a way to secure or lose sales abroad. "It is the last cent that tells," and this last cent is generally taken off by some simple little expedient which, for a stranger to see, is for him to have and for us to lose.

These things would soon be understood and appreciated if our implement makers would visit certain parts of Europe which I could point out, and see the copies of our machines and tools exhibited as "improvements on the American," and hear (to explain the assumption) how "Americans are cunning and inventive, but without the power to apply their knowledge, because not educated," and so on. Something of this is done in England and France, but not much. These countries are not small enough and petty enough to tolerate such things; beside, we are too well known to be charged with incapacity.

A word of caution in this way will not be out of place for the coming year. Thousands in Europe are waiting for a raid on our workshops; and while nothing should be done to detract from the character of the Exposition in Philadelphia, you will excuse me for suggesting that the influence of your widespread journal could not be better used than in giving stronger expression to the present subject than is possible at the hands of

OBSERVER.

Electric Force and Molecular Motion.

To the Editor of the Scientific American:

Mr. W. E. Sawyer, in his letter on "What is the Electric Force?" in your issue of October 9, says: "When one pulls a bell cord, and instantaneously a bell is rung in a distant room by the molecular transmission over or through the bell wire of the force applied at the cord, does not one realize that he is as veritably, as wonderfully, and by a similar molecular motion, transmitting that signal as though he were transmitting it by applying a battery to a telegraph wire, and thus setting the atomic particles in motion?"

I propounded the above question to myself, endeavored to realize it, and failed signally; therefore I apply to you for help, and trust it will be given, for Mr. Sawyer's explanations of the electric force seem so clear and forcible as to enable almost any one to form a good idea of the subject.

When one pulls a bell rope, causing a bell to ring at a distant point, one can readily realize the disturbance of the atomic particles from ocular demonstration. He sees the movement of the cord where the force is applied, and also where the bell lever receives it, and the only rational explanation is that of molecular transmission.

In the case of the telegraph, he sees no motion, either where the force is applied, or where it is taken off, even when the force so applied is very powerful. However, this may be deduced by reasoning, as Mr. Sawyer so ably shows, but the real difficulty is at the end, where it is utilized. The wire terminates in a coil, and inside of this coil, entirely separated from it, is a bar of metal, and entirely separated from this is the bell lever. Now it is difficult to conceive how the mere molecular disturbance of the wire causes a like disturbance in the bar, which again causes the same in the bell

lever or armature. If the motion were transmitted directly to the bell lever by a material connection, as in the first case, then there would be no difficulty in understanding this application of the theory.

Philadelphia, Pa.

THOMAS C. MARCKLEY.

An Amateur Chemist's Narrow Escape.

To the Editor of the Scientific American:

I am, by accident, the discoverer of a most wonderful explosive; I say that I am the discoverer of it, for the simple reason that, so far as I can ascertain, it has not heretofore been known. If I am wrong, I desire to be corrected. Of the nature of the explosive and the cause of its explosion, I am unable to speak; but from its composition, I should say that it was related to nitroglycerin; and its effective power confirms the idea, as, although its force was not nearly so powerful as that of nitroglycerin, it exercised it in much the same manner. I shall, most likely, and perhaps not without cause, be denounced as fool hardy, and be advised to let alone that of which I know nothing. But be this as it may, the following are the facts in regard to the composition of the compound, and the *modus operandi* of its discovery:

I had been experimenting on the absorptive powers of turpentine, and among the other substances employed was nitric acid; I found, after the acid had been in contact with the turpentine some twenty-four hours, that they had both undergone a material change in their nature; they had assumed an entirely different color, the acid being reddish, the turpentine yellow, and a third substance (between them) of an exceedingly red color, and their properties seemed to be changed in other respects. I thought this change might have been caused by some impurities in the acid, which was commercial; so I determined to repeat the experiment and use chemically pure acid. To carry out my plans, I procured a common eight ounce, glass-stoppered bottle, and poured into it two ounces of acid and the same quantity of turpentine. They both remained perfectly clear and colorless, and showed, on account of the great difference in their specific gravities, a decided division line. I then placed the stopper in the bottle and shook it, then let the liquid subside, and noted that the turpentine retained its colorless condition, but the acid was of a reddish tint; I once more shook it, and, when the contents had returned to rest, the turpentine was of a yellow color, the nitric acid a fiery red; the division line between them was almost lost. I then shook it a third time, and noted that the whole quantity was blood red; I had but just placed it on a table to allow the contents to settle when it commenced to effervesce; I picked it up, tried to pull the stopper, found I could not, and turned to a window distant some two feet; the window was up, but the shutters were closed. I made a motion to open the shutters, when there was a terrific report; the hand in which I held the bottle was empty, my face covered with acid, and the room completely filled with gas and vapor.

I left the room immediately, and applied water and milk to my face to stop the biting of the acid, and then returned to the scene of disaster. The floor was covered with glass almost in a state of powder. In a piece of walnut furniture, distant from the point of explosion fifteen feet, I found glass in pieces the size of shot, completely imbedded in the wood; the carpet, directly under where I had held the bottle, was torn in sundry places, and the glass buried in the floor. The bottle was demolished in the strictest sense of the word, being reduced to pieces from the size of corn grains down to wheat, and even finer. The stopper of the bottle I have not been able to find, and I suppose it was demolished also. The way in which I escaped was miraculous; the hand in which I held the bottle was not so much as scratched. I think the bottle must have passed from my hand before it exploded; but if it did, its passage and explosion were so instantaneous, that it seemed to burst in my hand.

I enclose for your inspection a sample of the remains of the bottle.

Monticello, Pa.

E. G. ACHESON.

[We are sorry to be compelled to dash the hopes of our correspondent by saying that his discovery is not new in many of our college laboratories.]

The experiment above described is one usually performed before a class beginning the study of chemistry, in order to demonstrate the power with which nitric acid oxidizes bodies capable of undergoing oxidation, like phosphorus, sulphur, carbon, and the hydrocarbons. Turpentine also is generally the hydrocarbon selected, as being nearest at hand. It is also frequently repeated by tyros with effects presenting a striking similarity to those graphically depicted in this thrilling narrative, but young students seldom venture upon more than a few drops of the mixture. There is certainly a great novelty in beginning to experiment upon four ounces of so unstable a body as nitric acid, and so volatile and inflammable an oil as turpentine. We make a publication of the results in this case, in the hope that it may be of service in preventing accident, if not loss of life, to other amateur experimenters. Our correspondent certainly had a narrow escape.—Eds.]

Steam Boiler Phenomena.

To the Editor of the Scientific American:

In the account of steam boiler phenomena on page 193 of your current volume, the temperature of the feed water is not given in either case. This is an important item in considering cases of this kind.

If in the first case, the feed water were very hot, it would require but little more heat to convert it into steam. This heat being supplied from the overheated boiler, the pressure would go up until the temperature of the iron was reduced to that of the feed water.

In the second case, if the feed water were cold, it would sooner absorb the heat of the boiler. It would then condense the steam and produce a partial vacuum, as stated.

The action would be similar in the two cases, the pressure going up to a point corresponding to the amount and temperature of the feed water and the heat contained in the iron of the boiler, and then falling, as I have no doubt it would have done in the first case if the pumping had been continued.

Perry, Ill.

L. D. KENNEDY.

American Grape Vines in France.

To the Editor of the Scientific American:

In regard to an article in your valuable paper of September 11, headed "American Grape Vines in France," I would respectfully call your attention to a letter which appeared some time ago in the *Gironde*, of the Canton of Bourg, contributed by M. Marchal (a justice of peace). He attributes the plagues of the grape vines, known as oidium and phylloxera, not the introduction of parasites from America, but to a diseased condition of the vines, caused by old age and general exhaustion, of which the parasites, which attack the roots, take advantage. As the vines are multiplied from the old plants by cuttings, he considers that there is no renewal, but only a propagation or continuance of its former life and age. If, therefore, the cuttings from old vines are planted, it is not a recreation of a new plant, but simply a continuance of the life of the older plant from which the cutting was transferred. The age, therefore, of a vine in general reaches to the time when it was first planted from the seed, consequently he advises growers, under these circumstances, to plant new vines raised only from the seeds.

May not the success of the American vines, being younger and more vigorous, and transplanted to different soil and to a different climate, be attributed to this law of Nature? To many, undoubtedly, this view will appear rational; and it certainly deserves a fair trial, not only in France but also in other countries, wherever the plant, that produces the golden or ruby fluid which makes the heart glad, flourishes.

Kissingen, Bavaria.

JOHN EITEL.

Black Oxide of Manganese for Destroying Noxious Gases.

Don Julius de Valmagini, of Vienna, claims to have discovered a new and valuable disinfectant in the ordinary black oxide of manganese. In the *Bayerisches Industrie und Gewerbeblatt*, he writes as follows:

"It is well known that ozone is the only substance which will rapidly decompose badly smelling gases; but up to this time we possess no method of preparing ozone cheaply and in large quantities. I have found by a series of experiments that ozone is present in black oxide of manganese (*Braunstein*) in large quantities, and that it is continually regenerated. It was not hitherto known that many kinds of oxide of manganese (manganite, pyrolusite, etc.) were ozone carriers; but I can prove that they not only possess all the properties of the known ozone bearers, but are excellently adapted to use in all cases where ozone has proved useful.

(a) Ozone test paper, prepared with starch and iodide of potassium, is immediately blued by the liberation of iodine without any acid being added.

(b) A solution of chemically pure iodide of potassium is at once decomposed by dropping into it a fragment or some of the pulverized mineral, the liberated iodine turning the solution brown. The liberated iodine is recognized by all its reactions, such as turning blue with starch paste, dissolving in chloroform or bisulphide of carbon, subliming at the boiling temperature, and the characteristic odor.

(c) Chemically pure binoxide of manganese, prepared artificially, shows the same reaction in chemically pure iodide of potassium as given above at b, reacting just like the natural product.

(d) When the pulverized mineral is strewn upon chemically pure silver and moistened, the silver is browned at once by the formation of oxide of silver; on heating, the brown spot entirely disappears, proving that it was not sulphide of silver which was formed.

(e) The air is also ozonized by contact with the surface of the mineral or of the powder.

(f) The reaction about to be mentioned now was indeed known, but was never considered as an ozone reaction, namely: Tincture of guaiacum is colored deep blue by the oxide of manganese.

(g) Black oxide of manganese is also well adapted, by its ozonizing power, to destroy putrid gases, such as sulphuretted hydrogen, and putrefactive gases, and that too in a very short time.

From this it may be concluded that many kinds of manganese ores could meet with extensive use for sanitary and building purposes."

The Soda Lakes of Wyoming Territory.

Professor Pontez, Geologist to the Union Pacific Railroad, reports as follows on an interesting deposit of carbonate of soda in Wyoming Territory:

"The carbonate of soda deposit is, by nearest road for wagon, sixty-five miles from Rawlins Station, nearly due north. There are two lakes. The upper and larger one covers about 200 acres; the water has an average depth of three feet and a specific gravity of 1.007; it therefore contains nearly one pound of soda to ten of water. The soda is nearly all carbonate. The second lake is situated about two miles east of the large lake, on a somewhat lower level. It is bowl-shaped, and covers rather more than three and one half acres. During the greater portion of the year, it is a concrete mass of crystals of carbonate of soda, mixed with a small quantity of dust blown from the adjacent plain. I ex-

cavated to the depth of six feet, but did not reach the bottom of the deposit. Its entire depth can only be ascertained by boring. It is a reservoir or pocket which receives its increase from the periodic influx from the larger lake. The water, having no outlet, evaporates during the summer, and by autumn becomes a compact mass.

The quality of the carbonate is fully equal to the imported article used throughout the country. Its minimum or bottom price has been \$45 per ton, up to \$67, its present price. Estimating the quantity by the specific gravity of the water, its depth and area, the large lake covering 200 acres will yield on evaporation 78,000 tons, which, at the market value, would realize, at \$45 per ton, \$4,510,000. Besides the cost of freight, the expense of preparing the article for market would be \$4 per ton, for evaporating.

The small lake already crystallized, and estimated only to the depth of six feet and an area of 155,000 feet, contains 30,000 tons, which, at \$45 per ton, would realize \$1,379,700, with no drawback except freight and commission.

The reason why this valuable deposit of a staple article has not already been drawn on largely is the difficulty and expense of hauling it 55 miles. A range of mountains called the Seminoles intervenes between the deposits and the Union Pacific Railroad."

The Practical Determination of Coal Tar Colors.

The colors fabricated from coal tar are commercially known by such a variety of names that it has become quite difficult for consumers to recognize the nature of the bodies employed by them. The following information, communicated to the *Muster Zeitung* by H. Goldschmidt, will serve as a practical guide in determining the principal dyes, etc. now produced.

The red coal tar colors most frequently met with in commerce are fuchsin, saffranin, and red corallin. These three are easily distinguished by their action in the presence of an acid, which will color an aqueous solution of fuchsin, yellow; of saffranin, violet blue; and with corallin, will give an orange yellow precipitate. The violet coloring matters are the violets of phenyl, of iodine, and of methyl. The first two are but partially soluble in alcohol and in water. To distinguish them, a certain quantity of the specimen is dissolved in alcohol, and ammonia is added. If the solution becomes red, phenyl violet is recognized; if colorless, then one of the other two. To determine which one, dissolve another portion of the specimen in water and add ammonia: violet of iodine gives a clear liquid; violet of methyl gives a colorless but troubled liquid.

Coal tar blues are aniline and alkali blues. The last is always soluble in water. Aniline blue presents two modifications, of which one is soluble in water and the other in alcohol. The two blues are easily distinguishable from the fact that aniline blue always gives a blue solution; while that of alkali blue is colorless until an acid is added.

The green aniline colors most commonly found are aldehyde green and green of iodine, simple or with picric acid. Determine first whether the body is soluble in water; if so, then it is iodine green. If not easily soluble, dissolve it in alcohol, and add cyanide of potassium. If the liquid then becomes colorless, the body is aldehyde green; if it turns brown, picric acid iodine green is present.

The commonest yellow colors are picric acid and its salts and naphthaline, all soluble in water. Dissolve, add cyanide of potassium, and heat; if the liquor becomes reddish brown, picric acid or a picrate is present; but if the color simply darkens, a little naphthaline is denoted. In the first case, to determine between picric acid and a picrate, treat with benzene and heat; picric acid, alone, dissolves.

The orange hues are yellow corallin, the salts of chrisanilin and of chrysotoluidin, Victoria orange and a mixture of naphthalin and fuchsin known as aniline orange. Add ammonia; if it dissolves, giving a red liquor, corallin or a chrisanilin combination is present. To distinguish which, dissolve a little of the sample in alcohol, add zinc and diluted sulphuric acid: if the liquor becomes colorless, corallin is denoted. If ammonia, as above, does not color the solution, dissolve in water and treat with acid; if there be any change, chrysotoluidin is recognized; but if a precipitate is formed, it is a sign that the substance is either Victoria or aniline orange. To distinguish which of the two, add to the aqueous solution cyanide of potassium; if the liquor turns brown on heating, Victoria orange is present; if the color changes but very slightly, aniline orange.

The browns are those of aniline, maroon, grenat, and two species of phenyl brown, one made with carbonic acid, the other with phenylendiamine. Determine, first, whether the substance is soluble in water. If not, add hydrochloric acid; and if a yellow color is produced, maroon is present. If the acid occasions no change, add to a portion of the solution some ammonia; if there be a precipitate, the substance is anilin brown or phenylendiamine brown; if the ammonia is without action, it is grenat (isopurpurate of potassium). Phenyl brown and anilin brown are distinguishable from the fact that the last yields a precipitate when cyanide of potassium is added to it, while phenyl brown similarly treated undergoes no change.

In preparing lard for the market, it should first be cut into pieces about the size of a walnut, and these should be allowed to stand in water for half an hour. Then work the material with the hands in 5 or 6 successive portions of water. Next pour off the water, melt the lard in a water bath, and strain through fine linen. In the first straining, it will be impossible to get rid of all the water; so that after cooling and draining, it will be necessary to remelt the lard and finally to filter it through paper in a warm closet.

IMPROVED VENTILATING HEATER.

A new heater is illustrated in the annexed engraving, which, besides supplying a uniform current of hot air, thus warming the apartment, is so constructed as to draw in fresh air, thus at the same time ventilating the room. There is no contact of the incoming air with red hot metal or with the hot coals, and hence the warm current is delivered pure and uncharged with carbonic acid. For churches, school rooms, halls, and other apartments where ventilation is much more frequently bad than good, the ventilating heater appears to be especially suited, and may advantageously replace the usual forms of stove. A perspective view of the invention is given in Fig. 1; the construction is exhibited in the sectional view, Fig. 2. From the latter it will be seen that there is a direct connection between fire box and flue, so that there can be no impediment to the draft. Surrounding the flue is a chamber, A, into which fresh air is led by the pipe, B, the latter connecting with the space between the flooring and with the atmosphere outside the building. In passing up through the chamber, as shown by the arrows, the air traverses several perforated metallic plates, one of which is shown in Fig. 3. These, in addition to impeding the flow of the current, heat the same, since the plates themselves become quickly warmed by the flue walls. The heated air then makes its escape into the room through the openings at C.

We are informed that the consumption of fuel in the stove is small, one hod of coal being sufficient for a ten hours' supply, provided the fire be properly cared for. Either hard or soft coal may be burnt. The construction is simple, and there are no parts to get out of order, nor is there any opportunity for fouling or clogging in the flues. Dampers being absent from the stove, all casualties from careless regulation are avoided. Patented through the Scientific American Patent Agency, September 7, 1875. For further information, address the inventor, Mr. M. C. C. Church, Parkersburg, W. Va.

PORTABLE STEAM ENGINES.

The portable engine illustrated on this page is one manufactured by Messrs. Clayton and Shuttleworth, of Lincoln, England, and was awarded the first prize given for portables at the last trials of the Royal Agricultural Society of England. The competitive trials by the Royal Society are of the most severe and searching nature; and in the case of all descriptions of engines, paid engineers of responsibility and eminence are intrusted with the duty of minutely examining and reporting as to the merits of each competing engine, embracing the distinctive points of strength, proportion and general construction, economy of fuel, quality of material, workmanship, and general efficiency. A combination of these advantages, it is claimed, have given to Messrs. Clayton and Shuttleworth the leading position in England, as portable engine makers, and to this date they have manufactured 12,000 of such engines, and their present production is 25 engines per week.

The following are some of the distinguishing features of the engine herewith illustrated:

The boiler is butt-jointed and riveted by hydraulic machinery, which process of manufacture makes incomparably stronger work than the old plan of hammering. The fire box is invariably of Low Moor iron. The boiler is lagged and covered with iron plate and banded, and the cylinder is steam-jacketed and lagged. All wearing parts, such as slide bars, nuts, pins, etc., are case-hardened. The engines are fitted with improved adjustable side blocks, carriages, and bearings, all of the best quality of gun metal. The crank

shaft is bent, in preference to using the cheaper overneck kind. A second lock-up safety valve and Salter's spring balance are affixed to each engine. Reversing gear is added, allowing the engine to run either way. The feed pump is supplied with an arrangement for heating the water; it is continuous in its action, and cannot get out of order.

The workmanship and material used in the construction of these engines are of the best kind obtainable, and the

meeting, looking not tired and weary, but quite refreshed with his bodily labor."

The Origin of Coal.

The discovery of diatoms in coal, by Count Castracane, recently announced, is of much interest, as throwing additional light on the mode of formation of carboniferous coal. These minute forms of plant life have not been recognized in any but very modern formations; but Count Castracane has succeeded in showing that they date from the palaeozoic epoch, and as far back, at least, as the carboniferous period. He says: "All the forms I have been able to observe among the ashes of the coal present such an appearance that the most practised and sharpest eye could not detect the slightest difference between them and actually living diatoms: outline, structure, shape, and number of the flutings—in short, all the peculiarities which characterize the species that we meet with in the state of actual vegetation—agree exactly with those of the carboniferous period." It can scarcely be denied that the existence of these minute forms of aquatic vegetation in the substance of carboniferous coal goes to confirm the view of those who (like Professor Bischof) hold that this mineral has been formed in presence of water, and the great preponderance of fresh water forms of the diatomaceae proves that this was fresh water; still the occasional occurrence of marine forms leads to the inference that the waters of the ocean occasionally had access to the lagoons or inland lakes.

In fine, the presence of diatoms, taken in connection with

the stratigraphical phenomena of carboniferous coal beds, appears to bear out the views of those who hold that the mineral has been formed from the decay of successive generations of plants and forest trees, growing with their stems partially immersed in the stagnant waters of vast lagoons these lagoons being nearly on a level with the waters of the sea, which sometimes gained access to them, and carried with them marine forms.

Epizootic in Horses.

This disease, that swept over this entire country and proved so serious in the fall of 1872, is appearing again this fall, though probably in a milder form. Nearly all the horses of this and other cities are affected with it already, and it is certain to spread to the country very soon. Horses that are in good condition will suffer the least from its attack. Its first symptom is a slight cough, which gradually becomes more frequent and severe, accompanied with running at the nose and swelling of the throat between the jaw bones. Horses that are in good heart and are properly taken care of will probably only be slightly affected.

A writer in the *Ohio Farmer* advises the simplest treatment possible. Keep the horses in a warm, comfortable, clean, and well ventilated stable, blanketed in wet, cold weather; feed well with oats and sweet hay (corn is too heating), with a good bran mash once a day; the only medicine needed is to thoroughly rub the throat with some good liniment if it should become much swollen, and be very careful not to let them take cold. A little exercise every day at light work or careful driving, we deem

beneficial, but any violent exercise, or anything approaching over exertion, will be almost certain to produce serious results.

The aim should be to keep the horse in as strong heart as possible, and Nature will soon work out the disease. The usual term of this distressing and destructive malady is from twelve to twenty days.

Fig 1

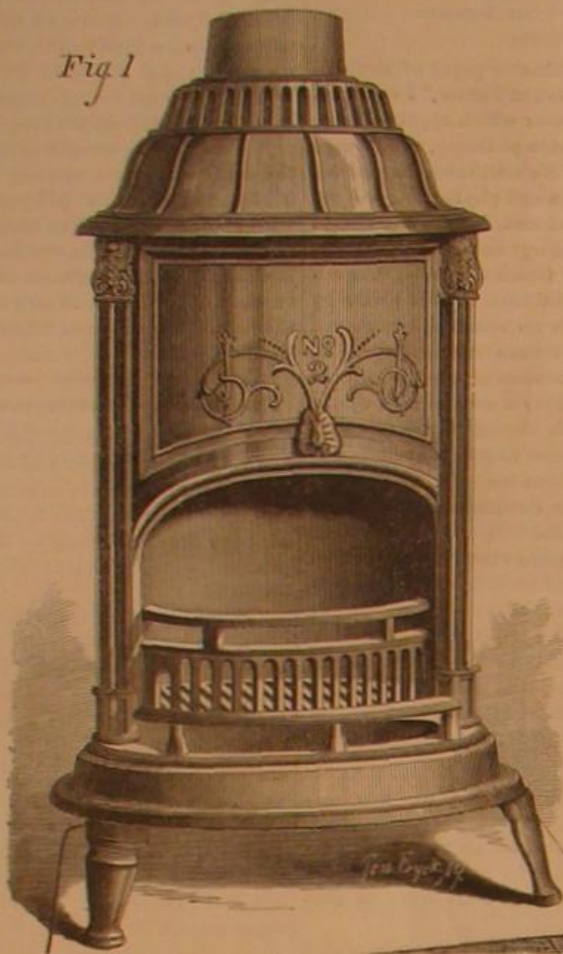
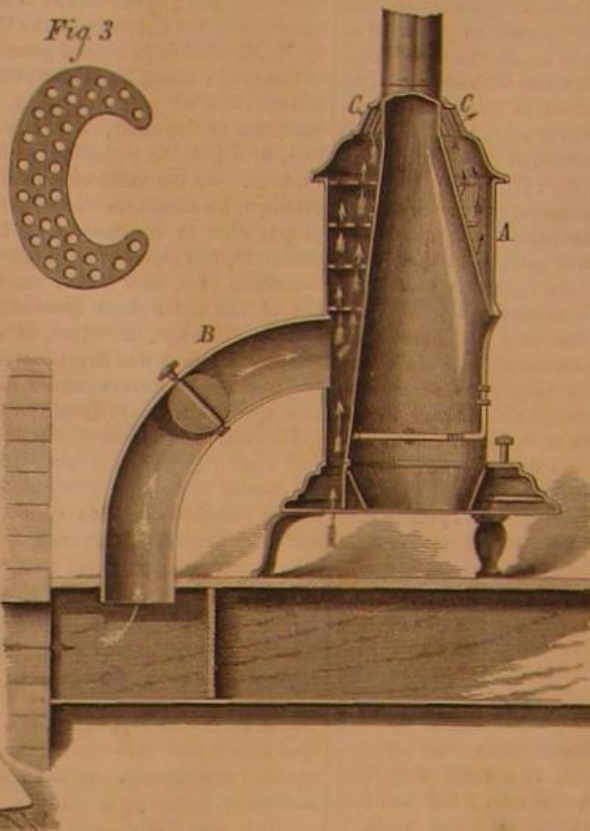


Fig 3



Fig 2

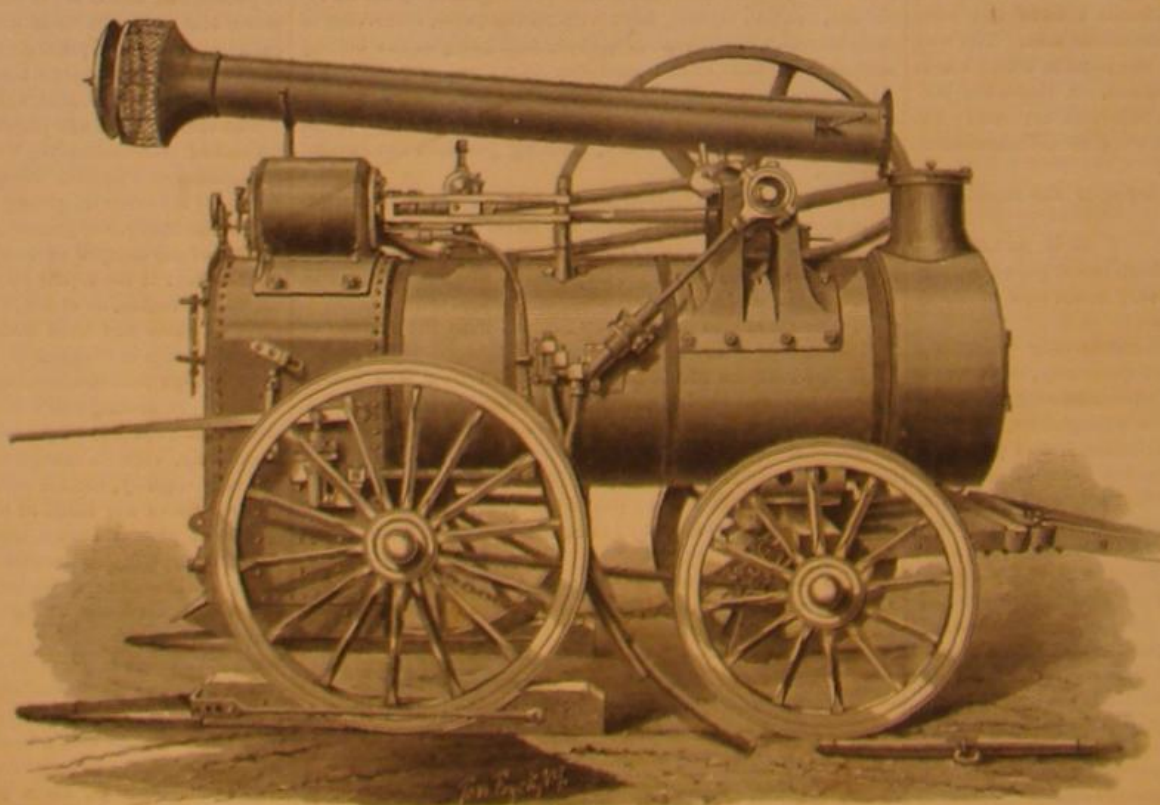


CHURCH'S VENTILATING HEATER.

boilers are tested to 200 lbs. per square inch. Mr. W. C. Oastler, 43 Exchange Place, New York, the agent for Messrs. Aveling & Porter's road engines, steam plows, etc., is also the representative of Messrs. Clayton and Shuttleworth in the United States.

Laborious Rest.

Speaking of the habits of English statesmen, a Liverpool paper states that two hours before the recent meeting at Hawarden "Mr. Gladstone was engaged in his favorite exercise of felling trees. For a portion of two days he has



CLAYTON AND SHUTTLEWORTH'S ENGLISH PORTABLE ENGINE.

been welding the ax upon a large tree in a lane at the outskirts of Hawarden village, and he succeeded in bringing it to the ground late yesterday afternoon. Those who saw him say that he went to work in true woodman fashion, with his braces thrown off behind him and his shirt collar unfastened. After completing his task, he walked home with his axe slung over his shoulder, and two hours afterward was at the

THE MANATEE OR COW FISH.

The manatee, says Mr. Frank Buckland, is one of the rarest and most interesting beasts that has been brought to England for many years past. His external appearance is very puzzling. At one moment he looks like a pig, the next moment he reminds us of a porpoise or herring hog. The home of the manatee is the shallow bays and quiet rivers of Central and South America. He is purely herbivorous, and lives upon the water plants which abound in those tropical regions. Mr. Bartlett, of the Zoological Gardens, London, has discovered that he is exceedingly fond of lettuces and vegetable marrows, cut into slices. His hind legs are flattened out into a fan, somewhat resembling a porpoise's tail. When he wishes to move forward he gets way on by moving his tail up and down; and—as those who unpacked him from his traveling box know—he is able to use this beaver-like tail with very great force. The manatee is purely mammalian, and suckles its young at the breast.

"The manatee is allied to the dugong found in Australia. The dugong has a face ornamented with a big, hooked nose, and when I see the figure of Punch performing in the street, it puts me in mind of the dugong. The dugong and the manatee are without doubt the origin of the fable of the mermaid; either of them, especially the dugong, when coming to the surface of the water to breathe or look round, is very human. The manatee now in the gardens is 7 feet 2 inches long; a full grown beast is from 14 feet to 16 feet long. Unfortunately for this animal, the flesh is very good eating. It has the flavor of pork with the taste of veal, reminding one of that curious relish 'beef cut with a hammy knife.' The skin of the manatee is like the rind of a prickly pear; he has stiff bristles inside his mouth; this is really a form of whalebone, as found in the whale's mouth. The animal seems to be a compromise between a pig and a porpoise.

LAND TORTOISES.

The two large tortoises, living at present in the Zoological Gardens, belong to a species indigenous and peculiar to Aldabra, a small island, or rather group of small islands, situated in the Indian Ocean, about 180 miles northwest of Madagascar.

The animals, of which a faithful representation has been given by our artist, have left their island home a long time ago. They were kept in a semi-domesticated state in a paddock, partly for the sake of their young, partly as a kind of curiosity, the male being the largest individual of its kind existing at present, of which the proprietor was very proud, and in which the islanders generally took an interest.

The female lays twice a year, between July and September, some forty eggs, which are hatched in about ten weeks. The young of such domesticated tortoises are allowed to grow till they are four years old, and from 12 inches to 15 inches long, when they are considered fit for the table. Some of the young individuals which are now on the continent of Europe are the offspring of the animals now in the Zoological Gardens. The tortoises were transported in separate cages, and that for the male had to be made as strong as wood and iron could do it, his strength being so great that, if he gets a good purchase with his feet and brings his shell against a square bar two inches thick, he is able to break it like a reed. In spite of every precaution, he nearly succeeded in getting out of the cage on board of the steamer conveying him to Aden. The sailors had placed the cage of the female opposite to his, and as soon as he obtained a sight of her he commenced to raise himself on his hind legs, and to break through the roof of the cage. There is no doubt that he soon would have succeeded in his efforts if Dr. Brooks had not resorted to the expedient of greasing from time to time the inside of the cage, so that he could no longer support himself against the slippery sides.

The two individuals differ from each other considerably, not only in size, but also in the form of the shell; and in the Seychelles they were thought to belong to different races,

possibly they come from different islands of the Aldabra group.

The shell of the male is 5 feet 5 inches long, and 5 feet 9 inches wide, measured over the curvature; the length of the head and neck is 1 foot 9 inches, and the circumference 1 foot 6 inches. The circumference of the foreleg is 1 foot 11 inches, of the hind leg 1 foot 5 inches. The weight of the animal when it left the Seychelles was 870 lbs; it is still



THE MANATEE OR COW FISH.

growing! The center of each of the scutes along the middle of the back is raised into a hummock, and also the other scutes are divided by deep grooves or sutures. The color is a dirty brown, gradually changing into black towards the center of each scute. The shell of the female is 3 feet 4 inches long, and 3 feet 10 inches broad (measured over the curvature); the circumference of its foreleg is 13 inches. The shell is perfectly smooth, nearly polished, without any unevenness.

They feed on vegetables of all kinds, of which they consume daily a large quantity; in the Zoological Gardens they seem to prefer cabbage and vegetable marrow, but eat grass freely. A constant supply of water to drink is essential; without it they would perish in a short time. They are fond of basking in the sun, but dislike a long exposure to the di-

as much as a sun, but we should not care to recommend this experiment, as the shells of these large tortoises are comparatively much thinner than those of the smaller kinds.

These tortoises never bite, and the male is so tame as to take the food out of the hand. He was thus sketched while being fed with a vegetable marrow. He is fond of being stroked and rubbed about the head and neck, which he stretches out of the shell to their full length. He shows great affection for the female, and this was especially apparent when he was released from the two months' confinement in his cage; he seemed stiff, without any inclination to move, until the female was placed before him, when he at once stretched out his head, and followed her about in their inclosure. Some time before sunset they go to rest, one with the fore part of the shell resting against that of the other. The male has a loud voice, compared by the keeper to the roaring of a bull.

Remarkable Electrical Phenomena

The night of July 7-8, 1875, will be long remembered in Switzerland for thunderstorms, several of them of almost unexampled severity. Of these, one that broke over Geneva was unprecedentedly severe and disastrous. It appears to have originated to westward, in the department of Ain, and took an easterly course up the valley, of the Rhone to Geneva, on reaching which it spread over a wider area, and thence directed its course over Savoy. As midnight came on, though the heat was suffocating and not a breath of wind stirred below on the streets, light objects on the roofs of the houses began to be whirled about and carried off as by a tempest of wind. At the same time a dull rumbling sound, resembling neither that of wind nor that of thunder, announced the approach of the thunderstorm, and at 12 midnight exactly it burst over Geneva in all its fury. An avalanche of enormous hailstones, with no trace of rain, was precipitated from the sky, and shot against opposing objects by a tempest of wind from the southwest. In a moment the street lamps were extinguished, and in a brief interval incredible damage was inflicted, the glass and tiles of houses smashed to powder, trees stripped of their bark on the side facing the west, and crops of every sort were, in many places, all but totally destroyed. The smallest of the hailstones were the size of hazel nuts, many were as large as walnuts and chestnuts, and

some even as large as a hen's egg. Some of the hailstones measured four inches in diameter, and six hours after they fell weighed upwards of 10 ozs. For the most part the hailstones were of a flattish or lenticular form, with a central nucleus of 0.16 to 0.40 inch diameter, developed in several concentric layers of ice, generally from 6 to 8 alternately transparent and opaque. A map has been printed in the *Journal de Genève*, showing the districts where the storm was felt as well as the degree of its intensity in each locality. The electrical phenomena were very remarkable; the flashes of lightning succeeded each other with such rapidity, from midnight till a few minutes after 1 o'clock in the morning, that a mean of from 2 to 3 were counted each second, or from 8,000 to 10,000 per hour. Electrical phosphorescence was remarkably intense before and during the hail. The ground, animals, prominent objects, as well as the hailstones, were strongly phosphorescent. Immediately after the hail, ozone was greatly developed, the smell being so pronounced as to be compared, by nearly all observers, to garlic. The incessant electrical discharges passed from cloud

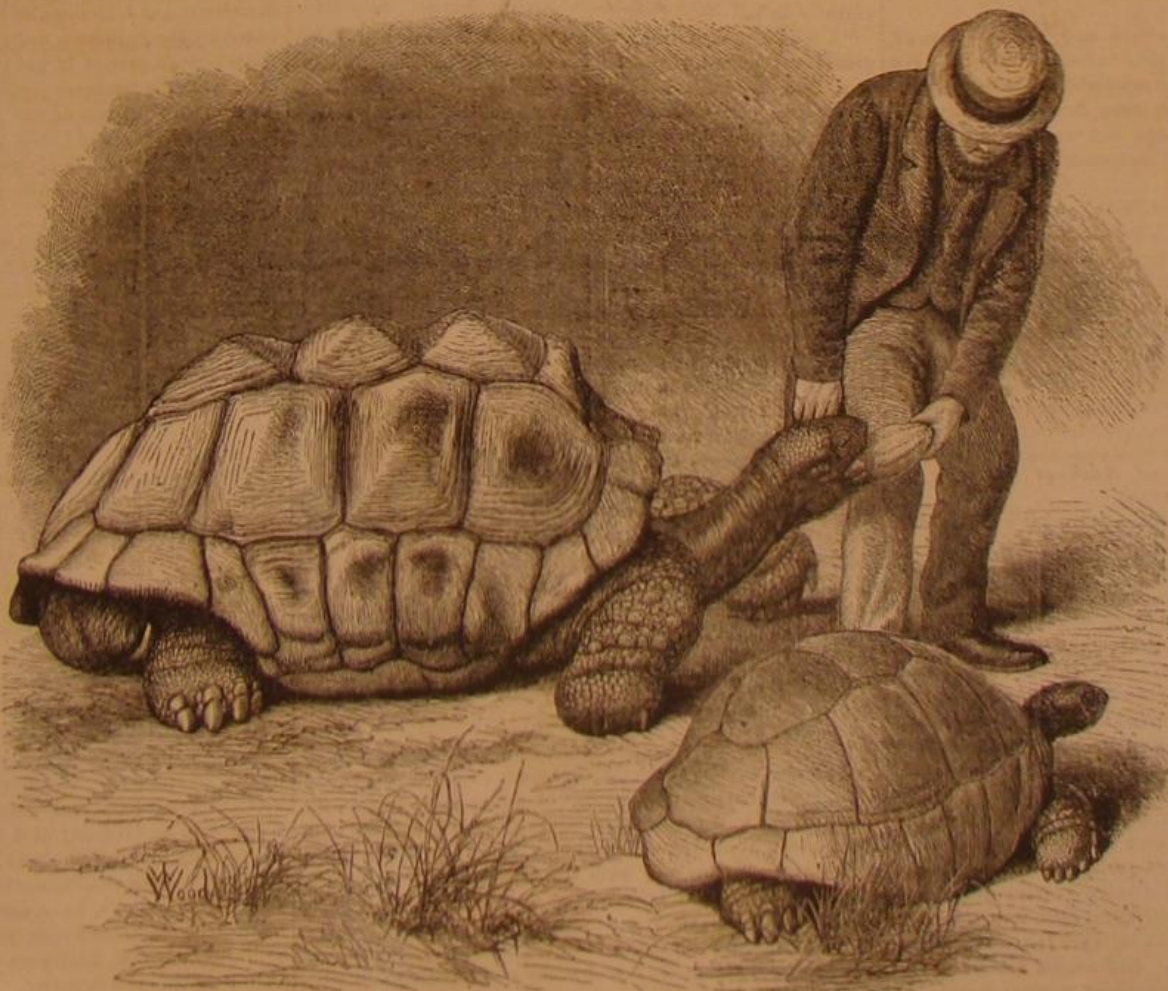
to cloud over a central point from which the hail fell, but thunder was very rarely heard.—*Nature*.

LAND TORTOISES IN THE ZOOLOGICAL GARDENS, LONDON

rect rays of a powerful midday sun, which they avoid by seeking the shade. As the temperature in the Seychelles does not sink at any time of the year below 70°, the utmost care is to be taken to shield them from the cold of the nights of early autumn; and we believe that neglect in this respect has been the cause why the specimens imported into England some thirty years ago never survived their transmission to Europe for more than a few months. Twenty-four hours' exposure to a temperature below 50° is fatal to them.

Their walk is slow and clumsy, but is not impeded by the weight of as many people as can possibly find room on the back of their shell. The male is believed to be able to carry

A good cheap paint for barns and outhouses is made as follows: Put 1 bushel of good lime in a clean barrel, and add sufficient water to make a thin whitewash; stir it well with a flattened stick until every lump of lime is dissolved. Then add 50 lbs. mineral paint, 50 lbs. whiting, 50 lbs. road dust, finely sifted. Mix to a thick paste with linseed oil and thin gradually to the proper consistence with sweet buttermilk, fresh from the churn. The covering quality is improved by the addition of 1 gallon soft soap.



THE SHOEMAKER'S OPPORTUNITY.

Not liking the crippled motion of the feet of a certain young American, whose unsteady gait when shod was very unlike his graceful carriage when barefoot, we protested that broader shoes should be furnished him. "They are not to be had" was the mother's reply. The child was wearing shoes half an inch longer than his feet, but they were too narrow, by half an inch, across the toes. To make matters worse, the heel was much too wide, allowing a slipping of the ankle from side to side, which even the stiff counters could not keep from causing a marked overrunning of the sole.

Remembering the reform which was made a few years ago in the matter of men's foot wear, we thought it altogether likely that the makers of children's shoes, or some of them at least, might have been led to pay some regard to the shape of children's feet; so we volunteered to find a suitable shoe for our friend's child. Our search was long and faithful; but we had to give it up defeated. There may be dealers in New York who sell children's shoes bearing some reasonable resemblance to children's feet; we sincerely hope there are; but we failed to find any.

The accompanying outline shows the relation between the sole of the child's foot—a perfect foot, such as a sculptor might copy—and the sole of the broadest shoes that could be found of corresponding length. Though they were button gaiters, and so far rights and lefts, not the slightest recognition of the right and left character of a child's feet is discernible in their shape, or the shape of any other children's shoes that we found in the market. "We almost always have trouble in fitting children, their feet are usually so chubby," said one honest salesman. "Why then don't you have the shoes made properly?" we enquired. "Because we could not sell them," was the reply. "A mother invariably judges a shoe by its looks. Show her one with a sole broad enough for a babe, and she will scarcely look at it. She wants something pretty and stylish."

Short-sighted shoemaker! To allow her to get off with the notion that anything could be prettier than her darling's tootay-wooties!

The society for the prevention of cruelty to children may go far before they find a more suitable occasion for the exercise of their authority. The aggregate amount of pain inflicted upon small children by misshapen shoes must be something enormous.

But surely all mothers are not vain and pitiless—though most of them are sadly uncritical of customary abuses. We are confident that any shoemaker who will adopt for a trademark the foregoing design—first come, first served, gratis—and advertise to furnish suitable foot wear for small children, will receive the thanks of thousands and be rewarded with a profitable business.

There is room for improvement in the material as well as in the shape of babies' shoes. A young creeper will ruin in a fortnight a pair of shoes costing a dollar or more at retail. A buckskin moccasin neatly made would be far more durable, vastly more comfortable, and much cheaper. Hard soles can well be dispensed with until after the child begins to run about outdoors; even then the uppers should be soft and easy.

Who, at this season of revivals, will lead off with the Centennial moccasin?

Mrs. Maxwell's Museum of Natural History in Colorado.

"On the corner of one of the streets in the town of Boulder, Colorado, is a building with a narrow and somewhat rickety staircase leading up on the outside. At the top of the staircase is the sign 'Museum.' Somebody had said in my hearing that all the animals in the museum were shot and stuffed by Mrs. Maxwell herself, and the collection was nearly a complete one of the native animals of Colorado. I went to the museum, expecting to be much amused by a grotesque exhibition of stiff and ungainly corpses of beasts, only in teresting as tokens of the prowess of a woman in a wilderness life.

"I stopped short on the threshold in utter amazement. The door opened into a little vestibule room, with a center table piled with books on natural history, shelves containing minerals ranged on the walls, and a great deer standing by the table, in as easy and natural a position as if he had just walked in. This was Mrs. Maxwell's reading room and study. On the right hand a door stood open into the museum. The first thing upon which my eyes fell was a black-and-tan terrier, lying on a mat. Not until a second or two did the strange stillness of the creature suggest to me that it was not alive. Even after I had stood close by its side I could hardly believe it. As I moved about the room I found myself looking back at it from point after point, and wherever we went its eyes followed us, as the motionless eyes of a good portrait will always seem to follow one about. There was not a single view in which he did not look as alive as a live dog can when he does not stir. The dog alone is enough to prove Mrs. Maxwell's claim to be called an artist.

"In the opposite corner was a huge bison, head down, forefeet planted wide apart and at a slant, eyes viciously glaring at the door—as distinct a charge as ever bison made. Next to him, on a high perch, was a huge eagle, flying with outstretched wings, carrying in his claws the limp body of a lamb. High above them was a row of unblinking owls,

labeled 'The Night Watch.' In a cage on the floor were two tiny young owls, so gray and fluffy they looked like little more than owls' heads fastened on feather cushions. Mrs. Maxwell opened the cage and let them out. One of them flew instantly up to its companions on the shelf, perched itself solemnly in the row, and sat there motionless, except for now and then lolling its head to right or left. The effect of this on the expression of the whole row of stuffed owls was something indescribable. It would have surprised nobody at any minute if, one and all, they had begun to loll their heads.

"The distinctive feature of the museum, however, is a dramatic group of animals placed at the further end of the room. Here are arranged mounds of earth, rocks, and pine trees, in a by no means bad imitation of a wild, rocky landscape. And among these rocks and trees are grouped the stuffed animals, in their families, in pairs, or singly, and every one in a most life-like and significant attitude. A doe is licking two exquisite little fawns, while the stag looks on with a proud expression. A bear is crawling out of the mouth of a cave. A fox is slyly prowling along, ready to spring on a rabbit. A mountain lion is springing literally through the branches of a tree on a deer, who is running for life, with eyes bloodshot, tongue out, and every muscle tense and strained. Three mountain sheep—father, mother, and little one—are climbing a rocky precipice. A group of ptarmigans shows the three colors—winter, spring, and summer. A mother grouse is clucking about with a brood of chickens in the most inimitably natural way. And last, not least, in an out-of-way corner is a touch of drollery for the children—a little wooden house, like a dog-kennel, and coming out of the door a very tiny squirrel, on his hind legs, with a very tiny yellow duckling hanging on his arm. The conscious strut, the grotesque love-making of the pair is as positive and as ludicrous as anything ever seen in a German picture book. Only the most artistic arrangement of every fiber, every feather, every hair could have produced such a result. We laughed till we were glad to sit down on the railing, close to the grizzly bear, and rest.

"But a funnier thing still was on the left hand—a group of monkeys sitting round a small table, playing poker. One scratching his head and scowling in perplexity and dismay at his bad cards, and another leaning back smirking with satisfaction over his certain triumph with his aces; one smoking with a nonchalant air; and all so absorbed in the game that they do not see the monkey on the floor, who is reaching a cautious paw and drawing the stakes—a ten dollar bill—off the edge of the table. Beard himself never painted a droll group of monkeys, nor one half so life-like. It will always be a mystery to me how, to these dead, stiff faces, Mrs. Maxwell succeeds in giving so live and keen and individual a look.

"I found, upon talking with her, that she has had for a great many years this passion for collecting birds and beasts. She began the collection for her own pleasure, and took several courses of instruction from taxidermists, that she might be familiar with all the processes. Her own methods, however, are peculiar. She molds the animal first of plaster, just as she wishes it to stand. Then she covers it with the skin, fitting the skin to it, instead of stuffing the skin out till it is in the shape of an animal. It seems that there is twice as much skin on an animal as it needs to cover it, and that one reason stuffed animals ordinarily look so frightfully unnatural is that the skin is stuffed till it is stretched out of all proper proportions.

"Mrs. Maxwell is, then, in reality a sculptor of animals. None of the animals in her museum are, properly speaking, 'stuffed animals.' They are sculptured animals, covered with skins appropriate to their kind. Her first collection she had sold, five years ago, to obtain money to make a larger one. Her great desire is to make a Colorado museum which shall be truly a complete one of all the animals and birds of the territory, and its minerals, and fossils, and Indian relics. Coloradoans ought to join hands with her in the enterprise, and all strangers who visit Colorado ought to see her museum—not only as a collection interesting in itself, but as evidence how independent a genuine passion for anything is of outside stimulus and help."—Mrs. Hunt, in the Independent.

Boilers.

At a recent session of the British Iron and Steel Institute, Mr. T. R. Crampton said: In the case of boiler performance, the question was how much water would a boiler evaporate with a given weight of coal, and the boiler which gave the highest performance in this way with the smallest area of heating surface was the best boiler. The question of what horse power the steam thus generated would develop was one which depended upon the class of engine to which the steam was supplied, and hence it had nothing whatever to do with the boiler. The class of boiler Mr. Crampton considered unimportant so long as good circulation and sufficient surface were provided for the work to be done. As a general rule, it was desirable to use the most simple construction of boiler possible under the given conditions; but under special circumstances greater complexity was justifiable to obtain the necessary area of heating surface within the required space. Mr. Crampton added that in 1842 he introduced the type of locomotive boiler with the firebox crown made flush with the barrel—the latter being made larger than in the older type—and he found that the additional water space thus provided at the sides of the tubes in the barrel had a decidedly beneficial effect on the circulation. For use in iron works in connection with a puddling or heating furnace, Mr. Crampton recommended a vertical boiler, say, about 8 feet diameter by 30

feet high, resting on the ground and free at the top, this boiler being surrounded by a brickwork casing, to the space between which and the boiler the heated gases from the furnace are admitted by a lateral flue, while they are led off at the top. Inside the boiler should be placed a tube some inches less in diameter than the boiler, thus dividing the ascending and descending currents, and thus promoting the circulation. A boiler thus arranged, Mr. Crampton stated, would never burn, and the gases would be discharged to the chimney with their temperatures reduced to 500°.

Lime in the Blast Furnace.

Mr. I. Lowthian Bell, says: "When limestone, in its natural state, is used as a flux, it quickly reaches a zone where the heat is sufficient to separate the carbonic acid from its calcareous base. The temperature of this region, indeed, is so intense that not only the carbonic acid associated with the lime, but a portion of that due to the deoxidation and carbon impregnation of the ore, is reduced to the form of carbonic oxide.

I have shown, on a former occasion, that the smelting of a ton of iron is probably accompanied by the conversion of 6.58 cwt. of carbon from the state of carbonic oxide to that of carbonic acid. The carbon in its acidified form, in the quantity of limestone consumed, upon one occasion, in a 48 feet furnace, was 1.92 cwt. Hence, we may infer that, were there no reduction of carbonic acid to a lower condition of oxidation, we ought to find, for each ton of iron produced, 8.50 cwt. of carbon, combined with its maximum dose of oxygen.

Instead of this quantity, only 5.47 cwt. of carbon so oxidized was found, in the escaping gases of one of the smaller furnaces referred to, per ton of iron of its make.

This change in the composition of the escaping gases of a blast furnace involves more serious consequences than what, perhaps, at first sight might appear.

There is the heat absorbed by splitting up carbonic acid containing (8.50—5.47) 3.03 cwt. of carbon . . . 9,696
The decomposition of this carbonic acid carries off the same weight of carbon which it contains, and which escapes combustion at the tweers, involving a further loss of . . . 7,272

16,968

The coke consumed upon the occasion which furnished these data amounted to 28.92 cwt. per ton of iron, and the heat estimated to be afforded by its combustion was 104,012 units. The proportion of the total heat generated, which was absorbed by the expulsion of carbonic acid from the limestone, and the decomposition of this compound of oxygen and carbon, amounted to 22 per cent. Of this, 16 per cent is due to the use of limestone, and 6 to the dissociation of the carbonic acid, produced by the reduction and carbon impregnation of the ore.

An expenditure of 16 per cent of the heating power of the fuel, which is rendered necessary by the presence of one of the constituent parts of our flux, affords *prima facie* a strong reason why we should seek to relieve the furnace of a duty represented by about 4½ cwt. of coke, particularly as half this weight of inexpensive small coal sufficed for the purposes of the limekiln.

I am not aware that the experience of any iron smelter justifies the belief that any approach to this economy was ever realized by the substitution of lime for limestone. With the same quality of coke in each case, one of the smaller furnaces (48 feet) gave the following results:

14 days' make per furnace.	Average No.	Coke per ton.	Yield per ton.	
tuns.		cwt.	per cent.	cwt.
419	3.34	29.06	41.9	Limestone per ton 14.53
444	2.20	29.64	42.6	Burnt lime " 11.14

Other examples from furnaces of similar dimensions gave the following averages:

14 days' make per furnace.	Average No.	Coke per ton.	Yield per ton.	
tuns.		cwt.	per cent.	cwt.
404	2.65	29.31	42.0	Limestone per ton 13.89
451	2.10	27.99	42.6	Burnt lime " 11.46

In the first two cases given, the consumption of fuel is practically the same, but the produce of Cleveland iron, when smelted with calcined limestone, is somewhat better. Discarding this cause of difference, the sole advantage from the use of lime is the increased make and superior quality of the iron. In the next two examples, an improvement in production and grade of metal is also observable, along with an economy of 1.32 cwt. of coke, part of which is probably due to the better yield from the ironstone (Cleveland), as well as to a somewhat superior quality of coke received at the works, when calcined limestone was being used. In none of these instances, judging by the relative qualities of burnt and raw limestone employed, has one half of its carbonic acid been expelled.

The apparent want of reconciliation between the theory and practice in the consumption of fuel, when using the flux raw or calcined, is, in my judgment, in a great measure independent of the imperfect expulsion of carbonic acid from the latter; and further, I am of opinion that a complete separation of this element would fail to effect, in a larger furnace, any appreciable good in respect to the coke required for this process.

SALE OF SEWING MACHINES.—From the *Sewing Machine Journal*, we learn that there were sold, during the year 1874, 602,074 sewing machines of the different American makes, and that, since 1853, when the first sewing machines were made, up to the end of 1874, there have been in the aggregate 3,785,968 made and sold. Quite a business.

The Fraunhofer Lines of Diffraction and Prismatic Spectra.

BY PROFESSOR JOHN C. DRAPER.

Having been engaged during the past year in making photographs of absorption spectra of organic bodies, in which a solar spectrum with Fraunhofer lines was formed by a diffraction grating, I have resorted to the following method of forming such solar spectra, a description of which may prove of interest to those who are experimenting in the same field.

The grating generally used was made by Mr. L. M. Ruthersford; it is ruled on speculum metal, 6,481 lines to the inch; it gives spectra by reflection. Other gratings on glass, now in my possession, give spectra by reflection and by transmission. The method answers equally well for both. It may be briefly stated as follows:

A beam of light is directed by the silvered plane mirror of a heliostat, A, into a darkened room.

It is received on an achromatic lens, B, 3.93 inches in diameter; focal distance from posterior surface, 23.50 inches.

A slit, C, is then placed within the focus of this lens, the distance being 18.86 inches from the lens, B.

After passing through the narrow slit, which is about 0.04 inch wide, the light is received upon a second achromatic lens, D, of the same diameter as the first, but with a focal



distance of 45.2 inches. The distance of this lens from the slit is 64.4 inches, and the focussing of the lines of the spectrum on a paper screen or on the ground glass of the camera is accomplished by moving the lens, D, nearer to or farther from the slit, C, or by moving the camera or screen, F, itself.

The grating, E, mounted on a suitable stand, is placed at a distance of 31.4 inches from the second lens. All parts of the apparatus being carefully adjusted, so that A, B, C, D, E are on the same horizontal axis, the grating is then arranged on its vertical axis, to throw the center of its reflected image on the opening of the slit, C.

The lines of the grating being accurately parallel to the sides of the slit, a series of beautiful spectra are produced on each side of the slit, any or all of which may be received on suitably adjusted screens, one of which is represented at F. In all of these spectra, if the slit has been very narrow, the prominent Fraunhofer, with numerous other lines, appear sharply defined.

Of the spectra described above, only the first, second, and third orders on each side of the image of the slit are available for general use on account of the overlapping of those that follow. Of those that are available, I have preferred to use the second order, since in this the dispersion is much greater than in the first, and by the apparatus described above a spectrum of a length of more than 11.8 inches is obtained.

For the projection of the prismatic spectrum a prism is substituted in place of the grating, when a very fine spectrum is produced, the focus of the violet end of which is very much closer to the prism than that of the red end.

In the diffraction spectra, also, it is necessary to vary the angle at which the screen is placed, to define sharply the lines at the extremities of each spectrum. In the spectra of the first order on each side, the screen is placed very nearly at right angles to a line drawn from the grating to b, in the spectrum. As each order in succession is examined, the divergence from this angle is greater and greater, and at the same time the focal distance of the lines moves nearer to the grating.

The lenses I have employed were those of a very fine photographic combination; they give with the rest of the arrangement a spectrum in which the definition of the lines is perfect, and they are present by hundreds. Though the lenses are 3.93 inches in diameter, only the central portion of each is used, a diaphragm with a circular aperture of 1.97 inches or less being placed in front of B.

To form the absorbent spectra of any organic substance, a suitable solution of the same is poured into a cell with parallel sides. This is placed at any convenient point between A and B, care being taken that the faces of the cell are at right angles to the course of the ray, A B. The slit may in this case be opened wider, when each spectrum will show the characteristic absorbent bands of the substance employed, the position being indicated (and if required, recorded) by their relation to the lines of the solar spectrum in which they are produced.

When the calcium or electric light is to be used for lecture room demonstration of diffraction spectra, the lens, B, should have as short a focus and as large a diameter as possible. The grating may also be so arranged on its vertical axis as to throw its image at a right angle to the line, B E, to be there received on a screen. Though by this device the spectra on one side of the image of the grating are greatly elongated and those on the other compressed, it presents the advantage of enabling the audience to see all the spectra at once, and also the optical contrivances by which they are produced.

At Příbram, in Bohemia, the Adalbert shaft of the silver and lead mines has reached the extraordinary depth of nearly 3,300 feet.

Useful Recipes for the Shop, the Household, and the Farm.

Varnish brushes should never be allowed to touch water, as it not only injures the elasticity of the hair, but a resinous substance is formed in the hilt of the brush, which can never be thoroughly removed, and which will work out little by little when the brush is used, destroying the glassy surface which otherwise might be obtained.

Paint intended for outside work, which will not be protected by varnish, is mixed as follows: Crush the color in lumps, and mix to a stiff paste with linseed oil, boiled or raw—the latter is preferable; then, if a dark color, add brown Japan or gold size, in the proportion of $\frac{1}{4}$ pint to a gallon of oil; in a light color, use patent dryer in similar quantities.

A large stick of cypress timber will rot off cypress tenons, or tenons of any other kind of timber (if put together when the cypress is green), if kept under shelter. Cypress will dry rot itself, if over 15 or 18 inches square; and green oak of any kind, 12 inches square, will rot a dry $1\frac{1}{2}$ inch pin of the same wood, or a pin of any other wood, if dry, and driven tight to exclude all air.

Horses will work much more easily, and lose less of their effective force, by working abreast, than when they are placed in single file. If four horses are to draw a load in one wagon, it is better to have a long double whiffletree, with a span of horses on each side of the tongue, than to have one span placed before the other.

A skilful sawyer, in sawing a log into scantling, which he knows will spring, will first mark off the ends into cuts; and then, after sawing once through on one side of the log, will saw a slab off the other side, and finish in the middle. By this means the lumber will be about as true as if the timber were not inclined to spring at all.

Chimneys are excellent lightning conductors. In view of which, it is recommended: First, that they be kept clean; then, that all the grates in a house be connected by means of a strong wire, such as is used for telegraph purposes, with a piece of metal in the earth, or with the iron gas or water pipes.

Veneered Diamonds.

The enterprising capitalists who are pecuniarily interested in the Keely motor will doubtless be glad to learn of another great discovery, which promises results certainly as astounding as those due to the "watery vapor." Abundant opportunities for investment are offered. The discoverer has worked twenty-eight years at the process, a little more than double Keely's time; and unlike the latter colossal genius, he doesn't keep the secret to himself, or lock it in the bosoms of a chosen few, but spreads it before an astonished world in this wise. Any body can try it for himself, and have a small Golconda in an incredibly short period of time. We extract from gigantic advertisements in the daily journals, the "Process of Producing the Parisian Diamonds."

"The body is of crystal, which is the hardest and best substance that could possibly be used for the purpose. Then, after the crystals are cut in proper shape, they are put into a galvanic battery, which coats them over with a liquid, that is made of diamonds which are too small to be cut and the chippings and cuttings that are taken off of diamonds during the process of shaping them. Thus all of the small particles of diamonds that have heretofore been comparatively worthless, can now, since this great discovery, be used to produce diamond liquid."

The Law of the Rail.

Some one, who has taken the trouble to post himself on the law governing railroad passenger travel, says that extra charges for failure to buy tickets are universally sustained by the courts, but there must be a full opportunity to buy afforded by the ticket seller. Passengers must show tickets when asked for. As to stopping off, there is only one decision, which is that a passenger cannot stop off, and resume his journey, without the previous assent of the company. As to the obligation of the road to furnish a seat to a passenger, a decision says: "A passenger who exhibits his ticket need not surrender it until he has been furnished with a seat." A railroad is not liable for things stolen out of a passenger's seat, there being no previous delivery to the company's servants; for the same reason the company is not liable for baggage in the passenger's own care. Passengers who neglect to look after their own baggage on arrival at their destination cannot recover it if it is lost without fault of the carrier. Baggage left in station houses for the passenger's convenience, after it has reached its destination, comes under a new class of rights and duties, the baggage master assuming the position of a gratuitous bailee, who only becomes liable in cases of gross negligence. The obligation of the railroad as carrier ceases when it has delivered it to its owner at the place of destination, or when he has had reasonable opportunity of receiving and removing it. It will interest sportsmen to know that they may recover for the value of dogs when they entrust them to baggage masters for hire because of their exclusion from the passenger cars.

Outdoor Amusements.

During the recent festival of the German turners in this city, a variety of curious gymnastic amusements were undertaken.

The competitive exercises on the horizontal bar attracted much attention, some of the contestants exhibiting great strength, ability, and endurance. There was also a swimming race in the East river. Twelve swimmers were taken in a tugboat nearly to Blackwell's Island (about 350 yards), and at a given signal all jumped into the water and struck out

for the New York shore. After a few dozen strokes three swimmers became exhausted, and were picked up by the boats in attendance. Of the entire number only four swam to the shore. Another amusing feature, and one which caused a great deal of merriment, was boat tilting. Ten boats were each manned by one rower and another man, who stood at the stern armed with a long pole topped with rubber. As the two boats were rowed past each other, each man tried to push off his opponent into the water with his pole.

Common sense Ventilation.

"The best practical statement I have met about ventilation," says Colonel Waring in the last *Atlantic*, "was contained in the remark of a mining engineer in Pennsylvania: 'Air is like a rope; you can pull it better than you can push it.' All mechanical appliances for pushing air into a room or a house are disappointing. What we need to do is to pull out the vitiated air already in the room; the fresh supply will take care of itself if means for its admission are provided. It has been usual to withdraw the air through openings near the ceiling, that is, to carry off the warmer and therefore lighter portions, leaving the colder strata at the bottom of the room, with their gradual accumulation of cooled carbonic acid undisturbed. Much the better plan would be to draw this lower air out from a point near the floor, allowing the upper and warmer portions to descend and take its place. An open fire, with a large chimney throat, is the best ventilator for any room; the one half or two thirds of the heat carried up the chimney is the price paid for immunity from disease; and large though this seems, from its daily draft on the wood pile or coal bin, it is trifling when compared with doctors' bills and the loss of strength and efficiency that invariably result from living in unventilated apartments."

A Hen Crocodile.

A female crocodile, recently shot in Florida, measured ten feet eight inches in length, and presented many points of contrast with the other. Her teeth were regular and white and sharp. The mottled black and yellow of her back and sides were distributed evenly, the yellow rather predominating than otherwise; while in the case of the male, no part was yellow except the belly—the sides shading off into the lusterless black which covered almost all of the back and tail. The ovary of the female contained four hundred and twenty eggs, varying in size from a No. 8 shot to a hen's egg, and all perfectly spherical. It may be added, in passing, that the female crocodile lays twenty or thirty eggs at a time, which she puts in layers in a hole in the mud or sand on the shore, covering each layer with a coat of earth and reeds and grass. She then leaves the process of hatching to the fermentation of this mass, which reaches the right degree of heat in about a month's time.

Just So.

We have waited long and patiently, says the *Philadelphia Evening Bulletin*, for Keely, because he said he wanted time to make his engine and to secure himself by patent in Europe. Since the announcement was first made, he has had time enough to have built one of the pyramids of Egypt, and to have obtained patents from every government on the civilized earth. Therefore, if Keely does not soon place that engine on a railroad track, and run it over to New York with a spoonful or two of water, it will be only natural that the public should finally determine that the enterprise is a humbug. Perhaps we may save time and ease popular expectation by expressing that opinion now.

For the preservation of wood by means of copper salts, says M. Rottier, cupric acetate and indigo, though good, are too expensive. Heating wood after impregnation with copper sulphates does not give reliable results. Cachou can only be used under certain circumstances. Ammoniacal copper salts are, however, susceptible of very general application, and when applied have more permanent effects than those of other copper salts.

The clay smoking pipes marked T. D., which have been in use longer than the oldest inhabitant, are made by Messrs. W. White & Sons, of Glasgow, Scotland, an honest old Quaker house which has conducted the manufacture for a century and a half. Over one million of these pipes are imported and consumed in this country annually.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)
From August 17 to September 8, 1875, inclusive.

ATTACHING HEELS TO BOOTS.—J. W. Brooks, Boston, Mass.
BEARINGS.—Lathrop Antifriction Company, New York City.
BUSTLES, ETC.—A. W. Thomas, Philadelphia, Pa.
CLEANING PIPES.—J. H. Hawley, Stapleton, N. Y.
COMBINED BEVEL, RULE, ETC.—W. Ascoug, Buffalo, N. Y.
CRANE.—J. Hahn, Pittsburgh, Pa.
DREDGING SOIL, ETC.—P. Cradock, Providence, R. I.
ENGINE AND METER.—J. S. Foster, Salem, Mass.
EXTENSION LADDER.—R. Glichest, Louisville, Ky.
IRON SHIP, ETC.—R. Powell, Washington, D. C.
KNITTING MACHINERY.—N. B. Westcott et al.
LIQUID METER.—J. H. Shedd, Providence, R. I., et al.
MATCH SPLINT MACHINE.—F. de Bowers (of Edison, Md.), London En
PREPARING FIBERS.—C. C. Coleman, San Francisco, Cal.
ROLLING MILL.—I. Hahn, Pittsburgh, Pa.
SEWING MACHINE APPLIANCES.—G. H. Bishop, Newport, Me.
SHEET METAL BOX, ETC.—H. Martyn, Boston, Mass.
SINK TRAP, ETC.—F. Ades, Brooklyn, N. Y.
STEAM GENERATOR.—D. Renshaw, Cohasset, Mass.
STREET CAR.—A. S. Gear, Boston, Mass.
TCY.—L. Schmeizer (of Chicago, Ill.), Bothenburg, Bavaria.
TREATING ROSE BLACK.—J. Gaudin et al., Brooklyn, N. Y.
TREATING PAPER, ETC.—H. Kellogg, Milford, Conn.
TYPE MAKING AND SETTING.—C. S. Westcott, Elizabeth, N. J.
UM REELIA, ETC.—J. C. Hurdcombe (of New York City), London, Eng and

NEW BOOKS AND PUBLICATIONS.

LIFE BOATS, PROJECTILES, AND OTHER MEANS FOR SAVING LIFE
By R. B. Forbes. Boston, Mass.: W. P. Lunt, 102 Washington street.

Mr. Forbes is Chairman of the Standing Committee of the Massachusetts Humane Society, and he details some of his views on another page of this issue. His work now before us is a well written resume of what has been done in this country and in Europe in inventing and perfecting means of saving life in case of shipwreck; and it should be read by all shipowner, and seafaring men, as well as by philanthropists and others who are trying to mitigate the dangers of the sea.

Recent American and Foreign Patents.

Improved Wooden Frame for Hinged Awnings.

Henry Sykes, New York city, assignor to himself and William Campbell, Brooklyn, N. Y.—This awning frame consists of metallic crew-threaded elbow couplings and wooden bars, provided with tenons, which are screwed into the said couplings, so as to make a perfectly rigid and smooth frame. It is stiffer than iron frames, and is not liable to rust, or to cause injury to the cloth.

Improved Farriers' Tool.

Michel Baltes, Franksville, Wis.—This is an instrument for cutting grooves in horses' hoofs to receive the clinch of the shoe nails. A straight jaw has a notch formed in the inner edge of its forward end. A curved jaw has an edge formed upon its forward end, and a spring is arranged in connection with the two jaws. In using the instrument, the straight jaw is placed against the hoof upon the upper side of the projecting part of the nail, and with the nail in the notch of the said jaw. The edge of the curved jaw is pressed against the hoof, and with an outward and downward pressure enough of the hoof will be scraped out to form a groove for the clinch. The use of this instrument avoids the use of a rasp to form a groove for the clinch, and avoids the injurious rasping of the hoof to take out the said grooves.

Improved Toy Whistle.

Henry B. King, Paterson, N. J.—This is a whistle or reed with funnel-shaped mouth and guide wing, the whole attached to a cord and whirled through the air to produce a sound. A vane keeps the mouth steadily against the wind, and produces thereby the sound, which, if more than one whistle or reed be used, may be varied so as to be harmonious and pleasant to the ear.

Improved Composition for Preserving Eggs.

Joseph K. Boone, Boonville, Mo.—This is a compound of alum and lime, in equal proportions, dissolved in hot water, for the preservation of eggs, which are dipped in, and allowed to remain for ten seconds. A cement is formed on the eggshell, producing an airtight polished surface.

Improved Feed Water Regulator.

Christopher M. Bridges, Leon, Iowa, assignor to himself and Creed Bobbitt, of same place.—A float in a chamber connected to the boiler at the water level rises when the water fills the chamber, and opens a passage from the chamber containing the float to the pump, thus allowing the boiler pressure to close the check valve in the supply pipe from the tank. A circulation of the hot water of the boiler by this means will be maintained through the pump as long as the water in the boiler is high enough to keep the chamber full and the float up; but when the water falls in the boiler below the connection with the chamber, the pump will exhaust the chamber, and the float will fall and close the passage from the float chamber. The check valve then, being relieved of the boiler pressure, will open, thus making an automatic regulator, and at the same time facilitating the circulation of the water, so that steam is made faster and more economically.

Improved Life-Preserving Stool.

Henry H. Nash, Baltimore, Md.—The object of this invention is to provide a simple, cheap, and effective life-preserving stool, applicable for use upon steamers and other sea-going vessels. It consists simply in arranging one or more disks of cork between two rounded boards, which constitute the seat of the stool.

Machine for Grinding and Fitting Pearl Veneers.

Jacob Hoffman and George Hoffman, Philadelphia, Pa.—The invention consists in a recessed gage and holder for the veneers, combined with the carriage, and an end-beveled gage connected with a beveled block and hinged dog. These improvements have been found in practice greatly to facilitate the grinding of the veneer.

Improved Meat Chopper.

H. P. Rankin, Allegheny, Pa.—The invention consists of a meat-block made in sections, held together by a metallic band that extends there above, so as to prevent the meat from escaping over the edges; and so that when one or more sections become uneven, the same may be replaced without destroying the whole block.

Improved Crimping Machine.

Thomas J. Greenwood, Warren, Ill.—This is a base plate, whereon is a crimping block or former, on which the boot is to be stretched. There is a clamp, which is the counterpart of some portions of the block, and a base plate for pressing the leather into shape upon it. A shaft, cam, and lever actuate the clamp, the shaft being detachably supported in its bearings, so that it can be taken out of the way readily for removing and applying the clamp, and the clamp being notched or serrated in the seat on which the cam works, to hold it whenever it comes to rest.

Improved Endless Chain Pump Bucket.

Jared S. Manley, Canton, Pa.—A circular disk is placed between two semi-globular pieces of rubber, and the whole is secured together by a bolt having washers, and swivels at the ends.

Improved Blind Slat Adjuster.

George A. Myers, Brooklyn, E. D., N. Y.—This is a device for adjusting and fastening the slats of a window blind at any desired angle, and for securing the blinds at an angle with each other. A wire attached to one cleat of the blind is secured at the other end to a block which slides in ways. After the slats are adjusted, the wire holds all in place, by a screw securing the block at any desired point on the ways.

Improved Apparatus for Holding Meat in Cutting.

William Tetley, Pana, Ill.—This is a curved bar hinged at one side of the butcher's block so as to be detachable. It is brought over the meat to be cut, so as to hold the same by pins projecting downward from the bar and into the meat, and is suitably secured on the opposite side of the block.

Improved Hose and Pipe Coupling.

Henry G. Koehler, Cleveland, Ohio.—One portion of the coupling enters the opposite portion. About the inner piece is a ring groove. On the outer piece are beveled spring catches, which, when the parts are pressed together, are forced into the grooves. Suitable spring tongs are used to pull the catches outward in uncoupling.

Apparatus for Gathering and Elevating Hay.

Alfred J. Park, Virginia, Mo.—This consists of a vertical frame supported on a pivot, and also on wheels resting on a bed, so that it has free rotation about a perpendicular axis. In the frame are posts having curved grooves in their sides to receive the shaft which forms the fulcrum of a hoisting lever. Said lever has a rapping device at one end, and a rope for raising or lowering it the other.

Improved Eaves Trough.

Chas. A. Coddling, Dowagiac, Mich.—This invention relates to certain improvements in the half-round eaves troughs attached to the lower edges of the roofs of houses for the purpose of conducting away the water. It consists of a band of metal, soldered upon the transverse lap seam and fastened at one end beneath the stiffening tube, and bent over the edge of the trough and soldered at the other. It also consists in a brace bar, one end of which is bent around and soldered to the tube, and the other soldered to the opposite side of the trough, to brace and hold the sides of the trough the proper distance apart.

Improved Drag.

David Miller, Carrollton, Md.—This invention relates to certain improvements in that class of drags in which a single log of wood is provided with draft attachments, and is drawn laterally across the field for the purpose of crushing and pulverizing the clods and leveling the surface of the ground. It consists in the combination, with such a drag, of a pair of handles rigidly attached thereto and projecting to the rear, provided with a pair of wheels, upon which as a fulcrum the drag may be raised from the ground by bearing upon the handles, so as to avoid stumps and stones, and facilitate the turning of the corners at the end of the row, the said wheels and handles serving also to prevent the drag from rolling under the horses' heels when going down hill.

Improved Method of Making Pills.

Jacob Dunton, Philadelphia, Pa.—This invention relates to certain improvements in the manufacture of pills, made by compression in dies or molds. In manufacturing pills according to this method, it is found that the pill compressed of materials containing the natural moisture of the air possesses but little cohesion of particles and stability of form; and in removing them from the die, the attraction of adhesion is often greater than that of cohesion, and they crumble and break in such a manner as to render this method of compressing certain materials into pills wholly impracticable. This invention is intended to obviate this difficulty, and it consists in the method of drying the material to be compressed, so as to expel the moisture and insure the more thorough cohesion of particles, and the lubrication of the die or mold.

Improved Three-Horse Equalizer.

Ezra Graham, Manchester, Iowa.—The invention relates to an equalizer by which three horses may be hitched abreast and be enabled to draw their respective proportions of weight. It consists in two unequal levers jointed on the same pole pin, and connected by a chain passing over a rear pulley.

Improved Wash Board.

Edwin S. Heath, North Hope, Pa.—The invention relates to the construction and arrangement of parts whereby the corrugated zinc plates which form the rubbing surfaces of the wash board are secured together and to the flexible grooved and bent frame piece.

Improved Car Coupling.

George Wernimont, Dubuque, Iowa.—The invention consists of a serrated link guide that is adjustably attached to supports of a lateral shaft. The crank shaft is also connected, by crank arm and chain, with a swinging crank frame that raises the pin chain and pin in the drawhead for uncoupling.

Improved Dinner Box.

James S. Davis, Monroe, Mich., assignor to himself and George R. Hurd, of same place.—This is a case having a series of drawers for the solid food entering at one side between suitable partitions, and a coffee or tea holder, connected to the front by slides, in such manner as to fasten the drawers in the case. This makes a simple and efficient arrangement, by which as many separate drawers or boxes as desired may be had for the solid food.

Process for Forming the Ends of Carriage Slat Bows.

Charles Benton, Meriden, Conn.—This is an improved die for forming the ends of slat bows for carriage tops, or similar forgings. The invention consists in passing the ends of the slat bows through a series of gradually narrowing and deepening dies with inclined edges, which raise the stock by the impressions given to the ends without the edging used at present.

Improved Carbonic Acid Motive Power.

John Westcott, Tocoi, Fla.—This invention has in view the utilization of carbonic acid and other gases as motive powers, and it consists in storing up the carbonic acid gas in a separate receiver from that in which it is generated through the agency of the surface attraction of animal or vegetable charcoal, the latter material absorbing five times its volume of the gas, so that large quantities of the gas may be stored up without increased risk to the tensile strength of the receiver, and yet be easily developed and eliminated by heat so as to furnish an available motive power. The invention also consists in the method of developing and eliminating and expanding the gas from its condensation upon the absorbent material by means of a vehicle of boiling oil passing through pipes in the reservoir.

Improved Harvester Rake.

Moses Ray, Valley Grove, W. Va.—This invention relates to certain improvements in harvester rakes, and it consists in a shaft driven by the harvester mechanism, and terminating in a pulley which engages with a frictional contact two other similar pulleys, one on each side. Around these pulleys passes a band to which is attached an arm or extension, one end of which is provided with a friction roller and moves in a groove in the adjustable supporting frame, and the other carrying at right angles to the arm a barrel. In said barrel is contained a loose standard which carries the rake. The standard falls out of the barrel of its own gravity when on the descending part of its revolution, and the rake takes the gavel at the cutter head and delivers it at the side of the harvester in the rear, a projecting arm attached to the rake standard striking a pin upon the table and giving the rake the necessary sweep. On the ascent of the rake, the standard is telescoped into the barrel and out of the way until ready for the next gavel. The entire frame work carrying the above described mechanism is pivoted upon the main shaft, and is provided with adjustable locking devices which engage with vertical supports and give necessary adjustment to the rake for high or low grain.

Improved Die Stock.

Virginus J. Reece, Greenfield, Mass.—In place of the bushing at present in use, adjustable guides are used, that are made in the shape of curved elbow levers, pivoted at one end to the die stock and acted upon by a sliding plate having eccentrically curved slots, which engage lugs of the guides at the corners of the same. The free ends of the guides are thrown, by the turning of the plate, in one direction toward the center of the die stock, being in any position at equal distance therefrom, so that they may be set to any size of bolt, and be firmly secured in position by a clamp screw.

Improved Gate Fastening.

William Leach, Omaha, Neb.—This invention relates to fastenings that enable a gate to be latched automatically as it swings to the head post, and consists in combining a rod having reversely beveled wings and weighted arm with a slotted angle plate.

Improved Fireplace Heater.

John B. Oldershaw, Baltimore, Md.—This invention consists in making a fireplace heater in sections, with a magazine open both at top and side as well as the cylinder, the two being connected by a chute.

Improved Hot Air Registers.

Edward A. Tuttle, New York city.—This is a combination of wall frame and register frame, fitting closely together in front, having lugs for fastening screws in a divergent angle between said frames.

In another register, patented to the same inventor, there is a segmental roller for carrying a slide and a slot and pin for working the fan, arranged on opposite sides of the slide. The pin for working the fan is arranged half the length of the throw of the slide from the pivot of the fan, in combination of a groove or slot of forty-five degrees of inclination to the slide. A notch in the end of the fans and a projection of the frame are so arranged that, by turning the fans a little beyond the vertical position to which they are brought to open the register, the notches pass beyond the projections, and thus free the fans to slide endwise far enough toward the frame to withdraw the opposite pivot from its bearing for taking out the fan or entering it to put the fan in its place.

Improved Strainer for Pumps.

Leonard Blass, Germantown, N. Y.—This invention consists in the combination of a cylinder having a cap screwed upon its lower end and a cap plate bolted to its upper end, and provided with an inlet pipe and an outlet pipe. The tube has a flange formed upon its upper end, a wire gauze plate attached to its beveled lower end, and a hole formed in its side, combined with each other to adapt the device to be attached to a pump pipe.

Improved Refrigerator.

Henry G. Gleyre, Glasgow, Mo.—In this refrigerator, the interior is supplied with cold and pure air, while it is also used as a water cooler. The ice receptacle has an inclined perforated rear flange, and forms, with the rear walls, an intermediate ventilating flue. A perforated cover, having a pendant flange, cuts off direct air communication between the ice receptacle and ventilating outlet for the passage of air outside of the refrigerator.

Improved Wagon Springs.

Michael Feigel, New Utrecht, N. Y.—This is a novel combination of the V rod and tie rods with the body and other portions of the wagon, the object being to strengthen the forward part of the running gear, to prevent the platform from sagging in the middle, and thus throwing the weight upon the fifth wheel, instead of keeping it around the king bolt, thus enabling the vehicle to be much more easily guided by the team.

Improved Earth Auger.

William Low, Webster, Mich.—The cutting bits have a point formed by a curve from the inner end to the wall of the throat and curved downward from the junction with the bottom to the point. They are arranged at opposite sides of the center with space between for the passage of stones, in combination with the bottoms, spirally molded for clearance.

Improved Pocket Book Lock.

Julius Hanau and Sigmund Bendit, New York city.—This invention consists of a series of short pieces of wire placed side by side in a little box, in combination with a spring at one or both ends of the series, so contrived that the hump may engage between any two of the rods whenever it may come along the rods, by reason of the pocket book being more or less full, the row of rods being ranged in the line of the hump. Thus the fastening is self-adjusting to the fullness of the book.

Improved Road Scraper.

Edward Huber, Marion, Ohio.—This invention is an improvement in the class of scrapers, the handles of which are unlocked from the body thereof by the action of the bail or draft rod when the handles are raised to a vertical, or nearly vertical, position. The elevation of the handles causes their spring catches to slide off the horizontal lugs affixed to the sides of the body of the scraper, thus allowing the latter to revolve and discharge its contents.

Improved Invalid Lounge.

Andrew Shiels, Portland, Oregon.—This invention relates to certain improvements in lounges, and consists in the combination, with the hinged bottom boards, of devices which enable the patient to adjust himself either from a recumbent to a sitting posture, or vice versa, without assistance.

Improved Horse-Detaching Apparatus.

Jobua W. Glover, Mount Savage, Ky., assignor to himself and William R. Kitchen, same place.—This consists of spring catches for detaching the traces by a cord passing over guide pulleys, and up into the carriage box, where a weight is attached for automatically detaching in case the carriage is suddenly overturned and the driver prevented from pulling the cord.

Improved Clothes Dryer.

John Sutton, Deep River, Iowa.—This consists of two racks suspended from a long plate supported at the middle on the top of a standard having a long narrow base, having swing feet to throw out and brace it laterally. The racks have braces which throw them out obliquely for use when the braces are adjusted on arms projecting from the standard below the top plate; and above these are two racks similarly supported on standards rising up from the top plate, and having braces to hold them out obliquely for use. Other clothes-supporting arms are used, some being permanently and others detachably connected, the whole making a rack that can be readily opened and extended for use and folded up out of the way.

Improved Hollow Staff for Watches.

William A. Beleher and David J. Plume, Ophir City, Utah Ter.—This is an improved staff, which may be quickly replaced when one of the pivots is broken off, without in the least interfering with the balance wheel or other parts. The staff is made hollow, with detachable center plug, that is readily removed and replaced without interfering with the other parts.

Improved Chimney Cowl.

Theodore C. Nativel, San Jose, Cal.—The ventilating cowl is formed of two parts or cylinder flues, one enclosed by the other. The inner part, or flue, has vertical exterior ribs, which form a bearing or support for the section of the outer flue, leaving air passages between. The flue sections are beveled at their ends to form a close and strong joint, and the ribs act as buttresses for each flue.

Improved Turbine Water Wheel.

Y. W. Larmon, Russellville, Ky.—This invention contemplates the improvement of turbine wheels so that they may run more easily against back water, under a less head of water, and be susceptible of adjustment of the power. The several features of improvement seem well adapted to the object in view, and will doubtless economize water and enable the power to be graduated with facility.

Improved Steaming Table.

Asabel J. Randell, Belvidere Seminary, N. J.—This invention relates to a culinary apparatus combined with a falling-leaved table, designed for cooking by steam. Beneath the table top is a case, which contains a steam chest having an upper bottom, beneath which is a drawer which extends entirely through the case and forms a fire chamber. A lamp and a gas burner are placed in this chamber, either of which may be used in the absence of the other. There is a removable bread tray in which is a dough mixer, and a case contains drawers for keeping dishes, table linen, and similar articles. With this apparatus, a family in close quarters or small apartments may be accommodated with the essentials of housekeeping in a small space.

Business and Personal

The Charge for Insertion under this head is \$1 a Line.

Hoadley Portable Engines. R. H. Allen & Co., New York, Sole Agents of this best of all patterns.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Soap Stone Packing, in large or small quantities. Greene, Tweed & Co., 19 Park Place, New York.

Screw Cutting Index and Rule for Compound Gearing, Price 10c. Address E. Lyman, C. E., N. H. Av., Ct.

Scale in Boilers Removed—No pay till the work is done. Send for pamphlet. Geo. W. Lord, Phila., Pa.

Suction and Blast Fans, Wood-working Machinery, &c. D. J. Lattimore, 31st & Chestnut st., Phila., Pa.

Wanted—Copy of Patent Office Gazette of April 29, 1875. Also, all issues of said Gazette from January, 1872, to June, 1875, inclusive. F. G. Jilison, Woonsocket, R. I.

Save your fuel 25 per cent worth, or get same amount of extra power, by applying the R. S. Condenser. T. Sault, Consulting Engineer, Gen'l Ag't, N. H. Av., Ct.

Fine and Elaborate 1st class Working Models made for exhibition. Address B. 1228, Chestnut St., Philadelphia, Pa.

Rubber and Oak Tanned Leather Belting. Greene, Tweed & Co., 18 Park Place, New York.

Patent Scroll and Band Saws, best and cheapest use. Cordesman, Egan & Co., Cincinnati, Ohio.

Geo. P. Rowell & Co., the N. Y. Advertising Agents, have the monopoly of space and location in many hundred newspapers, and know, by their experience, just where to invest money to the best advantage. —*Berkshire Courier.*

To Manufacturers—Pure Lubricating Oil, Sample Package (24 gals.), \$7. Send to Geo. Allen, Franklin, Pa.

Educational Lantern Slides—Send for Catalogue to Prof. W. A. Anthony, Cornell University, Ithaca, N. Y.

Wanted—To Invent, Improve, and Simplify Machinery for some manufacturing firm; will take part interest in the inventions or at a salary. Satisfaction guaranteed. Address inventor, Clark House, Minneapolis, Minn.

Carriage "Spring Equalizer" Patent for Sale. New thing, ornamental, principle the best, and takes with all who see it. Sold only on account of pressure of other business. Terms easy. Address S. Elliott, Box 118, New Haven, Conn.

For Sale—Pontiac Planing and Saw Mills, containing 32 in. Circular Saw and 18 modern Machines for the Manufacture of Sash, Doors, &c. Apply to H. Heitsch, Pontiac, Mich.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

Perfection of Hay Rakes, Self Dump, without Hatches, Gears or Springs, just patented. Address C. La Dow, Ballston, N. Y.

For Sale—Back-gear, Screw Cutting, Engine Lathes, as follows, viz: 38 in. x 10 ft. power cross feed, \$375; 32 in. x 8 ft., \$275; 30 in. x 7 ft., \$175; 12 in. x 7 ft. Hand Lathe, \$60; 48 in. Chucking Lathe, \$175; 70 in. x 32 in. x 27 ft. Planer, \$2,800; 48 in. x 48 in. x 20 ft. Planer, \$1,800; 32 in. x 32 in. x 16 ft. Planer, \$750; 26 in. x 26 in. x 6 ft. Planer, \$475; 36 in. B. G. Drill, \$175; 32 in. Horizontal Boring Machine, \$225; 72 in. Gear Cutter, \$450; 3 Milling Machines, \$175 each; Profiling Machine, \$150; Screw Machine, \$150; 8 Fowler style Presses, 1½ size, \$200 each; 5 Fowler Presses, 90 size, \$90 each; 4 Fowler Presses, 6 size, \$125 each; 5 Farrell Presses, 6 size, \$125 each; 2 very large Fallisber Presses, new; 100 Wrought Iron Vises at 40 per cent off list. All above tools good as new. Shearman & Hillel, 45 Cortlandt Street, New York.

Wanted—A Situation by a Machinist and Draughtsman. Address R. P., Machinist and Draughtsman, P. O. Boston, Mass.

To Purchasers of Engines, Boilers, and Machinery—Special and important information may be obtained, and special inducements will be offered, by addressing Todd & Bafferty Machine Company, Paterson, N. J., or No. 10 Barclay St., New York.

Hyatt & Co., New York, Manufacturers of Varnishes, make the best that is now in use. Wherever it is used, it takes the place of all others, and becomes at once the standard. This product is better than the best imported, and nothing in the country can compare with it.

For the best and cheapest breech-loading Military, Sporting, and Target Rifles, apply to Whitney Arms Co., New Haven, Conn.

Double-cut, self-feed, noiseless Ratchet Drill—Right for sale. H. C. English, Wilmington, Del.

Sand Papering Machine Wanted—One adapted to smoothing Wooden Shade Rollers. Address G. G. Hardy, East Newark, N. J.

\$5,000 invested in a valuable invention will give large returns.—A. D., 353 Morris Avenue, Newark, N. J.

Price only \$3.50—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 346 Canal St., New York.

Small Tools and Gear Wheels for Models. List rec. Goodnow & Whitman, 23 Cornhill, Boston, Mass.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

All Fruit-can Tools, Ferracite Wks., Bridgeton, N. J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Temples and Oilcans. Draper, Hopedale, Mass.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Steam Pumps 1 to 8. Injectors. Steam Traps and Damper Regulators on trial. Send for Circular. A. G. Brooks, 421 Vine Street, Philadelphia, Pa.

Wanted—To buy a good patent or patentable article to manufacture. Send description and price to J. H. Hession, 144 Superior St., Cleveland, Ohio.

Magic Lanterns and Stereopticons of all sizes and prices. Views illustrating every subject for Parlor Amusement and Public Exhibitions. Pays well on small investments. 72 Page Catalogue free. McAllister, 59 Nassau St., New York.

Enterprise Mfg Co., Philadelphia, Pa., Patented Hardware Manufacturers and Iron Founders. Small gray iron castings, warranted soft and smooth, made to order, and patented articles of merit manufactured on royalty.

Boulton's Paneling, Moulding and Dovetailing Machine is a complete success. Send for pamphlet and sample of work. R. C. Meeh's Co., Battle Creek, Mich.

The Original Skinner Portable Engine (Improved), 2 to 8 H.P. L. G. Skinner, Erie, Pa.

Small Engines. N. Twiss, New Haven, Conn.

For Sale—At a Sacrifice, the Patent Right to a small, easily manufactured article. Every housewife wants one. Address John P. Noble, Bridgeport, Conn.

The Haxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Brass Gear Wheels, for Models, &c., on hand and made to order, by D. Gilbert & Son, 213 Chester St., Philadelphia, Pa. (List free.) Light manufacturing solicited.

For best and cheapest Surface Planers and 1 Universal Wood Workers, address Bentel, Margedat & Co., H. Milton, Ohio.

Camp Lounges, \$5. C. L. Co., Troy, N. Y., and Newark, Ct. N. Y. City salesroom, 177 Broadway.

Water, Gas, and Steam Goods—New Catalogue packed with first order of goods, or mailed on receipt of eight stamps. Bailey, Farrell & Co., Pittsburgh, Pa.

For Sale—Large lot second hand Machinists' tools, cheap. Send for list. I. H. Shearman, 35 Cortlandt Street, New York.

The "Scientific American" Office, New York, is fitted with the Mifflin Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$6, with good battery. F. C. Beach & Co., 346 Canal St., New York, Makers. Send for free illustrated Catalogue.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

"Lehigh"—For Information about Emery Wheels &c., address L. V. Emery Wheel Co., Weisport, Pa.

American Metaline Co., 61 Warren St., N. Y. City.

Genuine Concord Axes—Brown, Fisherville, N. H.

Faught's Patent Round Braided Belting—The best thing out—Manufactured only by C. W. Arny, 148 North 3d St., Philadelphia, Pa. Send for Circular.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

(8) J. C. L. asks: How can I make a small cord (about 1/8 of an inch thick) impervious to dampness without diminishing its pliability? A. Saturate it with a concentrated solution of copper in ammonia, and dry.

(9) E. A. W. says: 1. In melting silver I have used a flux of pumice-stone and borax; and when I cast, part of the flux runs in with the silver. How can I avoid this? A. The pumice-stone should be added in sufficiently large quantities to absorb the superfluous borax. Do not crush your pumice-stone too fine. 2. How can I get the silver out of the pickle into which the bars are put after being cast, the pickle being made of sulphuric acid and water? A. Precipitate the silver in the form of chloride by the addition of muriatic acid. Then heat the precipitate together with a quantity of borax and a little rosin, in a small crucible, until the metal is reduced. The flux may then be removed by means of pumice-stone as before.

(10) B. asks: Is glue to be had in New York? A. We do not recognize any substance by this name.

(11) W. O. C. asks: Can you give me a recipe with which I can dissolve pieces of imitation tortoiseshell, so as to run it into molds? A. You do not state of what your imitation shell is composed. We of course must know its composition before we can tell what will make a good solvent.

Is there anything, not injurious, which will completely remove dandruff? A. Dandruff or pityriasis is a chronic inflammation of the skin, attended with redness and itching, and characterized by the production of minute white scales or scurf in great quantity. It may attack any region, but the scalp is the most common seat. Great cleanliness is the first consideration in its treatment. The use of tonic infusions and of sedative or alkaline lotions to the affected part are measures to be employed. A wash frequently used is the following: Boil 1 lb. rosemary in 2 quarts water, and add to the filtered liquid 1 oz. spirit of lavender and 1/4 oz. salt of tartar.

(12) G. F. L. asks: Is there any substance which will absorb coal gas when mixed in small quantities with the air in an ordinary living room? A. It can be absorbed by a solution of cuprous chloride in hydrochloric acid, presenting a large absorbing surface.

(13) L. S. C. asks: In the manufacture of brown sugar from cane juice, I have large quantities of muddy sediment in the bottom of juice vats, also a great quantity of skimmings: both are somewhat gummy in character, but as valuable as clear juice, if purified. Can this material be filtered through bone black, charcoal or any other material, and made reasonably pure, and how? A. You will require charcoal filtration, and Dumont's filter will probably work to your satisfaction. It consists of a wooden box of the form of a four-sided truncated pyramid with a double bottom. The inner bottom is a metallic plate pierced with numerous holes; upon it a cotton cloth is laid, and coarse-grained animal charcoal moistened with water is then spread layer by layer, each layer being rendered of uniform thickness, and packed or pressed closely together by means of a trowel. When the bone black has been thus formed into a compact bed or stratum of about 15 inches in thickness, and within 5 to 10 inches from the top of the box, it is covered with another cotton cloth, and with another metallic plate pierced with holes. The object of the second cloth and metallic cover is to collect any substances which would otherwise obstruct the interstices of the superior stratum of the bone black, an inconvenient accident which is easily prevented by the use of such a cover, and this cover is readily exchanged for another, should it become itself obstructed. It is important, in order to avoid false passages, that the juice should be constantly at the same level of about three inches above the cover of the bone black. This is accomplished by means of a self-regulating cock. Animal charcoal is expected to purify, on an average, an equal weight of fine, or twice its weight of seconds, sugar. The same bone black may be employed any number of times, provided the substances which it has withdrawn from the sirup be removed. This is often done by simple rekindling. Consult Muspratt's "Chemistry," vol. 2, pp. 950 to 1,000.

(14) C. Z. P. asks: In one of your late numbers you said that silver (metallic) is to be re-obtained from nitrate of silver by melting it with borax or rosin. Will this be applicable for oxides or other metals, such as lead or zinc? A. Gold may be reduced by this method, but not lead, zinc, or any of the more common metals.

(15) S. B. P. asks: If the lower metals are alkaline, are the higher metals acids? Is there any distinct division between the alkaline and other metals? A. We do not understand your classification of the metals. The term alkali is restricted to those bodies, such as potash and soda, which have an acid, nauseous taste, and are unctuous to the touch. If the metals be arranged into a table with reference to their affinity for oxygen, the noble metals—gold, silver, platinum, etc.—will be found at one end, and the metals of the alkalis at the other. Those elements having the greatest affinity for oxygen are called electropositive; while those at the other end of the list are known as electronegative bodies. There is no definite dividing line between these, each element being negative to the one preceding, and positive to the one following it.

(16) C. L. W. asks: What oil is best for oiling silk for insulation? A. Paraffin oil.

(17) O. B. asks: What is the formula for producing oxide of gold? A. The protoxide of gold is obtained as a dark green powder by precipitating the protochloride of gold by a dilute solution of potash.

(18) I. B. M. asks: What is the name of a microscopic organism, occurring in an infusion of walnut leaves last spring, and consisting of a cup-shaped head anchored by a thread to a twig? The thread slowly contracts to a spiral spring, and then suddenly and projects the head forward, as if to secure food. A. The microscopic organisms described by you are infusorial animalcules, of the family vorticellidae, or bell animalcules. The genus vorticella consists of little creatures placed at the top of a long flexible stalk, the other extremity of which is attached to some object, such as the stem or leaves of an aquatic plant. This stem, slender as it is, is nevertheless a hollow tube, through the entire length of which runs a muscular thread of still more minute diameter. When in activity and secure from danger, the little vorticella stretches its stalk to the utmost, while its fringe of cilia is constantly drawing to its mouth any luckless animalcule that may come within the influence of the vortex it creates; but at the least alarm the cilia vanish, and the stalk, with the rapidity of lightning, draws itself up into a little spiral coil. But the vorticella is not wholly condemned to pass a sort of vegetable existence, rooted, as it were, to a single spot by its slender stalk; its Creator has foreseen the arrival of a period in its existence when the power of locomotion would become necessary, and this necessity is provided for in a manner calculated to excite our highest admiration. At the lower extremity of the body of the animal, at the point of its junction with the stalk, a new fringe of cilia is developed; and when this is fully formed, the vorticella quits its stalk, and casts itself freely upon its world of waters.

(19) W. W. B. asks: 1. What is the form of galvanometer used in testing the connection of a lightning rod with the ground? A. An ordinary tangent galvanometer of the form designed by Dr. Bradley is most convenient. 2. What is the method of operation? A. Two earth connections in addition to that of the rod are necessary. Call these B and C, and the rod A. Measure the resistance of A and B together, then A and C, and finally Band C. Add the resistance of A and B to that of A and C, subtract the resistance of Band C from their sum, and divide the remainder by 2. This will give the resistance of the rod alone. 3. Would a sink vault be a good place to insert a lightning rod? A. Yes, provided it exposes sufficient surface.

(20) J. W. F. says: In a rainstorm, four barrels of water were caught on one half of a roof of a house 16x24 feet. I claim that the same amount of water would have fallen on a piece of ground 8x24 (leaving out projection of eaves). A friend claimed that the roof, being 1/4 pitch, contained more square feet, consequently would catch more rain. Which is right? A. You are right. It is the same problem as that of perpendicular pickets in a fence running up hill; it takes the same number of pickets over a hill as upon level ground. When the rain is driven obliquely against the roof, there will, of course, be more to fall upon one incline, but just to the same extent will there be less falling upon the other.

(21) A. B. C. asks: 1. What is the proper pronunciation of Léclanché? A. Leclanché. 2. Please explain why the zinc of a battery is the positive pole or element (as stated on p. 167, vol. 33) when the flow of electricity is from the other pole to the zinc? A. There seems, at first sight, to be some inconsistency in using the terms positive and negative in connection with the zinc plate of a battery; but as any part of a circuit considered by itself must present both a positive and a negative pole, and as the outside poles alone are of practical importance, these are the ones alluded to when any are mentioned: the negative pole being that one towards which the current is directed. When the metal itself is referred to, we call that one positive which is consumed, because, in this case, attention is more particularly called to the direction of the current in the battery, and here it is from the metal on which the action takes place. 3. Which of the following four methods is best applied to lightning arresters for telegraph offices: Points, connected with the line wire presented to points connected with the ground, line points presented between ground points, line points presented to a plain ground surface, or ground points presented to plain surface connected with the line? A. Experiments, made for the purpose, showing that those lightning arresters are most efficacious which combine, in one system, opposed points and opposed plates separated by very thin pieces of mica. 4. Why do you think that the best one? A. By their diffusive property, points tend to prevent an accumulation or charge; sometimes, however, the sudden presence of a great quantity of electricity exceeds this power of points; in such cases, the plates act like condensers, in which the potential becomes so high that a discharge takes place between them rather than through the instruments; this is what constitutes their principal advantage. 5. Is the efficiency of the arrester increased by increasing the number of points? A. Yes.

(22) E. M. C. says: Our orchards have been greatly infested with caterpillars, which seem to have few enemies, as no bird round here will eat them. But I have several times noticed small gatherings of red ants, and upon examination found them to be eating a large caterpillar; and since then I have often seen two or three ants attack, kill, and eat large caterpillars. Is this common? A. Yes. It is by no means a new discovery.

(23) A. K. asks: 1. How can a writing ink be made that will stand the test of acids, so that no acid can erase it? A. Aniline black, asphalt in turpentine, and coal tar in the same solvent have been used for this purpose. 2. What color is most permanent? A. Writing fluids are, as a rule, more permanent than ordinary black ink. After a short exposure to the air they become black, or nearly so.

(24) B. B. S. says: I have never succeeded in making a perfect ink or fluid from any recipe, either with extract of logwood, nutgalls, or a combination of both. How can I make a bright, limpid, and bluish green at first, turning black on drying? A. Try the following: 12 ozs. nutgalls, 8 ozs. each sulphate of indigo and copperas, a few cloves, 4 or 5 ozs. gum arabic, for a gallon of ink. The addition of the sulphate of indigo renders the ink more permanent and less liable to mould. It is blue when first written with, but soon becomes an intense black. It is a true solution, and in composition nearly resembles that of P. & J. Arnold.

(25) C. O. O. says: I am using tin for plating; it works well for a time, but becomes hard by being heated so often. What can I do to make it flow more freely? A. This is probably due to impurity in the bath. You should state what are the character and the composition of the articles plated.

(26) R. S. W. asks: How can brass be melted on a small scale, by amateurs? A. The operation is rarely at first accomplished by amateurs without considerable difficulty. It requires a good furnace, capable of fusing copper, and a crucible capable of withstanding the high temperature. For this latter reason black lead crucibles are generally employed. The crucible is placed in the newly made fire, so as to heat up gradually. When well heated, place in your copper in small pieces and force your fire until the copper is just fluid; then place in your zinc, stirring the fused alloy meanwhile. Do not allow the temperature to rise too high, as in this case a great part of the zinc will be volatilized, and coming into contact with the air, will become ignited and converted into a copious white vapor of oxide of zinc. It is advisable to keep the surface of the fused metal covered with a quantity of chloride of ammonium (sal ammoniac), in order to preserve the surface free from oxide and clean.

(27) H. T. C. asks: Is there any scientific method by which to ascertain the depth to water underground, without digging or boring? A. No.

(28) W. A. D. asks: 1. Is there an article of the nature of oilcloth, or thin rubber cloth, that can be put over a frame about 3 feet square, and heated, from underneath, to a temperature of from 100° to 140° or 150° Fahr., and will admit of a shower of water being thrown on immediately after the discharge of heated air, without injury to the covering or any disagreeable odor from the material? It must needs be airtight and watertight. A. Try a suitable modification of asbestos cloth. 2. What material could I get for heating the space in the manner described? A. Try gas manufactured from a suitable light coal oil.

(29) J. A. says: I have seen an argument that, the centrifugal and centripetal forces at work in the earth's rotation not being equal, the earth is consequently hollow. What are the centrifugal and centripetal forces in this connection? A. Consult "Sketches of Creation," by Professor Winchell, pp. 35-60.

(30) A. E. says: I have been troubled for a long time with my well water. The well is over 40 feet deep; the water is delicious, clear, and cool; and yet, on holding a glass of it between you and the sunlight or lamplight, you can see minute living creatures. I have discovered two species. There are also earth worms occasionally drawn up in the bucket. Will you tell me the cause of these appearances? A. It is very unusual for animal life to be developed in water of such a character as you describe. The earth worms have probably gotten in accidentally, and the living creatures may not have come from germs present in the water itself. 2. Is wholesome water ever found in this condition? A. If you fill a quart bottle half full of the water, close it with a good cork, put it in a warm room, and then after a week's time find on opening the bottle there is no smell, the water is probably wholesome.

(31) J. J. G. asks: 1. Why will not aniline yellow (lemon) and aniline blue mix? A. They are used separately—first the blue, and finally the yellow—in order to obtain the desired shade of green. 2. What colors can I take that will make any shade of green ink I may want? A. Verdigris dissolved in acetic acid gives an elegant green.

(32) W. H. B. asks: Is there any way to remove printed matter from postal cards, sufficiently to allow the surface to be legibly written over? A. Remove the printing by means of a sharp steel eraser, and polish with a good bone or ivory paper knife.

1. How can I make a liquid preparation to apply to cuts and bruises, such as will quickly dry and form an artificial cuticle? A. Use collodion. 2. Is collodion dissolved in ether a good preparation for this purpose? A. Yes. 3. Can collodion be dissolved in alcohol? A. Collodion is a solution of negative cotton in ether, or a mixture of ether and alcohol. Gun cotton is insoluble in alcohol alone.

(33) F. A. H. asks: Can a good durable white ink be made? If so, what are the ingredients? A. Shake up a little finely ground oxide of zinc with a small quantity of gum water. This, we think, will answer your purpose.

(34) G. M. S. says: How do you compound nitric acid with water so as to give galvanized iron the snowflake finish? A. Use muriatic acid 3 parts, nitric acid 1 part, and water 3 parts; wash immediately afterward with pure water.

Why does metal blister after it comes out of the water, immediately after galvanizing? A. This may be due to the fact of the metallic surface not having been perfectly clean, or on account of the too rapid cooling of the surface.

(35) C. W. B. asks: How can I crystallize alum, so that it will adhere readily, in quantity and in regular forms? A. Make a concentrated

solution of the salt in boiling water, and set it aside to cool slowly.

(36) C. L. C. says: A grain of corn consists of the heart or soft part (the germ) and a hard portion; which of these would produce the most spirits, starch, and sugar, respectively? What difference is there in the chemical composition between the hard and soft parts? A. We do not find any published statement that furnishes the desired information, and an experimental investigation would require considerable time.

(37) J. S. asks: Is there anything that can be mixed with glue to make it harder? A. Try the following: Melt together equal parts of common pitch and gutta percha. Apply hot.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. C. B. F.—It is sulphide of iron.—C. B. K.—It is a rock composed of felspar and hornblende. The brilliant yellow metallic particles are sulphide of iron.—D. H.—It is decomposed potash mica. For a possible advantageous use of such mica, see an article by Professor Leeds in the *Gardener's Monthly* for August, 1875.—E. A. H.—You are right. A further examination, however, shows that these specimens contain a small percentage of lime and silicic acid. It is largely used in the manufacture of paints, for which the mineral sent would answer.—M. M. C.—It is difficult to account for the presence of such a mass of the mineral which you send, at the bottom of a well. It is sulphide of iron. Such concretions sometimes occur, but the fact of one being in a well may be due to accidental circumstances.

COMMUNICATIONS RECEIVED.

The Editor of the *Scientific American* acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Large and Small Wygon Wheels. By S. L. M.
On Tens and Hundreds. By W. S. H.
On Weather Predictions. By M. O. R.
On the Keely Motor. By F. K.
On Railroad Cars. By S.
On Natural Phenomena and Temperatures. By J. K.
On Mouse Traps. By C. R.
On Repairing Bells. By T. K. A.
On the Relation of Time and Movement. By A. W.

Also inquiries and answers from the following:
G. V. B.—J. G. R.—S. W.—J. T. F.—B. S.—H. D.—W. B. W.—J. G. A.—J. C. W.—J. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes an air or steam engine suitable for driving a sewing machine? Who sells podometers? Who sells machines for making matches? Who sells steel drills, used in riveting crockery and glass? Who sells mica in sheets?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week ending

September 21, 1875.

AND EACH BEARING THAT DATE.

(Those marked (r) are renewed patents.)

Addressing machine, G. H. Stout.....	167,952
Bale-rolling attachment, H. Riesel.....	167,959
Bale tie, W. H. Walker.....	167,960
Bed bottom, spring, J. N. & M. Hoyt.....	167,962
Bed bottom, spring, A. T. Sherwood.....	168,006
Bedstead fastening, C. T. Laib.....	167,969
Bedstead, sofa, J. B. Kline.....	167,968
Bell, door, E. M. Lockwood.....	167,946
Belt and band, driving, E. G. Isaacs.....	167,898
Belt, clasp for machine, G. H. Fox.....	167,892
Blind, inside Venetian, J. Seaman.....	167,912
Blind slat adjuster, G. A. Myers.....	167,923
Blind slats, compressing ends of, E. Cather.....	167,924
Blind, Venetian, T. Foyat.....	167,899
Bolt, F. E. S. Crane.....	167,828
Book supporter, R. T. Stoddard.....	168,351
Boot and shoe, M. Rohling.....	168,061
Boot and shoe fastening, H. E. Dennett.....	167,829
Boot and shoe heel, R. Vint.....	167,939
Boot channel opener, etc., T. L. Miller.....	168,045
Brick for constructing retorts, M. Foster.....	167,831
Buckle, D. L. Smith.....	167,947
Buckle, harness, T. J. Magruder.....	167,917
Burner, lamp, A. Taplin (r).....	6,650
Burnisher holder, A. Swallow.....	167,953
Button book, Baxines & Power.....	167,397
Buttons, attaching, D. Heaton.....	168,016
Can, metallic, G. W. Bell.....	167,820
Can paint, J. F. Drummond.....	168,001
Car coupling, G. H. & C. L. McGlothlen.....	168,041
Car heater, railroad, E. H. Ashcroft (r).....	6,652
Car poles, draw iron for street, L. C. Prouty.....	167,933
Car, sleeping, Field & Pullman (r).....	6,648
Car, sleeping, E. P. Kellogg.....	168,007

Car, sleeping, E. Wheeler (r).....	6,651
Car starter, L. C. Parkes.....	167,928
Car, stock, J. R. McPherson.....	168,043
Car, stock, Stevenson & McGrath.....	168,061
Cars, drawbar for street, F. F. Adams.....	167,968
Carburetor, air and gas, Porter & Grimes.....	168,048
Carpetstretcher, B. Darragh.....	167,876
Carriage seat irons, bending, Emerson et al.....	168,007
Carriage spring, J. Cunningham.....	167,921
Carriage spring, H. M. Curtis.....	167,992
Carriage spring, J. Fredeburgh.....	167,888
Cartridge shells, necking, Salisbury & Wells.....	167,940
Cement, marble, A. Bosq.....	167,979
Centering device, M. T. Greenwood.....	167,834
Centrifugal machine, C. C. Webber.....	167,962
Chandelier, F. McLewee.....	167,921
Chandeliers, clutch for, E. C. Bruen.....	167,884
Chuck, planer, H. Thomas.....	167,064
Church pew, I. Lancaster.....	167,910
Churn, E. Grost.....	167,893
Churn, E. Husher.....	168,024
Churn, W. P. Mangum.....	167,918
Cigar box, revenue stamp, F. C. Hamilton.....	168,014
Clock case, W. N. Weeden.....	167,963
Cloth press, W. Heddon.....	168,017
Coal-agglomerating press, A. G. Lasserre.....	168,031
Coal hod, G. Seyfang.....	167,857
Coal tar burner, Brooke & Wright.....	167,873
Cock, glass gage, Bee & Garrett.....	167,813
Cock, shower and bath, H. J. Bailey.....	167,817
Condensing vapors, gases, etc., Speir & Mather.....	168,060
Cooking apparatus, steam, G. H. Ferris.....	167,830
Corset, D. H. Horne.....	167,898
Corset fastening, F. E. Vandercook.....	167,938
Countersink, T. P. Farmer.....	167,884
Cradle rocking device, L. L. King.....	168,028
Cryolite, decomposing, H. Burgess.....	167,966
Cultivator, Winfield & Flynn.....	168,074
Dam, adjustable, W. Smith.....	167,945
Dental engines, fan for, Hopkins & Beidler.....	168,023
Dental forceps, L. J. P. E. Gallard.....	168,012
Derrick, W. C. Wetherill.....	167,863
Doll, walking, A. E. Hotchkiss.....	167,899
Door spring, O. F. Comfort.....	167,989
Drill, rock, G. Frisbee.....	168,010
Drills, ratchet brace, H. C. Hart.....	167,897
Eaves trough hanger, W. H. & H. W. Trisler.....	167,855
Electric machine, magneto-O. Heikel.....	168,014
Elevator, grain, E. Körting.....	168,029
Engine, rotary, W. Lyon.....	168,035
Engines, dash pot for, E. Steele.....	167,950
Faucet, basin, J. Donning.....	167,880
Faneet, vent, R. Brenner.....	167,821
Fellies and tires, clip for, H. Ray.....	167,908
Fence, farm, J. E. Winters.....	167,966
Fifth wheel, W. A. Parker.....	167,927
File-cutting machine feed, J. Garland.....	167,833
Fire escape, F. M. Harman.....	168,015
Fire extinguisher, E. H. Ashcroft (r).....	6,653
Fire kindler, C. A. Maynard.....	167,849
Fire place blower, J. C. Kennedy.....	167,906
Flour packer cut-off, A. M. Hobbs.....	168,020
Fruit and jelly press, Cook and Bostwick.....	167,827
Fuel, artificial, E. F. Laiseau.....	167,914
Fuel, mixing artificial, E. F. Laiseau.....	167,913
Furnace for brick kilns, W. S. Colwell.....	167,826
Garments, machine for cutting out, J. L. Fry.....	168,011
Gas apparatus, F. H. Eichbaum.....	168,006
Gas apparatus, J. H. Pugh.....	168,049
Gas check for ordnance, L. W. Broadwell.....	167,981
Gas mains, drain for, J. Nader.....	167,854
Gas, making, T. W. Lion.....	167,844
Gas making, T. S. C. Lowe.....	167,847
Gate, automatic, L. E. Thorson.....	167,954
Gate hinge and closing rod, W. H. McCormick.....	168,040
Generator, furnace grate, A. Winton.....	168,075
Governor, J. Felber.....	167,885
Grain, steaming, J. C. Hunt.....	167,837
Grain binder, C. E. Donnellan.....	167,997
Grist alarm, G. H. Eastman (r).....	6,655
Harness, check guard for, F. Howard.....	167,836
Harness cockeye, Schneider and Meek.....	168,054
Harrow, I. N. Harbaugh.....	167,996
Harrow, J. W. Price.....	167,932
Harrow and cultivator, J. W. Dilley.....	167,879
Hat and fur box, J. C. Budd.....	167,985
Hat brushing machine, Silver and Swords.....	167,945
Hatchway, C. M. Dalsen.....	167,993
Hay, gathering and elevating, A. J. Park.....	167,926
Heater, M. W. Bailly.....	167,868
Heel trimming machine, J. H. Russell.....	167,874
Hinge, combination spring, G. Z. House.....	167,900
Horse boat, J. B. Hall.....	167,895
Horse power, N. Potter.....	167,980
Horseshoe, J. T. Walker.....	168,068
Horseshoe blanks, etc., swaging, R. Hale et al.....	167,894
Horseshoe machine, S. Espach.....	168,008
Hose reel, J. A. Miller.....	167,851
Hub band, D. W. Baird.....	167,970
Ink, copying, A. J. Dexter.....	167,878
Ironing apparatus, G. W. Cottingham (r).....	6,654
Ironing board, J. Watson.....	168,069
Jack, lifting, G. W. Edwards.....	168,005
Joint, combination shell, O. C. Little.....	167,845
Lamp, E. Blackman.....	167,871
Lamp bracket, Willson and Vassie.....	167,864
Lamp, diver's, C. Marchalk.....	168,038
Lamp drip cup, A. Bechet.....	167,869
Latch, reversible, P. Mathes.....	168,008
Latch slide rest, G. F. Ballou.....	167,974
Lock, combination, A. E. Peters.....	167,929
Lock, seal, A. F. Whiting.....	168,070
Lock, time, E. Stockwell.....	168,062
Locomotive exhaust pipe, J. C. Farmer.....	167,883
Mantel for fire places, D. K. Jones.....	168,025
Meat, preserving, J. A. Wilson.....	168,073
Milk, flour, T. C. Delaplane.....	167,995
Molder's flask, H. H. Garrett.....	167,890
Motor, mechanical, J. W. H. Doubler.....	167,969
Nail, A. Marotzki.....	168,037
Nut lock, C. Holton.....	168,021
Nut lock, Shoemaker and Jones.....	167,944
Nut lock, J. C. Wright.....	167,967
Paper ruling machine, J. Stewart.....	167,859
Pegging machine, screw, A. C. McKnight.....	168,042
Pencil, making, R. Lanstrom.....	168,030
Piston, steam, O. M. Stillman.....	167,960
Pitcher, molasses, L. Wagner.....	167,962
Pitman oscillating joint, A. K. Smith.....	167,948
Plane guide, W. S. Shippe.....	167,943
Planer cutter sharpener, G. Marvel.....	167,929
Planter, corn, E. Morgan.....	168,046
Flow, wheel, J. Flow.....	167,997
Pocket book, S. Lyon.....	167,916
Pocket book fastener, L. Frahar.....	167,832
Polishing machine, B. E. Sperry.....	167,854
Press, cloth, W. Heddon.....	168,017
Printing press delivery, J. W. Kelberg.....	167,840
Pump, T. Dowling.....	167,891
Pump, M. J. Johnson (r).....	6,649
Pump bucket, chain, W. Cooper.....	167,930

Pump bucket, endless chain, J. B. Manly.....	167,919
Pump, rotary, W. Lyon.....	168,034
Punch, hydraulic, J. B. Barnes.....	167,975
Railroad crossing, C. C. Shelby.....	168,055
Railroad crossings, gate for, S. Keller.....	167,842
Railroad signals, electric, W. H. Spang.....	168,058, 168,059
Rammer, steam road, S. Johnson.....	167,839
Reeling and furling sails, P. B. Leary.....	167,911
Refrigerators, ice floor for, H. Braunlich.....	167,980
Register, F. J., & W. H. Hoyt.....	167,901
Registering machine, etc., F. W. Brooks.....	167,982
Rein holder, B. F. Brown.....	167,983
Rein holder, Gilmore & Spencer.....	167,891
Rolling metal tubes, C. L. Johnson.....	168,026
Rolling mill feed, S. Vanstone.....	167,841
Roof, composite, B. Lee.....	168,032
Roundabout, L. Schaeffer.....	167,941
Row lock, J. S. Dougherty.....	168,000
Sad iron, H. H. Robbins.....	168,050
Sash fastener, E. B. Beach.....	167,976
Sash fastener, E. W. Brettell.....	167,822
Sash fastener, R. L. Prun.....	167,933
Sash holder, J. Stauffer.....	167,949
Saw, hand, H. Diston.....	167,906
Saw handles, crosscut, J. L. Edgar.....	168,000
Saws, inserting diamonds in, J. E. Emerson.....	167,882
Sawing machine, scroll, I. P. Hicks.....	168,019
Screws, cutting wood, Chamberlin & Cushing.....	167,988
Settee, J. P. Sayles.....	168,053
Sewing machine, shuttle, H. L. Walker.....	168,067
Sheet iron blank, G. E. Taylor.....	168,013
Shoe, club foot, W. Autenrieth.....	167,867
Shoe edge trimming, Addy & Abbott.....	167,816
Shoe-pegging machine, J. H. Oliver.....	167,855
Shutter fastener, R. L. Prun.....	167,934
Shuttle fastening, C. Smith.....	168,057
Signal, fog, W. S. Martin.....	167,848
Sink, L. Robinson.....	168,032
Slate polisher, Coffin & Klotz.....	167,876
Sleigh, G. McConnell.....	168,039
Soap-cutting machine, J. C. Ralston.....	167,936
Soldering iron, J. Aguilar.....	167,969
Soles, buffing, J. B. Johnson.....	167,904, 167,905
Spindle steps, securing, A. S. Hopkins.....	168,022
Spindles, oiling, Buttrick & Flanders.....	167,823
Spinning machine whirl, Wilson & Hall.....	167,965
Stamp, etc., revenue, Caslick & McIntire.....	167,987
Stamps, composition for, J. Scott.....	167,856
Stamps, canceling, F. C. Hamilton.....	168,013
Stove, J. Duffy.....	168,002
Stove, J. A. Moore.....	167,852
Stove door, turn button, W. Morand.....	167,853
Stove leg, I. A. Lovejoy.....	167,915
Stove, magazine cooking, Perry <i>et al.</i>	168,047
Sucker rod socket, P. E. Jenks.....	167,903
Suspenders, A. R. Warren.....	167,961
Table, ironing, J. W. Field.....	167,886
Table, paper hanger's, J. Orrell.....	167,934
Tailor's measure, F. H. Ulrich.....	167,957
Tanning hides and skins, J. Angus.....	167,866
Telegraph, printing, T. A. Edison.....	168,004
Thrashing machine feed, A. W. Lockhart.....	167,912
Tire shrinking machine, J. D. Hobbs.....	167,835
Tire-upsetting machine, J. H. Mertz.....	167,912
Trap, fly, J. S. White.....	168,071
Truss, H. Becker.....	167,818
Truss, J. N. Bell.....	167,977
Tube cleaner, J. Williams.....	168,073
Tubes, rolling metal, C. L. Johnson.....	168,026
Tweeds, making, E. J. Mildren.....	167,850
Type-setting machine, A. Miller.....	168,044
Valve, balanced, J. F. Allen.....	167,865
Vegetable cutter, J. T. Lohr.....	168,033
Vehicle spring, M. Gluck.....	167,892
Vehicle wheel, E. Ball.....	167,971
Wagon axle, Lantz & Mitchell.....	167,813
Wagon spring, L. P. Devendorf.....	167,877
Walls, construction of, G. H. Ballentine.....	167,923
Wash stand and water closet, R. C. Ball.....	167,972
Washing machine, T. P. Benton.....	167,978
Washing machine, T. B. Kirkwood.....	167,807
Watch balance staff, J. J. Thornton.....	168,065
Watches, escapement for, Bourquin.....	167,872
Watchman's time check, Osborne & Le Grande.....	167,925
Water closet valve, P. D. Donnelly.....	167,998
Water, indicating velocity of, G. F. Deacon.....	167,904
Water wheel, H. Twitshell.....	167,956
Weather strip, G. P. Bennett.....	167,820
Wind wheel, turbine, L. G. Fellner.....	168,009
Windmill attachment, H. Weld.....	167,964
Wrench bars, etc., die for forming, A. G. Coes.....	167,825
Yarn, machine for spooling, A. M. Wade.....	168,005

- 5,191.—G. Kallmeyer et al., Hamburg, Germany. Button hole machine. Sept. 25, 1875.
 5,192.—J. Howe, Milford, Mass., U. S. Sand-papering machine. Sept. 25, 1875.
 5,193.—J. D. Imboden, Richmond, Va., U. S. Car axle lubricator. Sept. 25, 1875.
 5,200.—H. F. Eberts, Detroit, Mich., U. S. Wheel tender for vehicles. Sept. 25, 1875.
 5,201.—A. H. B. Blanchard, Montreal, P. Q. Yard and caravanserai holder. Sept. 25, 1875.
 5,202.—M. Durand, Montreal, P. Q. Fire escape apparatus. Sept. 25, 1875.
 5,203.—G. W. Cook et al., Chicago, Ill., U. S. Safety attachment to car trucks. Sept. 25, 1875.
 5,204.—W. W. Lambie et al., St. Mary's, Ont. Fanning mill. Sept. 25, 1875.
 5,205.—S. S. Ryckman, Hamilton City, Ont. Lamp cleaner. Sept. 25, 1875.
 5,206.—N. D. Martin et al., North Troy, Vt., U. S. Milk cooler. Sept. 25, 1875.
 5,207.—A. H. Watkins, Wellesley, Mass., U. S. Vapor burner. Sept. 25, 1875.
 5,208.—H. C. Moody, Oswego, N. Y., U. S. Carriage curtain. Sept. 25, 1875.
 5,209.—D. Gurnsey, Watertown, N. Y., U. S. Milk cooler. Sept. 25, 1875.
 5,210.—V. Colvin, Albany, N. Y., U. S. Portable boat. Sept. 25, 1875.
 5,211.—A. G. Rykert, Attica, N. Y., U. S. Carriage painter's jack. Sept. 25, 1875.
 5,212.—G. M. Jones, Rose, N. Y., U. S. Turbine water wheels. Sept. 25, 1875.
 5,213.—J. W. Reed et al., Kalamazoo, Mich., U. S. Lubricator. Sept. 25, 1875.
 5,214.—S. Williams et al., Boston, Mass., U. S. Mitering machine. Sept. 25, 1875.
 5,215.—C. L. Holland, Ipswich, Mass., U. S. Lock nut. Sept. 25, 1875.

Advertisements.

Back Page \$1.00 a line.
 Inside Page 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.



WASHINGTON, D. C.,
 Sept. 15, 1875.
 JNO. MATHER,
 Treas. Valley Machine Co., East
 Hampton, Mass.
 Dear Sir: The "Wright Bucket
 Planter Steam Pump" you built for
 the government "works like a
 top." Am sure it has never had its
 equal in any of the Departments,
 and I have no hesitancy in recom-
 mending this Pump to any one in
 want of a first class, noiseless Steam
 Pump. Very respectfully,
 J. THOS. MILLER,
 Chief Engineer U. S. House of
 Representatives.
 Send us for Catalogue,
 V. M. COMPANY.

A SUPERINTENDENT WANTED.
 One of the largest SEWING MACHINE COMPANIES in the
 United States wants to employ a first class practical
 mechanical engineer, and Superintendent. A man expe-
 rienced in the manufacture of sewing machines is desired.
 First class reference will be required regarding Ability,
 Honesty, Integrity, and Sobriety. Applicants will please
 give full name and place of residence, their experience,
 and the length of time engaged in the business, with
 whom, and where; the names of references, and the
 amount of salary wanted, and, if convenient, inclose a
 photograph of themselves. Address B. C. O., care C. A.
 CLEGG ADVERTISING AGENT, TRIBUNE BUILDING,
 NEW YORK CITY.

IMPERIAL GRANUM.

THE GREAT MEDICINAL FOOD.

This justly celebrated DIETETIC Preparation is, in
 composition, principally the GLUTEN derived from the
 White Winter Flint Wheat Cereal, a solid extract, the in-
 vention of an eminent chemist.
 It has not only been highly recommended, but certified
 to by a large number of CHEMISTS and PHYSICIANS—
 representing a very high degree of medical science—as
 the SAFEST, MOST ACCEPTABLE AND RELIABLE
 FOOD for the growth of Infants and Children, and for
 Mothers lacking sufficient nourishment for their off-
 spring.
 Unlike those preparations made from animal or vitious
 matter, which are liable to stimulate the brain and irri-
 tate the digestive organs, it embraces in its elementary
 composition—

THAT WHICH MAKES STRONG BONE AND MUSCLE.
 THAT WHICH MAKES GOOD FLESH AND BLOOD.
 THAT WHICH IS EASY OF DIGESTION—NEVER
 CONSTIPATING.
 THAT WHICH IS KIND AND FRIENDLY
 TO THE BRAIN.
 AND THAT WHICH ACTS AS A PREVENTIVE OF THOSE
 INTENSIVE DISORDERS INCIDENTAL TO
 CHILDHOOD.
 And while it would be difficult to conceive of anything
 in Food or Dessert more creamy and delicious, or more
 nourishing and strengthening as an aliment in—

FEVERS, PULMONARY COMPLAINTS,
 DYSPEPSIA, PROSTRATION OF THE SYSTEM,
 OR GENERAL DEBILITY.

its rare medicinal excellence in all intestinal Diseases,
 especially in—
 DYSENTERY, CHRONIC DIARRHOEA, AND
 CHOLERA INFANTUM.

has been incontestably proven.
 See circulars for testimonials. Sold by Druggists gen-
 erally and at the wholesale depot by—

JOHN CARLE & SONS,
 151 Water Street, New York.

**Amateur Workers in
 FANCY WOODS**

Can be supplied with the following HARD and RAFF
 WOODS, planed ready for use: 1/4, 3/4, 1, 1 1/4, 1 1/2, 2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000, 1002, 1004, 1006, 1008, 1010, 1012, 1014, 1016, 1018, 1020, 1022, 1024, 1026, 1028, 1030, 1032, 1034, 1036, 1038, 1040, 1042, 1044, 1046, 1048, 1050, 1052, 1054, 1056, 1058, 1060, 1062, 1064, 1066, 1068, 1070, 1072, 1074, 1076, 1078, 1080, 1082, 1084, 1086, 1088, 1090, 1092, 1094, 1096, 1098, 1100, 1102, 1104, 1106, 1108, 1110, 1112, 1114, 1116, 1118, 1120, 1122, 1124, 1126, 1128, 1130, 1132, 1134, 1136, 1138, 1140, 1142, 1144, 1146, 1148, 1150, 1152, 1154, 1156, 1158, 1160, 1162, 1164, 1166, 1168, 1170, 1172, 1174, 1176, 1178, 1180, 1182, 1184, 1186, 1188, 1190, 1192, 1194, 1196, 1198, 1200, 1202, 1204, 1206, 1208, 1210, 1212, 1214, 1216, 1218, 1220, 1222, 1224, 1226, 1228, 1230, 1232, 1234, 1236, 1238, 1240, 1242, 1244, 1246, 1248, 1250, 1252, 1254, 1256, 1258, 1260, 1262, 1264, 1266, 1268, 1270, 1272, 1274, 1276, 1278, 1280, 1282, 1284, 1286, 1288, 1290, 1292, 1294, 1296, 1298, 1300, 1302, 1304, 1306, 1308, 1310, 1312, 1314, 1316, 1318, 1320, 1322, 1324, 1326, 1328, 1330, 1332, 1334, 1336, 1338, 1340, 1342, 1344, 1346, 1348, 1350, 1352, 1354, 1356, 1358, 1360, 1362, 1364, 1366, 1368, 1370, 1372, 1374, 1376, 1378, 1380, 1382, 1384, 1386, 1388, 1390, 1392, 1394, 1396, 1398, 1400, 1402, 1404, 1406, 1408, 1410, 1412, 1414, 1416, 1418, 1420, 1422, 1424, 1426, 1428, 1430, 1432, 1434, 1436, 1438, 1440, 1442, 1444, 1446, 1448, 1450, 1452, 1454, 1456, 1458, 1460, 1462, 1464, 1466, 1468, 1470, 1472, 1474, 1476, 1478, 1480, 1482, 1484, 1486, 1488, 1490, 1492, 1494, 1496, 1498, 1500, 1502, 1504, 1506, 1508, 1510, 1512, 1514, 1516, 1518, 1520, 1522, 1524, 1526, 1528, 1530, 1532, 1534, 1536, 1538, 1540, 1542, 1544, 1546, 1548, 1550, 1552, 1554, 1556, 1558, 1560, 1562, 1564, 1566, 1568, 1570, 1572, 1574, 1576, 1578, 1580, 1582, 1584, 1586, 1588, 1590, 1592, 1594, 1596, 1598, 1600, 1602, 1604, 1606, 1608, 1610, 1612, 1614, 1616, 1618, 1620, 1622, 1624, 1626, 1628, 1630, 1632, 1634, 1636, 1638, 1640, 1642, 1644, 1646, 1648, 1650, 1652, 1654, 1656, 1658, 1660, 1662, 1664, 1666, 1668, 1670, 1672, 1674, 1676, 1678, 1680, 1682, 1684, 1686, 1688, 1690, 1692, 1694, 1696, 1698, 1700, 1702, 1704, 1706, 1708, 1710, 1712, 1714, 1716, 1718, 1720, 1722, 1724, 1726, 1728, 1730, 1732, 1734, 1736, 1738, 1740, 1742, 1744, 1746, 1748, 1750, 1752, 1754, 1756, 1758, 1760, 1762, 1764, 1766, 1768, 1770, 1772, 1774, 1776, 1778, 1780, 1782, 1784, 1786, 1788, 1790, 1792, 1794, 1796, 1798, 1800, 1802, 1804, 1806, 1808, 1810, 1812, 1814, 1816, 1818, 1820, 1822, 1824, 1826, 1828, 1830, 1832, 1834, 1836, 1838, 1840, 1842, 1844, 1846, 1848, 1850, 1852, 1854, 1856, 1858, 1860, 1862, 1864, 1866, 1868, 1870, 1872, 1874, 1876, 1878, 1880, 1882, 1884, 1886, 1888, 1890, 1892, 1894, 1896, 1898, 1900, 1902, 1904, 1906, 1908, 1910, 1912, 1914, 1916, 1918, 1920, 1922, 1924, 1926, 1928, 1930, 1932, 1934, 1936, 1938, 1940, 1942, 1944, 1946, 1948, 1950, 1952, 1954, 1956, 1958, 1960, 1962, 1964, 1966, 1968, 1970, 1972, 1974, 1976, 1978, 1980, 1982, 1984, 1986, 1988, 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018, 2020, 2022, 2024, 2026, 2028, 2030, 2032, 2034, 2036, 2038, 2040, 2042, 2044, 2046, 2048, 2050, 2052, 2054, 2056, 2058, 2060, 2062, 2064, 2066, 2068, 2070, 2072, 2074, 2076, 2078, 2080, 2082, 2084, 2086, 2088, 2090, 2092, 2094, 2096, 2098, 2100, 2102, 2104, 2106, 2108, 2110, 2112, 2114, 2116, 2118, 2120, 2122, 2124, 2126, 2128, 2130, 2132, 2134, 2136, 2138, 2140, 2142, 2144, 2146, 2148, 2150, 2152, 2154, 2156, 2158, 2160, 2162, 2164, 2166, 2168, 2170, 2172, 2174, 2176, 2178, 2180, 2182, 2184, 2186, 2188, 2190, 2192, 2194, 2196, 2198, 2200, 2202, 2204, 2206, 2208, 2210, 2212, 2214, 2216, 2218, 2220, 2222, 2224, 2226, 2228, 2230, 2232, 2234, 2236, 2238, 2240, 2242, 2244, 2246, 2248, 2250, 2252, 2254, 2256, 2258, 2260, 2262, 2264, 2266, 2268, 2270, 2272, 2274, 2276, 2278, 2280, 2282, 2284, 2286, 2288, 2290, 2292, 2294, 2296, 2298, 2300, 2302, 2304, 2306, 2308, 2310, 2312, 2314, 2316, 2318, 2320, 2322, 2324, 2326, 2328, 2330, 2332, 2334, 2336, 2338, 2340, 2342, 2344, 2346, 2348, 2350, 2352, 2354, 2356, 2358, 2360, 2362, 2364, 2366, 2368, 2370, 2372, 2374, 2376, 2378, 2380, 2382, 2384, 2386, 2388, 2390, 2392, 2394, 2396, 2398, 2400, 2402, 2404, 2406, 2408, 2410, 2412, 2414, 2416, 2418, 2420, 2422, 2424, 2426, 2428, 2430, 2432, 2434, 2436, 2438, 2440, 2442, 2444, 2446, 2448, 2450, 2452, 2454, 2456, 2458, 2460, 2462, 2464, 2466, 2468, 2470, 2472, 2474, 2476, 2478, 2480, 2482, 2484, 2486, 2488, 2490, 2492, 2494, 2496, 2498, 2500, 2502, 2504, 2506, 2508, 2510, 2512, 2514, 2516, 2518, 2520, 2522, 2524, 2526, 2528, 2530, 2532, 2534, 2536, 2538, 2540, 2542, 2544, 2546, 2548, 2550, 2552, 2554, 2556, 2558, 2560, 2562, 2564, 2566, 2568, 2570, 2572, 2574, 2576, 2578, 2580, 2582, 2584, 2586, 2588, 2590, 2592, 2594, 2596, 2598, 2600, 2602, 2604, 2606, 2608, 2610, 2612, 2614, 2616, 2618, 2620, 2622, 2624, 2626, 2628, 2630, 2632, 2634, 2636, 2638, 2640, 2642, 2644, 2646, 2648, 2650, 2652, 2654, 2656, 2658, 2660, 2662, 2664, 2666, 2668, 2670, 2672, 2674, 2676, 2678, 2680, 2682, 2684, 2686, 2688, 2690, 2692, 2694, 2696, 2698, 2700, 2702, 2704, 2706, 2708, 2710, 2712, 2714, 2716, 2718, 2720, 2722, 2724, 2726, 2728, 2730, 2732, 2734, 2736, 2738, 2740, 2742, 2744, 2746, 2748, 2750, 2752, 2754, 2756, 2758, 2760, 2762, 2764, 2766, 2768, 2770, 2772, 2774, 2776, 2778, 2780, 2782, 2784, 2786, 2788, 2790, 2792, 2794, 2796, 2798, 2800, 2802, 2804, 2806, 2808, 2810, 2812, 2814, 2816, 2818, 2820, 2822, 2824, 2826, 2828, 2830, 2832, 2834, 2836, 2838, 2840, 2842, 2844, 2846, 2848, 2850, 2852, 2854, 2856, 2858, 2860, 2862, 2864, 2866, 2868, 2870, 2872, 2874, 2876, 2878, 2880, 2882, 2884, 2886, 2888, 2890, 2892, 2894, 2896, 2898, 2900, 2902, 2904, 2906, 2908, 2910, 2912, 2914, 2916, 2918, 2920, 2922, 2924, 2926, 2928, 2930, 2932, 2934, 2936, 2938, 2940, 2942, 2944, 2946, 2948, 2950, 2952, 2954, 2956, 2958, 2960, 2962, 2964, 2966, 2968, 2970, 2972, 2974, 2976, 2978, 2980, 2982, 2984, 2986, 2988, 2990, 2992, 2994, 2996, 2998, 3000, 3002, 3004, 3006, 3008, 3010, 3012, 3014, 3016, 3018, 3020, 3022, 3024, 3026, 3028, 3030, 3032, 3034, 3036, 3038, 3040, 3042, 3044, 3046, 3048, 3050, 3052, 3054, 3056, 3058, 3060, 3062, 3064, 3066, 3068, 3070, 3072, 3074, 3076, 3078, 3080, 3082, 3084, 3086, 3088, 3090, 3092, 3094, 3096, 3098, 3100, 3102, 3104, 3106, 3108, 3110, 3112, 3114, 3116, 3118, 3120, 3122, 3124, 3126, 3128, 3130, 3132, 3134, 3136, 3138, 3140, 3142, 3144, 3146, 3148, 3150, 3152, 3154, 3156, 3158, 3160, 3162, 3164, 3166, 3168, 3170, 3172, 3174, 3176, 3178, 3180, 3182, 3184, 3186, 3188, 3190, 3192, 3194, 3196, 3198, 3200, 3202, 3204, 3206, 3208, 3210, 3212, 3214, 3216, 3218, 3220, 3222, 3224, 3226, 3228, 3230, 3232, 3234, 3236, 3238, 3240, 3242, 3244, 3246, 3248, 3250, 3252, 3254, 3256, 3258, 3260, 3262, 3264, 3266, 3268, 3270, 3272, 3274, 3276, 3278, 3280, 3282, 3284, 3286, 3288, 3290, 3292, 3294, 3296, 3298, 3300, 3302, 3304, 3306, 3308, 3310, 3312, 3314, 3316, 3318, 3320, 3322, 3324, 3326, 3328, 3330, 3332, 3334, 3336, 3338, 3340, 3342, 3344, 3346, 3348, 3350, 3352, 3354, 3356, 3358, 3360, 3362, 3364, 3366, 3368, 3370, 3372, 3374, 3376, 3378, 3380, 3382, 3384, 3386, 3388, 3390, 3392, 3394, 3396, 3398, 3400, 3402, 3404, 3406, 3408, 3410, 3412, 3414, 3416, 3418, 3420, 3422, 3424, 3426, 3428, 3430, 3432, 3434, 3436, 3438, 3440, 3442, 3444, 3446, 34

Advertisements.

Back Page \$1.00 a line.
Inside Page 75 cents a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

Engine, Spindle, & Cylinder Oil. E. H. KELLOGG,
11 Cedar St., N. Y., manufactures the best. Established '58.

Railroad Gazette Publications.

THE CATECHISM OF THE LOCOMOTIVE, by M. N. Forney, M. E. 625 pages, 4x7 inches, and 250 wood cuts. Price \$2.50.
THE ROADMASTER'S ASSISTANT AND SECTION MASTER'S GUIDE, by Wm. S. Huntington. 144 pages, 4x5 1/2. Price \$1.00.
THE RAILROAD PROBLEM, by Charles Francis Adams, Jr. 19 pages. Price 15 cents.
THE COST OF TRANSPORTATION ON RAILROADS, by L. P. Morehouse, C. E. 17 pages. Price 25 cents.
A COST OF RAILROAD TRANSPORTATION, RAILROAD ACCOUNTS, AND GOVERNMENTAL REGULATION OF RAILROAD TARIFFS, by Albert Fink. 48 pages. Price 50 cents.
A GENERAL CLASSIFICATION OF RAILWAY REALTIES, RIGHTS AND PLANT, by Geo. T. Balch, C. E. 42 pages. Price 25 cents.
NARROW GAUGE RAILWAYS IN AMERICA, by Howard Fleming. 80 pages. Price 50 cents.
ENGLISH VERSUS AMERICAN BRIDGES. 30 pages. Price 25 cents.
NINTH ANNUAL REPORT OF THE PROCEEDINGS OF THE MASTER CAR BUILDERS' ASSOCIATION. 201 pages. Price 75 cents.
THE RAILROAD GAZETTE is an illustrated weekly journal, devoted to Transportation, Engineering, and Railroad News. Subscription price \$1.50 per year.
For any of the above publications, address the RAILROAD GAZETTE, 73 Broadway, New York.

THOMAS'S FLUID TANNATE OF SODA—
Never fails to remove Scale from any Steam Boiler, using any kind of water. It is in Barrels 500 lb., 1/4 lb. 250 lb., 1/4 lb. 125 lb. Price only 10c per lb. Address N. SPENCER THOMAS, Elmira, N. Y.

PORTLAND CEMENT

For Walls, Cisterns, Foundations, Stables, Cellars, Bridges, Reservoirs, Breweries, etc.
Remit 6 cents postage for Practical Treatise on Cements.
S. L. MERCHANT & CO., 76 South St., New York.

Diamond Solid Emery Wheels.

PRICES—6x4, \$1.25; 6x6, \$2.25; 12x1 1/2, \$3.50; 16x2, \$12.50; 18x2, \$16.00; 24x2, \$19.50; 36x2, \$42. All other sizes at proportionate prices. Fast cutting, free from glazing, they are the best Solid Emery Wheels. Give diam. of holes in your order for wheels. Emery Grinders unequalled by any in the world. Address AMERICAN TWIST DRILL CO., Woonsocket, R. I.

IRON AND STEEL
DROP FORGING.

Of Every Description, at Reasonable Prices.
The Hull & Belden Company, Danbury, Ct.

HASKELL'S THREE CYLINDER PUMP—
Hand or Power. Cheaper than a Steam Pump. Will outwear a Rotary Pump—do more work, with less power, than any other pump. Not liable to get out of order. Any blacksmith can repair it. Adapted to any kind of hard work. Send for Circular.
CHASE MACHINE COMPANY, Boston, Mass.

ENGINES AND BOILERS, New and Second-Hand Portable and Stationary. For description, address GOODWIN & WHITE, Oil City, Pa.

GLASS OIL CUPS

of all kinds. Brass Fittings for Steam, Water and Gas. Brass Castings. Send for Catalogue.
HILLARD & HOLLAND, 55 Gold St., New York.

8,000 in Use!
Blake's
STEAM PUMPS
for every possible duty. Send for Illustrated Catalogue.
GEO. F. BLAKE MFG CO.,
56 & 58 Liberty Street,
New York.
Cor. Causeway and Friend
Sts., Boston, Mass. 50 and 52 South Canal
St., Chicago, Ill.

ENGINES & BOILERS—New and 2d hand, perfect condition. Very cheap. Address BINGHAM & RICHMOND, City, Pa.

Pyrometers, For showing heat of Boilers, Stoves, Super-Heated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
36 Liberty St., New York

A PRACTICAL MACHINIST and Draughtsman—over 25 years' experience in designing all kinds of Steam Engines, Boilers, Saw Mills, Flouring Mills, and general Machinery, in making Estimates, Specifications, and Contracts in second to none—will be disengaged Oct. 10th, and desires a permanent situation as Manager, Superintendent, or Salesman. Address MECHANICAL ENGINEER, Chicago, Ill., care of J. C. Howell, Att'y at Law, 125 Clark St.

10
DECALCOMANIE.
47 TRANSFER PICTURES, with book of 24 pp., giving full instructions in this new and beautiful art, sent post-paid for 10 cts. 100 sets of pictures, 50 cts. They are Birds, Landscapes, Animals, Birds, Insects, Flowers, Autumn Leaves, Comic Figures, &c. They can be easily transferred to any article so as to imitate the most beautiful painting. Also, 2 beautiful GEM CHROMOS for 15 cts., 10 for 50 cts. Agents wanted.
Address J. L. PATTERSON & CO., 142 William Street, New York.

FOR SALE OR TO LET—A Valuable Saw Mill, run by water—Lefter's turbine wheel, 40 inch, under 10 ft., 30 ft required—capable of cutting 10,000 ft. in 10 hours; by a little expense, can be made to cut 15,000 ft.; also planer, groover, shingle machine, and chopping mill, with 20 acres attached; also a large quantity of lumber and logs in the yard. Will also sell a large lot of pine standing within three miles of the mill. There is attached also one two horse engine, new, in splendid working order. Will be sold reasonable, or rented for a term of years. It is 10 miles from Chatsworth, 17 from Owen Sound, 17 from Port Huron. It is a central, good business place. D. A. FITZPATRICK, Sullivan, Marmion P. O., Grey County, Ontario.

THE BASTET
MAGNETIC ENGINE.

FOR RUNNING SEWING MACHINES, PUMPS, DENTISTS' AND JEWELERS' LATHES, PRINTING PRESSES, BLOWING PA LOR AND CHURCH ORGANS, OR WORKING ANY MACHINERY THAT CAN BE MOVED BY HAND OR FOOT.

Simple, Durable, and Economical.

SEND FOR CIRCULAR.

State Agents wanted.

L. BASTET,

607 Broadway, N. Y.



The TANITE EMERY WHEEL

Is a rotary file which runs a mile in a minute, and whose cutting points never grow dull. THE TANITE COMPANY publish monthly a first-class Mechanical Journal, called *The Emery Grinder*, which is printed in English, German, and French, and which is the best advertising medium known, both for this country and Europe. THE TANITE COMPANY publish an illustrated pamphlet of 128 pages.

THE TANITE COMPANY manufacture the most uniform and reliable Emery Wheels ever made, and are constantly getting up novelties in Emery Grinding Machinery. For Emery Wheels, Emery Grinders, Diamond Tools, Newman's Emery Planers, Suction Fans, Davis' Speed Indicators, &c.
Address THE TANITE CO.,
STROUDSBURG, MONROE CO., PA.
PURE EMERY,
arranted equal to any in the market, at prices lower than any other first class Emery.

BOGARDUS' PATENT UNIVERSAL ECCE-
NTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guano, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Coconut, Flaxseed, & Abosston, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.

W. E. FRANKLIN, V. P. J. M. ALLEN, Pres.
J. E. FERRIS, Sec.
HARTFORD, CONN.

WHIPPLE'S
Patent Door Knob.
Awarded a Bronze Medal at the American Institute Fair for 1874. The Judges say: "We consider this method of fastening DOOR KNOBS a great improvement over anything yet invented for the purpose, as it obviates the use of side screws and washers, and can be regulated to suit any thickness of Doors." Send for Circular.
THE PARKER & WHIPPLE COMPANY,
West Meriden, Conn., or 97 Chambers St., N. Y.

NOYE'S
Mill Furnishing Works
are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills.
J. T. NOYE & SON, Buffalo, N. Y.

Niagara
Steam Pump Works
ESTABLISHED 1862.
CHARLES B. HARDICK,
No. 23 Adams Street,
BROOKLYN, N. Y.

Todd & Rafferty Machine Co.
MANUFACTURERS OF
The celebrated Greene Variable Cut-Off Engine. Lowe's Patent Tubular and Fine Boilers, Plain Slide Valve Stationary, Hoisting, and Portable Engines. Boilers of all kinds. Steam Pumps, Mill Gearing, Shafting, &c. Sills, Tow Oskum, Bagging, Rope, Flax and Hemp Machinery. Agents for the New Haven Manufacturing Co.'s Machinery Tools; for Judson's Governors and Stop-Valves; Sturtevant Blowers; and Differential Pulley-Blocks. WAREHOUSES, 10 BARCLAY ST., NEW YORK. WORKS PATTERSON, NEW JERSEY.

Excelsior Do Your Own Printing
Portable \$3 Press for cards, labels, envelopes, etc. Larger sizes for larger work.
Business Men do their printing and advertising, save money and increase trade. Amateur Printing, delightful pastime for spare hours. BOYS have great fun and make money fast at printing. Send two stamps for full catalogue press types, etc. to the Mfrs.
KELSEY & CO., Meriden, Conn.

Our Boiler and Pipe Covering
Save 25 PER CENT.
in FUEL.
ASBESTOS FELTING COMPANY,
315-321 FRONT ST., New York.

Shaping Machines
Have novel device for changing length of stroke while in motion; also, automatic down feed, and quick return. Four sizes.
Patented 1868, 1871, 1874.
Wood & Light Machine Co.,
Worcester, Mass.
Manufacturers of all kinds of Iron Working Machinery
Shafting, Pulleys, &c.

THE NATIONAL
Steel Tube Cleaner.

Adopted and in use by U. S. Navy. For sale by dealers. Send for Circular. THE CHALMERS SPENCER CO.,
Foot E. 9th Street, N. Y. Agents for the U. S.

NON-COMBUSTIBLE STEAM BOILER & PIPE
COVERING
WITH AIR SPACE IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCER CO.,
Foot E. 9th St., N. Y.; 1202 N. 2nd St., St. Louis, Mo.

TO DYERS AND MANUFACTURERS.
Thomas's Fluid Tannic Acid, or Black Color Base, for Coloring Hats, Carpets, and all Felt Goods, and Textile Fabrics, and for making Ink. Price 6c per lb. Address N. SPENCER THOMAS, Elmira, N. Y.

Bradley's Cushioned Hammer
has larger capacity, is more durable, takes up less room, does more and better work with less expense for power and repairs than any other Hammer in use.
Guaranteed as recommended.
Address
BRADLEY Manufacturing Company,
SYRACUSE, N. Y.

DITCHING and EXCAVATION.
RANDOLPH'S DITCHER and EXCAVATOR: Simple, strong, and adapted to all soils reasonably free from stumps or large stones. Will do the labor of 100 men, steadily, at the cost of ten. Machines of all sizes, cutting from three inches wide, three feet deep, to 36 inches wide, four feet deep. Extra sizes made to order. Circulars, &c., sent on application to
RANDOLPH BROS., 111 Broadway, New York.

THE BEST INJECTOR
For Locomotive and Stationary Boilers.
FRIEDMANN'S PATENT.
Over 15,000 Now in Use Here and in Europe
Throws more and hotter water, with less steam, than any others. It has two Waterways, fixed Nozzles, and no movable parts to get out of order.
NATHAN & DREYFUS, Sole Manufacturers,
108 Liberty St., New York.
Send for Catalogue.

ROGERS' TANNATE OF SODA BOILER
SCALE PREVENTIVE. JOS. G. ROGERS & CO.,
Madison, Ind. Send for book on Boiler Incrustation.

Portland Cement.
From the best London Manufacturers. For sale by
JAMES BRAND, 35 CHIT ST., N. Y.
A Practical Treatise on Cement furnished for 25 cents.

IMPORTANT FOR ALL CORPORATIONS AND
MAN'G CONCERNS.—Buerk's Watchman's
Motion Detector, capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular.
J. E. BUERK, P. O. Box 979, Boston, Mass.
N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. Proceedings have been commenced against Imhaeuser & Co. for selling, contrary to the order of the Court, and especially the clock with a series of springs in the cover, and marked Pat'd Oct. 20, '74. Persons using these, or any other clocks infringing on my Patent, will be dealt with according to law.

RICHARDSON, MERIAM & CO.,
Manufacturers of the latest Improved Patent Saws and Woodworth Planing Machines, Matching, Sash and Molding, Tenoning, Mordising, Boring, Shaping, Vertical and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway Cut-Off, and Rip-Saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty Street, New York.

DAMPER BEST AND LEVER
REGULATORS GAGE COCKS.
MURRILL & KEIZER, 44 Holliday St., Balt.

Machinists' Tools.
EXTRA HEAVY AND IMPROVED PATTERNS.
LUCIUS W. POND, MANUFACTURER,
Worcester, Mass.
WAREHOUSES 95 LIBERTY ST., N. Y.
Lathes, Planers, Boring Mills, Drills and Gear Cutters a Specialty.

Machinery of Improved Styles for making
SHINGLES, BEADING, AND STAVES.
Sole makers of the well known IMPROVED LAW'S PATENT SHINGLE and BEADING SAWING MACHINE. For circulars, address
TREVOR & CO., Lockport, N. Y.

IRON
BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa.—
The attention of Engineers and Architects is called to our improved Wrought-Iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided. We are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph, address Carnegie Brothers & Co., Union Iron Mills, Pittsburgh, Pa.

BLAKE'S PATENT
Stone and Ore Breaker
Crushes all hard and brittle substances to any required size. Also, any kind of STONE for ROADS and for CONCRETE, &c.
Address BLAKE CRUSHER CO.,
New Haven, Conn.

IRON PLANERS.
ENGINE LATHES, DRILLS, &c. Send for Price List.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

PATENT
COLD ROLLED
SHAFTING.

The fact that this shafting has 75 per cent greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLIER'S PAT. COUPLING, and furnish Pulleys, Hangers, &c., of the most approved styles. Price list mailed on application to
JONES & LAUGHLIN,
Try Street, 2nd and 3rd Avenues, Pittsburgh, Pa.
100 S. Canal Street, Chicago, Ill.
Stocks of this Shafting in store and for sale by
FULLER, DANA, & FITZ, Boston, Mass.
GEO. PLACE & CO., 121 Chambers St., N. Y.
PIERCE & WHALING, Milwaukee, Wis.

John Cooper Engine Mfg Co.
MOUNT VERNON, OHIO.

MANUFACTURERS OF FIRST CLASS STATIONARY ENGINES, 5 to 500 H. P., PORTABLE ENGINES, CIRCULAR SAW MILLS, STEAM BOILERS, ROTARY BOILERS, MILL and FACTORY MACHINERY, &c., BUILD GRIST MILLS, GUARANTEED 30 BARRELS FLOUR WITH ONE TON BEST COAL, or 50 Barrels Flour with One Cord Best Wood; also, Engines to run on 3 lbs. coal per hour per indicated horse power.
Send for circulars.

THE HEALD & SISCO
Patent Centrifugal Pumps.

VERTICAL & HORIZONTAL.
First Premiums at New Orleans, Cincinnati, and New York. "Medals of Special Award,"
American Institute, 1872.
Perfect satisfaction guaranteed. The cheapest, simplest, strongest, most efficient and popular Pump in use, for emptying dry-docks, Coffers, dams, etc., and for use in Paper Mills, Tanneries, and Factories. STEAM PUMPS very low, for Wrecking, Dredging, Irrigating, etc. Illustrated pamphlet, free. Nearly 1,000 references to actual customers. 25 pages first class lithography. Address
HEALD, SISCO & CO., Baldwinville, N. Y.

Munn & Co.'s Patent Offices.

Established 1846.

The Oldest Agency for Soliciting Patents
in the United States.

TWENTY-EIGHT YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draftsmen that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions, and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions on behalf of inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office paying the government fees, and watch each case step by step while pending before the examiner. This is done through their branch office, corner F and 7th Streets, Washington. They also prepare and file caveats, procure design patents, trademarks, and releases, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interferences give written opinions on matters of infringement, furnish copies of patents; in fact attend to every branch of patent business both in this and in foreign countries.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this Agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

A pamphlet of 110 pages, containing the laws and full directions for obtaining United States patents, also a circular pertaining exclusively to Foreign Patents, stating cost for each country, time granted, etc., sent free. Address

MUNN & CO.,

Publishers SCIENTIFIC AMERICAN

37 Park Row, N. Y.

BRANCH OFFICE—Corner F and 7th Streets
Washington, D. C.

PROSPECTUS

OF THE
SCIENTIFIC AMERICAN,
FOR 1875.
THE MOST POPULAR SCIENTIFIC PAPER
IN THE WORLD.

THIRTIETH YEAR.

VOLUME XXXIII.—NEW SERIES

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the third day of July 1875, a new volume commenced. It will continue to be the aim of the publishers to render the contents of the new volume more attractive and useful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pursuits should be without the SCIENTIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

The SCIENTIFIC AMERICAN is devoted to the interests of Popular Science, the Mechanic Arts, Manufactures, Inventions, Agriculture, Commerce, and the industrial pursuits generally; and it is valuable and instructive not only in the Workshop and Manufactory, but also in the Household, the Library, and the Reading Room.

TERMS.

One copy, one year (postage included)..... \$3.20
One copy, six months (postage included).... 1.60
One copy, three months (postage included).... 1.00
One copy of Scientific American for one year, and one copy of engraving, "Men of Progress"..... 10.00
One copy of Scientific American for one year, and one copy of "Science Record" for 1875..... 5.20

Remit by postal order, draft, or express.
Address all letters and make all Post Office orders and drafts payable to

MUNN & CO.

37 PARK ROW, NEW YORK.

MODELS AND MECHANICAL DRAWINGS
PHOTOGRAPHED TO A SCALE OF 1" = 1" BY
ROCKWOOD, 839 BROADWAY, N. Y.

THE "Scientific American" is printed with
CHAS. KNEU JOHNSON & CO. 8 INK, Tenth and
Lombard Sts., Philadelphia and 59 Gold St., New York

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIII.—No. 18.
(NEW SERIES.)

NEW YORK, OCTOBER 30 1875.

\$3.20 per Annum.
(POSTAGE PREPAID.)

MODERN BRITISH LOCOMOTIVES.

Although railway gages are no wider than they were, and consequently the space at the disposal of locomotive builders is limited, there is a continual progress being made in the efficiency of the locomotive engine. The machine itself is so complicated that the proper proportions of many of its parts are still matters of experiment; and many engines have been built especially to attain a maximum result, only to reveal on trial that the weight is improperly distributed on the wheels, or that the springs are ineffective on heavy grades or around sharp curves.

In England, the progress of locomotive building is noticeable on several grounds. The Great Western Railway, Brunel's masterpiece, with its 7 foot gage, for many years has possessed engines which no narrow (4 feet 8½ inches) gage railway could hope to rival. In their boilers, nearly 3,000 square feet of heating surface gave a tremendous steam-making capacity; and the admirable proportions of the whole engine, and the concentration of the heavier parts around and above the center of gravity, made them remarkable for steadiness, even at a speed of 60 miles an hour, the usual rate of travel on Great Western express trains, and their economy in fuel and repairs has yet to be surpassed. But the numerous connections with narrow gage lines have at last made the broad gage a serious disadvantage to this line; and its conversion into one of the ordinary dimensions will before long be completed.

In the meantime, the narrow gage engine is being improved till it seems fairly in the way to become as big and as powerful as the width of the track will let it. The London and Brighton Railway, a line with a very heavy passenger traffic, has made much advance in this direction, under the guidance of Mr. W. Stroudley, the company's locomotive engineer, and we give herewith an engraving, showing in section his latest work; it is an engine named the Grosvenor, which possesses many points of interest, and which has already performed some notable feats.

The first thing in the representation of this engine that strikes the critical observer is the large heating surface. The firebox is of unusual dimensions, the outside shell being 72½ inches by 46, and the inside 66 by 40½ by 71. The diameter of the boiler is 53 inches, and the tubes are 206 in number, and of 1½ inches outside diameter. The tubes are distributed nearly all over the cross section of the boiler, giving a high water level; and dryness of steam is insured by use of a steam dome. The cylinders are inside, giving the engine

the additional steadiness imparted by concentrating the weight; their dimensions are 17 by 24 inches, and they are supplied by ample steam pipes, 3 inches in diameter. The slide valves travel 4 inches, and give ½ inch lead with a maximum travel, the outside lap under the same circumstances being ½ inch. The driving wheels are 6 feet 9 inches in diameter, and the leading and trailing wheels, 4 feet 6 inches. The two latter pairs of wheels have leaf springs, 3 feet 6 inches by 5 inches wide; while the driving wheels have volute springs, as shown, which are, perhaps, the one feature in the design which is open to criticism. The weight on these springs is no less than 14 tons, and this pressure must tell on the springs, rendering them very liable to set under so heavy a load; and the excellent devices for tightening them up can only defer the time when they will go to the scrap heap. The total weight of the engine is 33 tons.

The tender is of unusual dimensions, to allow of long runs without stopping for water; it will hold 2,520 gallons, and has a warming apparatus of 153 square feet of heating surface, so that cold water need never be pumped into the boiler. The tender runs on 3 pairs of wheels, and weighs 15 tons 6 cwt.

It will be predicted that this engine has a great power of making steam, and of keeping up the supply; and this surmise has been verified by feats actually performed. The Grosvenor recently took a special train from Portsmouth to London, 87 miles, in 1 hour 50 minutes, the average speed being 48 miles an hour. But a still greater proof of the staying power—to borrow a term from the race course—of the engine was a run from London to Brighton, 50½ miles, in 1 hour 10 minutes, with 22 railway carriages in the train. This last will be regarded as an extraordinary speed with such a load, especially when it is remembered that the railway is troubled with many long and heavy grades.

An invention of Mr. Stroudley's calls for special mention. It is a speed indicator, consisting of a fan with straight arms, revolving in a brass casing and sending water up a copper pipe which terminates in a glass gage tube. The height at which the water stands shows the speed at which the engine is traveling. It certainly is a convenient appliance, and is said to be exceedingly accurate.

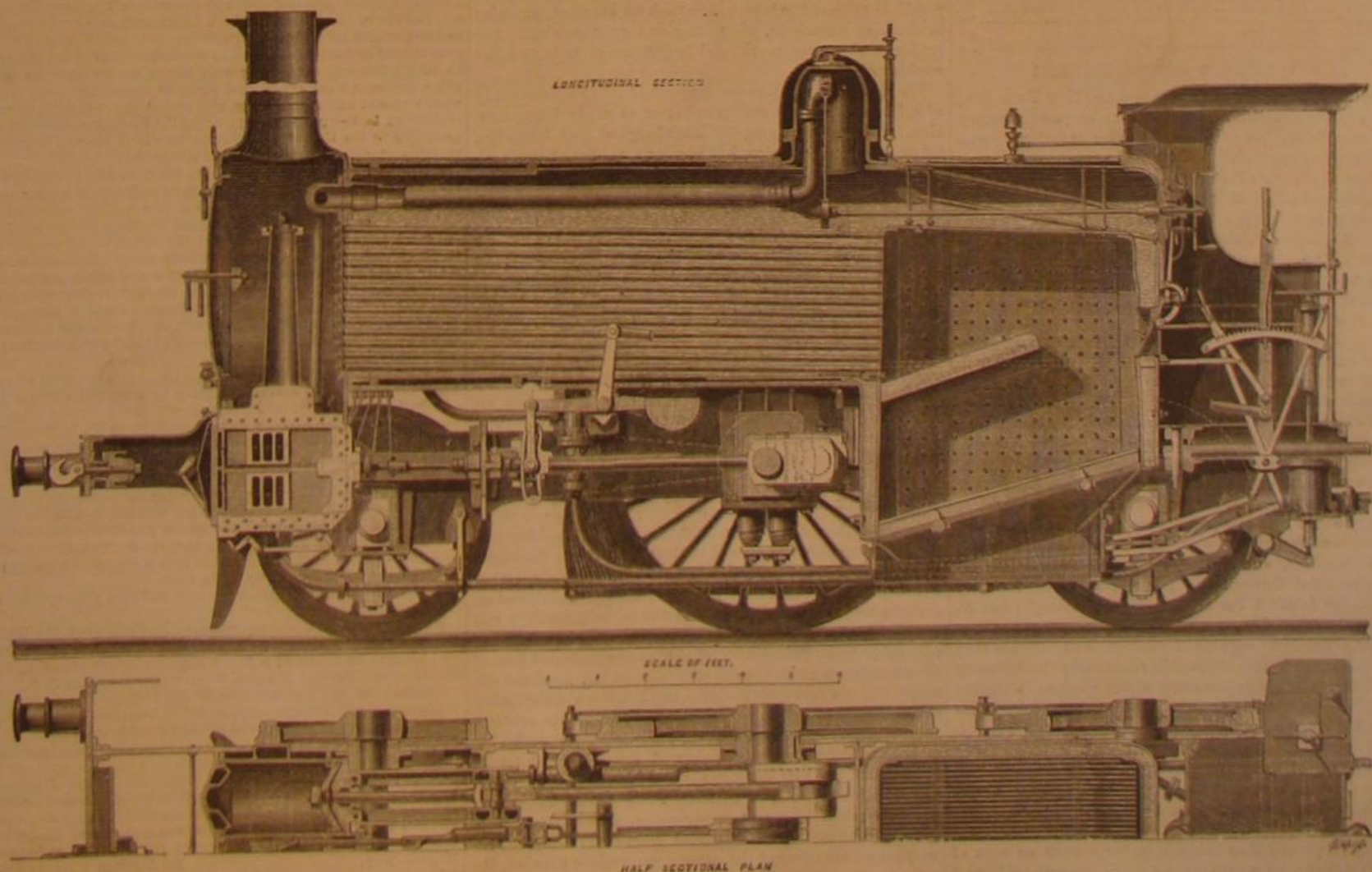
THE National Tube Works Company has just been awarded a gold medal by the Mechanics' Institute Fair, San Francisco, Cal., for the merits of their patent enamel water pipe. Their address can be found in our advertising columns.

A Skillfully Executed Job.

A new and interesting experiment in house-moving was performed in this city, not long ago, at No. 116 West Twenty-fourth street, in the presence of a number of prominent builders and inspectors. About a month ago the Society St. Crescent de Paul determined to build on the vacant lots in rear of their Twenty-third street building. A survey of the land being made, it was discovered that the wall of the five-story brick livery stable adjoining, occupied by S. C. Mott, encroached eighteen inches on their property. The owner was notified to remove the wall to the eastward, and Weeks and Brothers, builders, were authorized to tear it down and rebuild. Mr. Weeks did not like to pull down the wall, and hit upon a plan for moving it bodily.

Ten yellow pine timbers, 12 by 12 inches, planed on the upper surface, were let in horizontally under the wall, at equal distance, just above the foundation, and at right angles to its face. "Needles," builders call them. The upper surface of each needle was profusely greased, and a smaller needle, planed surface down, inserted along each larger one. Spur braces fixed at the foot in these upper timbers held the wall plumb. The jack screws, working horizontally, were set at the ends, on one side of the ten upper needles. This being done, an eighteen inch slit was taken off vertically from the stable building just inside the wall. At 7 o'clock in the morning, says the New York World, a man at each jack screw began to work it, and the wall moved an inch safely. "Go on!" said the boss, with some little excitement, and this time one of the ten men did not work his rack as much as the rest. The overseers were a little nervous at this, but the wall carried the lazy needle along with the rest. By 10 o'clock the 4,900 square feet of wall were pushed up tight against the open side of the stable, and the whole was perfectly plumb and unshaken. The men in the stable pursued their usual avocations during this performance, which attracted a crowd of interested spectators.

ACCORDING to Dr. Schuller of London, the bad effects of chloroform on the *pia mater* are neutralized by nitrate of amyl. This substance, it is stated, even in cases of complete anesthesia, arrests suffocation, reestablishes normal respiration, and allows the pulse to regain its vigor. This, if demonstrated beyond doubt by further necessary investigations, will be an important discovery, since it tends to neutralize the serious danger which now in many instances attends the use of chloroform.



A MODERN BRITISH LOCOMOTIVE.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 87 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included.....\$3 20
One copy, six months, postage included..... 1 60

Club Rates.

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included..... 2 70
By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXIII, No. 18. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, OCTOBER 30, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

Accumulator, an.....	270
African expedition, new.....	271
Antiscope, the.....	271
American Institute fair, the.....	271
Anchor tripper, an.....	271
Angle joints.....	271
Angular gearings.....	271
Answers to correspondents.....	271
Aquometer, the.....	271
Aurograph, the.....	271
Artificial arm, the.....	271
Ball falling in a car, a (15).....	271
Ball from gun, deviation of (5).....	271
Balls, round and conical (20).....	271
Battery for plating (34).....	271
Battery reaction, the French (36).....	271
Bolter, horse power of a (30).....	271
Bolter phenomena (2).....	271
Bolters, dangerous (4).....	271
Bolters, springs, etc., in (15).....	271
Bones, buffalo.....	271
Bronzes, Japanese.....	271
Business and personal.....	271
Centennial notes.....	271
Chloroform, antidote for.....	271
Cincinnati exposition, the.....	271
Colleges and the hard times.....	271
Cone plate for boring.....	271
Cordials, American.....	271
Cryсталizing fruit (17).....	271
Darwin and his doctrine (22).....	271
Decomposition, preventing (14).....	271
Electrical exhibition in Paris.....	271
Electrical fish bait, an.....	271
Electric sign, military.....	271
Element, discovery of a new.....	271
Engine and horse power (22).....	271
Engine cylinders, fallow in (8).....	271
Engine on the center, an (6).....	271
Engines, etc., for boats (19).....	271
Expansion, the force of.....	271
Fence posts, setting (24).....	271
Filter, pressure in a brick (28).....	271
Forest, a buried.....	271
Friction clutch pulley.....	271
Gas, new process for.....	271
Germination of seeds, the.....	271
Glass opaque, to render.....	271
Gunpowder and steel (23).....	271
Heat on steel, effects of.....	271
Horticulture, oriental.....	271
Hospital construction, recent.....	271
Hyperbolic logarithms (15).....	271
Incubator, a new.....	271
Inventions, useful and curious.....	271
Ivory, preserving color of (37).....	271
Jaws, stone, to clean (1).....	271
Joints, tight, to unscrew (41).....	271
Keely motor deception, the.....	272
Kettle, improved tea.....	272
Knapsacks.....	272
Leaks in floors, etc., (23).....	272
Leverage on screws (16).....	272
Locomotive, semi-centennial the.....	272
Locomotives, modern British.....	272
Locomotive, traction of (7) (35).....	272
Magnetism, effect of stress on.....	272
Microscope, a home-made.....	272
Microscopical solère, a.....	272
Mills, improved grinding.....	272
Oil car, new.....	272
Patent laws, State (11).....	272
Patents, American and foreign.....	272
Patents, foreign, cost of.....	272
Patents, list of Canadian.....	272
Patents, official list of.....	272
Patents, reduced cost of.....	272
Plows, re-pointing (10).....	272
Polishing steel buttons, etc. (39).....	272
Polishing wrought iron (5).....	272
Pond, L. W.....	272
Power required for grinding (39).....	272
Practical mechanism—No. 34.....	272
Preserving meat.....	272
Railroad, the first U. S. (27).....	272
Refrigerator, carriage, new.....	272
Refrigerator and counter.....	272
Scissors and ripping knife.....	272
Skilfully executed job, a.....	272
Slotting machine tools.....	272
Snake within a snake, a.....	272
Steamers, fast (45).....	272
Steam, expansion of (32).....	272
Steel an artificial production (17).....	272
Steel ingots, casting.....	272
Subterranean festivities.....	272
Suicidal epidemic, a.....	272
Telegraph wires, enclosed.....	272
Telegraphy, cable.....	272
Telegraphy, progress of American.....	272
Telescopes, marine (35).....	272
Testing gold (12).....	272
Tinning iron wire (14).....	272
Tinny small castings.....	272
Torpedo system useless, is our.....	272
Trade marks, rise and progress of.....	272
Tube Company, the National.....	272
Varnish for paper (31).....	272
Vessels, vertical motion of.....	272
Water for turbines (28).....	272
Water in tubes, pressure of (22).....	272
Water, shortening ropes with (42).....	272
Water, testing for animal matter.....	272
Wells, artesian (28).....	272

IS OUR TORPEDO SYSTEM USELESS?

An editorial has recently appeared in the New York *Sun*, advocating the abolition of the engineer corps of the army on the ground that that arm of the service is no longer useful. Referring more particularly to the Government torpedo station at Willett's Point, on the Narrows of Long Island Sound, where a school of instruction in the manufacture and use of torpedoes for the army engineers has been for some time past established, the *Sun* considers that the same is of no value to the country, mainly on account of the defects known to exist in fired submarine torpedoes, which class of weapon the *Sun* seems to believe is the only one made the object of military study. Our contemporary fortifies its arguments, which are directed against the entire torpedo system, by extracts from a report of Admiral Porter, in which that officer suggests several points in which he deems the submarine mine to be deficient.

It is well known, to all who have watched the remarkable progress which, during the last few years, has been made in torpedo science, that of all types the planted torpedo is probably the weakest. Unless a vessel comes within a destructive range, which experiment has proved to be quite contracted, no injury would result; and there are besides the other disadvantages of the concussion of one submarine mine blowing up the others, and of possible deterioration of the explosive material through long immersion. These facts are set forth by Admiral Porter, and are true enough; but on other hand it should be remembered that in themselves they constitute problems capable of solution, and because they exist now is the strongest possible reason why the engineers should continue the experiments already begun with that object. Again, the *Sun* and the Admiral place much stress on the failure of submarine torpedoes during the war. It should be remembered, however, that such torpedoes (with the exception of a few attempts made by the Russians during the Crimean war) were the first ever employed, and were of the crudest imaginable construction. Nitro-glycerin never entered into their composition, and seldom gun cotton; and very frequently they were merely tin cans or kegs of powder rigged with a percussion fuse to blow up on impact with the vessel, or some equally imperfect arrangement, to

be fired by a friction tube attached to a cord from the land, and which, if left under water for months, might easily become harmless. They are certainly not to be compared for an instant with such submarine torpedoes as were used in the recent Oberon experiments in England, to explode which electrically worked devices were employed, which not only enabled the operator to blow up the sunken mine, but also exactly indicated when a vessel had arrived within the destructive area of the torpedo.

We think, therefore, that, even if the engineers devoted themselves to nothing but submarine mines, which is not the case, the continued existence of the corps would be an advantage to the country. The fact is, however, that the engineers study not only the system of fixed but that of movable torpedoes; and that the latter constitute the vastly more effective branch, the *Sun* fails to consider. To every one inventor who is giving his attention to the fixed torpedo, a dozen are devoting their energies to the movable types, and the movable torpedoes are those which will play the prominent part in future conflicts. We have already noted the remarkable success which has attended the experiments upon the Lay and Ericsson boats, which can be directed into the midst of an enemy's fleet when the latter is miles away from shore, and be made to blow up the strongest vessels without those on board having the slightest indication of their presence. There are the spar torpedo launches, now built in England, of steel, and capable of steaming at the rate of 18 knots per hour. Half a dozen of these swift craft, each provided with a heavy torpedo, could on a foggy night run in among a fleet of vessels, and each sink or shatter its victim before the crews could get to their guns. The heaviest cannon would be of little use against rapidly moving objects which could noiselessly steam inside of point blank range before fairly discovered by the lookouts.

Our readers are sufficiently posted in the progress made in torpedo science not to require any review of what has been accomplished at Newport, the work at which station is well supplemented by that at Willett's Point. Both schools have acquired a high reputation abroad, and the abolition of either would be, we think, a loss which the country can ill afford to incur.

THE COLLEGES AND THE HARD TIMES.

No one will deny that money is "tight" at the present time. Nine men out of every ten we meet exclaim: "Oh, I can't get any money." At this time it would be well to remember the principle embraced in the famous reply of that sturdy old New Englander, who said that, among the rocks where they could raise nothing else, they built schoolhouses to raise men. When you cannot find work for the hands, set your brains at work. If you cannot labor, study. If the counting houses, the woolen mills, the machine shops, even the railways, will not open their doors to your sons, there are plenty of educational mills where they will be thrice welcome. Every trade seems overstocked with men just now; but he who lays a sound foundation at any technical or scientific school during his enforced vacation will be the better prepared to profit by the revival of trade and manufacture when it does come, as come it must and will in due time. The machinist who has mastered the higher mathematics, or acquired skill and facility in the use of his pencil, is prepared to take a high rank as inventor, superintendent, or proprietor, when time and practice shall have rendered him equally skillful in the use of tools and the working of metals.

We met a gentleman recently who had taken up the study of a foreign tongue in order the better to study his profession. To-day, he tells us, the knowledge of that language, taken up only as a means, has become a source of profit almost equal to that which had been his main object of study. Many are the cases we have met where some subject, pursued at odd times as recreation, has become a source of honor, if not of glory. Dr. Priestly, the discoverer of oxygen gas, was a theologian, and chemistry was his pastime; but chemists honor his memory and celebrate his achievements, while his name has long since passed from the notice of the theologians, or is mentioned only with disrespect and disgust.

It is a gratifying fact to notice that the attendance at all our principal institutions of learning is larger this year than ever before; new colleges are being opened, old ones are generally full; salaries and appropriations are raised, new chairs are endowed, and general educational prospects are bright and encouraging.

THE LOCOMOTIVE SEMI-CENTENNIAL.

On the 27th of September, 1825, the first railroad for conveying passengers was opened in England between the towns of Darlington and Stockton. The occasion brought together a throng of witnesses, some doubtful, more scornful, and all perhaps better prepared to scoff at the failure, which it was confidently predicted awaited the bold inventor in his daring attempt to make vehicles travel at the unprecedented rate of fifteen miles an hour, than to congratulate him upon the triumph which upset their theories and left them questioning the reliability of their senses. It is suggestive to contrast this unbelieving assemblage with the gigantic gathering which has enthusiastically celebrated the day which marks the lapse of the half century since that victory over prejudice and ignorance was gained. Sooty Darlington, opportunely washed by recent heavy rains, donned her gayest garb. Flags and banners flaunted from every building, triumphal arches spanned the streets, processions paraded, the railway magnates and notabilities congregated at a great banquet, and a peer of the realm unveiled a statue of Joseph

Pease, the philanthropist and capitalist, in whose open purse George Stephenson found the staunch material support which enabled him to prosecute his labors to their successful end. On the following day, the festivities were continued in adjacent towns, and so, for forty-eight hours, the jubilee existed.

In Darlington, the locomotive which drew the first passenger train was exhibited actually at work. It was propped up so as to be just clear of the rails; and being held in a stationary position, its wheels revolved at their utmost speed, which would have carried the engine along at its old maximum rate of eight miles per hour. The weight of the machine is but six tons, twenty-five tons less than that of the magnificent engines which English workshops now produce. The contrast between the two (of which next week, when we publish the engravings of both, our readers will have an opportunity to judge) is as proportionately great as that between the knot of unbelievers of 1825 and the cheering crowds of the recent festival.

Stephenson, it may be remembered, was born at Wylam-on-Tyne, and it was there in 1813 that a locomotive called the "Puffing Billy" was built, under William Headley's patent, for Christopher Blackett, Esq., the then proprietor of the collieries. The machine was used to drag coal long before Stephenson constructed his railway engines. Probably it was from this crude old apparatus (which, after working at Wylam continuously from the year above mentioned up to 1862, was removed to its present resting place in the Patent Office Museum in London) that Stephenson gained some of the ideas which he subsequently developed. Puffing Billy has, however, another and greater claim upon popular notice, one especially interesting in these later days, when railroad litigation has become so vast and extended that a new code of laws has sprung up for its government, and that it is that it was the subject of the first legal controversy engendered by the railway. The question of nuisance, on which the difficulty was based, became afterwards the ground for many of the most absurd objections to Stephenson's proposed use of the locomotive for passenger transportation. "The smoke and dirt will annoy everybody on the line," "the noise of the machine will scare cows so badly that their lacteal functions will be arrested," "if cows get on the track, how will the engine get out of the way?" are specimens of this cavilling, familiar to every one who has perused Stephenson's eventful biography. The smoke nuisance seems to be the trouble in this earliest dispute, and the opinion of the counsel learned in the law, who was appealed to in the matter, we give below. It is a curious contribution to the history of the railroad, and we are indebted for it to a London correspondent, who copied it from the original manuscript now hanging framed beside the old engine.

9th July, 1814.

CASE RESPECTING THE USE OF A STEAM ENGINE FOR CONVEYING COAL.
FEE FOR MR. WILLIAMSON'S OPINION, 1 GUINEA.

BAINBRIDGE:

CASE.

Mr. Blackett is Proprietor of a coal mine at Wylam in Northumberland and for the purpose of sending his coal to Lemington he took Wayleaves on various Estates between there and Wylam, especially over the estates of A, for a term of years not yet expired whereby a demise of a sufficient and convenient Wayleave Liberty and Passage to and for Mr. Blackett his Executors Administrators and assigns and his and their Agents Servants and Workmen from time to time and at all times during the continuance of said demise to take leave and carry away with horses carts waggons or any other carriages whatever all and every or any of the coals to be won, wrought and gotten forth and out of the said colliery and coal mines in through over and along the lands and closes of A, according to the line of way therein described under the yearly certain and contingent rents therein mentioned.

When the Wayleave was granted Mr. Blackett led his coal by the ordinary coal waggons drawn by horses; but his agent has recently discovered an invention to them by a Steam Engine instead of horses and for that purpose he obtained his Majesty's Letters Patent as a reward for his ingenuity and the Steam Engine is now actually at work. In the operation a little noise and smoke is certainly made, which A considers a nuisance and has requested Mr. Blackett to suspend the use of it. Mr. Blackett is extremely anxious of being on good terms with his Landlord and is inclined to yield to his wishes so far he consistently can, but in the first place he is desirous of having the Question of right and wrong established between them.

The Patent in Question is granted for the express purpose of enabling the Patentee to carry the waggon by means of a Steam Engine instead of Horses, and it is rather improbable that Government would license a thing the use whereof could be deemed a nuisance; and in a Mining Country like this Every Encouragement should be given to the Ingenuity of Mankind in all things that tend to decrease the Expence of Labor.

In consequence of the Waggon way being made, the county road has in many places been laid close to and contiguous with the Waggon way and it is alleged that the Steam and Smoke will frighten the Horses passing and repassing and render traveling unsafe. However in many places the road has been removed to the Waggon way, and not the Waggon way to the road.

You will be so good as peruse the case and give your opinion on the following Queries:

Whether under all the circumstances stated in the case Mr. Blackett has a right by virtue of the above recited Leave to carry his coal Waggon by means of a Steam Engine which is placed upon a Frame resembling that of a Coal Waggon over the lands of A.

Whether the use and exercise of the Steam Engine upon the Waggon way and for the purpose above suggested can under all the circumstances of the case be deemed a nuisance.

It does not appear to me that there is any objection arising from the Leave itself, to Mr. Blackett conveying his coal waggons by means of this Steam Engine. But I think that the use of such an Engine may be deemed a nuisance to A. If the smoke and noise occasioned thereby render his habitation unhealthy or uncomfortable. But this must entirely depend upon the quantity of smoke and noise so occasioned, and the distance of the house of A. from the Waggon Way.

If the noise of the engine disturbs the cattle grazing on the lands adjacent to the Waggon Way so as to injure them with regard to their feeding, I think it may be considered a nuisance. R. H. W.

PROGRESS OF AMERICAN TELEGRAPHY.

According to the recent annual report of the Western Union Telegraph Company, this great corporation has now in operation 72,833 miles of telegraph line, 179,294 miles of operating lines, and 6,563 offices. Its receipts for the past year were nine and a half millions of dollars, expenses six and a half millions, nearly—net profits over three millions. Over seventeen millions of messages were transmitted, the cost of which to the company was 37 cents per message. This is rather cold comfort for new companies that would like to compete with the Western Union by a reduction of the rates. Rather dismal, also, for the advocates of government telegraphy, who propose a uniform charge of 25 cents for each message, being the rate now in vogue in England, where the telegraphs are worked by the government at a great annual loss.

Our British cousins are a little apt to think that what they don't know about telegraphy isn't worth knowing. But the truth is they have not as yet learned the A B C of rapidity in the business. In this respect the American telegraph engineers are in advance of other nations; nor in this very surprising, since both the telegraph works and telegraph experiences of individual nations are diminutive when compared with those of the United States. For example, the length of all the telegraph lines in the United Kingdom is only 23,878 miles, while, as shown above, a single company in this country is now working more than three times that length.

Another reason for the advanced situation of telegraphy in this country is the fact that there are thousands of telegraph operators and electricians here who, under the stimulus of our patent system, are constantly studying how they may improve instruments or make discoveries by which the operation of the line and adjuncts can be improved, quickened, or made more economical. Their success is astonishing, and in one branch is illustrated by the report of the Western Union Company, which shows that, by the employment of the new duplex and quadruplex instruments, they have greatly reduced the expense of transmission, besides increasing the capacity of the lines.

If our telegraphs were in the hands of government officials there would be less striving or competition for excellence, and little encouragement, we fear, would be offered for the discovery of new improvements.

The recent invention of Elisha Gray, heretofore described by us, by which sixteen or more messages may be transmitted each way, at one time, over one wire, promises wonderful results in the future. It indicates that the time is coming when household and private telegraphic lines will become as common as the existing method. It is one of the peculiarities of Mr Gray's remarkable method that, while sixteen different persons may use the wire, none of their messages need interfere with or become known to any of the other users, save the sender and his designated correspondent.

A new organization entitled the National Telegraph Company, with a capital of \$25,000,000, has been organized in California, and it is to be hoped that it will meet with success. But this it can only hope to achieve by improving the existing service. If it can send messages as promptly, at no greater prime cost than that now paid by the present companies, it may secure a share of the business. But this will be up-hill work in the face of the admirable management of companies like the Western Union, which are constantly striving to improve every branch of their service, and quick to adopt every practical improvement that inventors present.

FOREIGN PATENTS—REDUCTION OF COSTS.

We would direct special attention to the announcement, published in another column by Messrs. Munn & Co., of an important reduction in the costs of foreign patents.

Throughout all Europe there is a large and increasing demand for American inventions, and those of our ingenious countrymen who neglect to secure foreign patents, if their improvements are good, simply throw away golden opportunities.

Many millions of dollars are already invested in Europe in the manufacture of American inventions, introduced there by enterprising adventurers, who are always on the alert to pick up and patent abroad, for their own benefit, all new American devices of any account, the foreign patents for which have been neglected by the original authors in this country.

American patentees have it entirely within their power to put a stop to this species of piracy. They can always, if they desire, file in their applications for foreign patents in advance of others, because the invention remains unknown abroad until the patent issues here.

Indeed, one of the provisions of the American law is intended for the special convenience of our inventors in securing their foreign patents. After the official examinations have been made here and the patent allowed, the inventor then possesses good *prima facie* evidence that his improvement is equally good and patentable in all other countries; and after such allowance, the patent need not be issued under six months, if the patentee so elects, or for such less period as he wishes, thus giving him abundant time to take as many patents in foreign countries as he desires.

Our patentees are not sufficiently alive to the importance and value of this excellent provision of law. It should be their aim, in all cases where the invention is of probable value, to secure European patents promptly, before they are deprived of the privilege by interlopers.

Where the original author is unable to meet the necessary expenses, he can generally, by a little perseverance, find partners to assist him: one of whom, for example, would pay

for the English patent, and share in its proceeds; another for the French patent, and so on.

The facilities of business, steam, postal, and telegraphic connections between this country and Europe are now so great that patents may be taken and handled in the chief European States with almost as much ease and promptitude as in this country; and, we repeat, it is a folly for our patentees to overlook the matter.

THE KEELY MOTOR DECEPTION.

By a special invitation of the managers of the Keely motor, Vice Admiral Wellesley, of the great ironclad Bellerophon, and a party of his associate officers and friends, were lately admitted to a private exhibition of this *rara avis*. The admiral was attended by several of the original promoters of the scheme, among whom, according to the Philadelphia *Times*, were Professor B. Howard Rand—who, it will be remembered, certified in effect that, while he did not know actually anything about the wonderful gas, he did know that its nature and generation were totally unknown to Science—by W. H. Rutherford, Chief Engineer U. S. Navy, by the learned counsel of the company, who so adroitly managed to get a hundred thousand dollars in cash out of the New York capitalists, by Keely himself, and several of his best helpers.

Keely went through the juggle in the usual manner. The boiler was suspended by chains from a beam overhead, to satisfy the visitors that there was "no humbug." Water was then run through the boiler, which visitors were allowed to smell and taste, indicating no chemicals present. Keely then blew his breath into her as usual, turned the cocks, and lo! the gage indicated 1,750 lbs. pressure per square inch. This was allowed to escape for half an hour, more or less, through a pipe having the bore of about the size of a horse hair, during which time the gage went down to 500 lbs. One of the British officers suggested that this didn't look like a constant force, or capability of doing actual work. To which Keely made the old reply, originally given three years ago and repeated at every performance, to the effect that the new machine was not quite done, would be ready in about two weeks, and then, etc. The sum total of information gained by the British officers, if we may judge from their reported expressions made after the exhibition, was that they saw the gage go up; but how it was done they were not shown, nor was anything of a practically useful nature developed in their presence.

THE FAIR OF THE AMERICAN INSTITUTE.

That telegraph wires in cities will eventually have to be laid underground is a fact which is beginning to force itself upon the popular mind. It is only necessary to recall the wholesale destruction of the aerial wires by the accumulated ice during last winter, and the danger in which the city was placed for the time owing to the consequent rupture of the fire alarm system, to perceive the importance of the change, without considering other reasons which militate in its favor. Inventors consequently are turning their attention to the devising of means for enclosing the subterranean lines, and one new mode of so doing we find among the exhibits at the fair. Copper wires are drawn through glass tubes of a somewhat larger diameter. These tubes are in turn enclosed in iron pipe and held firmly therein by paraffin, which is poured in a melted state. For lateral connections, as well as for convenience in laying, traps are used, into which the pipe is screwed, the wires passing over non-conducting bridges, so that any wire may be taken out and replaced without interfering with the working of the others. The pipes are made in suitable lengths and are connected by couplings, the joints being faced with paraffin. The inventor states that the device has been tested over considerable distances with success.

THE AQUOMETER.

is a new steam pump now in operation in the machinery department. It bears a strong resemblance both in shape and in construction to the similar apparatus known as the pulsometer. There are two working chambers combined with an interposed pressure chamber. Steam enters one chamber or the other according to the position of a steam valve, and presses upon the surface of water in the chamber, forcing the same out. As soon as the live steam reaches the discharge port, its free escape produces a reduction of pressure in the working chamber. The discharge valve then closes, the steam valve cuts off further entrance of steam, and the body of water in the central pressure chamber opens the suction valve and causes an instantaneous condensation of the entire volume of steam within the working chamber, so as to produce a vacuum therein, which causes said chamber to fill with water. The suction valve then ceases, and the momentum acquired by the water flowing up the suction pipe operates to fill the pressure chamber. As the one chamber is thus filling, the steam current operates to force the water out of the opposite chamber, so that a constant flow is produced in the discharge pipe. The steam valve is balanced in its chest, and means are provided to prevent injury by the entrance of grit or dirt.

Any farmer who possesses a manure heap, according to the inventor of

A NEW INCUBATOR

on exhibition, is provided with the essential means of artificially hatching chickens. The idea is to utilize the natural heat of the manure, to produce and maintain the requisite temperature for the incubating process. The apparatus, which is quite simple, consists of a cask or cylinder of wood, near the bottom of which is a door for convenient access to the interior. On the bottom is placed a sieve for the recep-

tion of the eggs. In the head is made a kind of chimney covered with an adjustable sliding piece. A bed of horse manure about a foot thick is prepared, and on this the cask is stood. Then manure is heaped about the sides of the latter, flush with the top. A thermometer is placed upon the sieve; and when this shows the interior heat to have reached 104°, the eggs are inserted. Nothing further remains to be done, but to watch the thermometer during the usual hatching period. If the heat exceeds 104°, some of the manure is removed and a portion of the circumference of the cask left exposed; if the mercury falls below the above point, manure fresh from the stable is substituted for the older material. When the chickens appear, the interior of the cask is cleaned, and an artificial mother, composed of a disk covered on its under side with buffalo hair, is inserted and adjusted to a proper height from the bottom, by means of a threaded rod passing through a nut in the cover of the cask. The manure is still left around the latter, the heat being necessary for the young chickens until they have grown sufficiently to warrant their removal. The chimney on top serves for ventilating purposes. The inventor says that any number of eggs that can be conveniently disposed on two sieves, if need be, can be thus hatched.

The manufacture of

AMERICAN CORDIALS.

is interesting as the starting point of a possible new industry. The visitor will find in a small room adjacent to the main hall a large variety of these liqueurs, and will also have an opportunity of witnessing the preliminary operation of their distillation. It is proposed, of course, to compete with the maraschinos, chartreuses, and other cordials of foreign make; and to this end the manufacturers confine themselves, as far as possible, to herbs and other ingredients of American production. The distilling apparatus now in operation is worked by steam. The ingredients, moistened, are placed in a vessel which is contained in a larger receptacle, into which the steam enters. The effect of the heat of the latter is to vaporize the materials, the vapor first passing to a drum above and thence through a high arched pipe to a cooler, which is simply a receptacle enclosed in a cold water bath. The high pipe prevents the passing over of the heavy oils, so that only the fine aromatic essence is condensed, and afterward, in liquid form, drawn off from the cooler. Subsequent distillation is carried on with California brandy or native wine, which supplies the spirituous principle; and the result is a cordial of fine flavor, in many respects equal to that of foreign production.

Mr. L. W. Pond.

The death of Mr. L. W. Pond, the well known machine tool manufacturer of Worcester, Mass., recently occurred in a very sad and unlooked-for manner. He took passage in the night steamer Providence from this city for Boston. The weather was quite stormy, and the vessel had considerable motion, owing to the rough sea. When last seen Mr. Pond had quitted his state room, partially undressed, and probably was suffering from the effects of the rolling of the boat. His apartment in the morning was found empty with the exception of a few articles of clothing, and no traces of its occupant could elsewhere be discovered. From the fact of Mr. Pond being known to have a considerable sum of money about him, together with the circumstance of his having occupied a state room in a very quiet and retired portion of the vessel, a suspicion of foul play was engendered; but this has since given way to the more probable assumption that the unfortunate gentleman, while near the side of the boat, lost his balance, and was thrown over the rail by a heavy lurch.

The terrible death which he thus met, while it will awaken a deep feeling of sympathy among all, cannot add to the sorrow with which those who knew Mr. Pond will regard his loss. He was one of those persevering, enterprising men such as are naturally fitted to be leaders in great industries, and such as the country can least afford to part with, an inventor and a patentee of celebrity and of marked genius and ability, and beyond all he possessed a personal character untainted, through a busy life, with the faintest shadow of reproach.

Rise and Progress of Trademarks.

Examples of the practice of using marks to show the workmanship of various manufactures have been discovered at Herculaneum, such signs having been in vogue among bakers and others. In modern times similar tokens have been adopted in textile and various other fabrics, though the earliest extant are those of paper. After the invention of paper (15th century) from pulp of linen rags, water marks were introduced into the fabric, doubtless to show the manufactory from which the paper was issued. The process has since become general, and the trademark a recognized part of the system of commerce, by which a guarantee is given to the purchaser and a legitimate protection afforded to the manufacturer. The legislation of 1862 is a step in the right direction, and has already done service to trade and morality. It is upon the uniform good quality of manufactured commodities that any foreign trade depends for its continuance, and the obligation of the legislature to secure the purchasing public from fraud, whether the purchaser be a home or foreign consumer, is more and more stringent when the goodness or badness of the object cannot be readily detected by ocular inspection. It is in such cases that the use of trademarks is most useful.

The above, from so good authority as the London *Stationer*, applies with equal force to our manufacturers. There are some things in which the slow Britishers excel the more rapid Yankee. In the matter of securing trademark protection on their products, and the extent of advertising their goods, they are far ahead of our people.—Ems.

IMPROVED TEA KETTLE.

This is an age of utilizations. It is a province of invention to prevent waste—to economize everywhere—facts well exemplified in the device illustrated herewith, the object of which is to usefully employ the steam which issues from the tea kettle, and thus to enhance the value of that indispensable vessel. Incidentally the invention serves to prevent water boiling over upon the stove, and also offers a convenient funnel for filling the kettle.

About the main portion of the kettle and about the handle there is nothing peculiar, save that the latter is provided



with a metal guard, A, to protect the hand from the steam. The opening of the vessel, however, has a funnel-shaped rim, B, the space inside which may be utilized for steaming, cooking, or warming various articles placed therein, and enclosed by the cover, C. The top aperture of the kettle is closed by an interior perforated cover, which has a centrally applied slide piece, D, and button, so that the opening for the escape of the steam into the upper chamber can be increased or diminished at will.

Patented through the Scientific American Patent Agency February 16, 1875. For further information, address the inventor, Mrs. Harriet Gray, lock drawer 5, Marquette, Mich.

COMBINED SCISSORS AND RIPPING KNIFE.

Combination implements are coming more and more into use. Every day brings us new forms of instruments, more or less complicated, designed to reduce the number of tools which an operative must have at hand by placing several tools in one handle. Many of these devices show considerable invention, and save expense in first cost, as well as time and trouble in manipulation.



The annexed engraving shows the device very clearly.

Mr. C. M. Johnson, of New York city, is the inventor of an ingenious arrangement of a knife blade with a pair of scissors, the object of the knife being to cut or rip seams or perform other operations incidental to the seamstress' labor. One blade of the scissors is made a little thicker than usual, and a longitudinal slot is cut in it, in which the square part of the knife is received. The latter can be pushed out or in, as desired, and is secured in any position by an ordinary clamp screw.

RECENT HOSPITAL CONSTRUCTION.

There has recently been erected in London a hospital for children, in the construction of which there are many novel and important features. The building is from a design by Mr. Edward M. Barry, R. A., and it consists of a center block and lateral wings, the former containing the hall, main staircase, chapel, operating theater, and administrative offices, the wings containing the wards, which run longitudinally, being lighted on both sides. The hospital is intended to accommodate 200 in patients, and a dispensary, for the relief of out patients, is located in the basement. The chapel is small, being about 26 feet square; but the *Building News* states that so unique and costly a gem of art, for its size, has seldom been seen. It is the gift of an anonymous donor, and no expense has been spared on its decoration. The richest marbles and alabaster are used in its walls, and the pavement is mosaic.

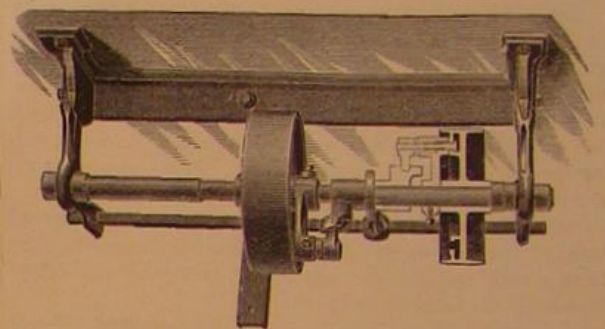
The wards are about 80 feet long by 23 feet wide, and 13 feet high, and each contains 18 beds; thus each patient has about 1,200 cubic feet space. Five such wards are provided,

besides separate apartments for infectious and surgical cases. At the end of each ward are bath rooms and closets, each bath being provided with flexible tubes for filling portable baths for the small children; and each closet is flushed every time a child pushes the door. Slate and glass are used for utensils and for shelving, for cleanliness' sake, and the walls are made double to secure warmth and dryness, the inner surface being of glazed brick, which is easily washed, and is so completely non-absorbent that it gives no foothold for the spread of infection. The floors are of teak, so perfectly laid that they are waterproof; and they are polished so that simply sweeping them insures cleanliness.

The exterior of the building, as shown in our engraving, is of the modern classic order. The ornamental piers, which are striking ornaments, contain the smoke and air flues, while the shafts for admitting the pure air and extracting the foul are in the pyramidal roofs of the end towers. Colored brick and tile are freely used in the work, and serve to show how highly ornamental a structure can be, by the hands of a real artist, constructed of brick.

IMPROVED FRICTION CLUTCH PULLEY.

This engraving represents Bean's patent friction clutch pulley applied to a countershaft, such as is used over engine lathes and other machinery requiring quick and positive change of motion. This countershaft has innumerable



advantages. It runs without noise, and it is strong and durable. It is not complicated in its construction, and is consequently always in working order, the few wearing surfaces being so arranged that they can be very easily and quickly adjusted.

For use on heavy machinery where it is necessary to start and stop gradually, to prevent strain or breakage, and upon line shafting where it is desirable to stop a part or the whole without slackening the speed of the engine, the application of this friction clutch pulley is guaranteed by the manufacturer to give full satisfaction.

One of these countershafts can be seen in operation at the Fair of the American Institute. For circulars and particulars apply to D. Frisbie & Co., New Haven, Conn.

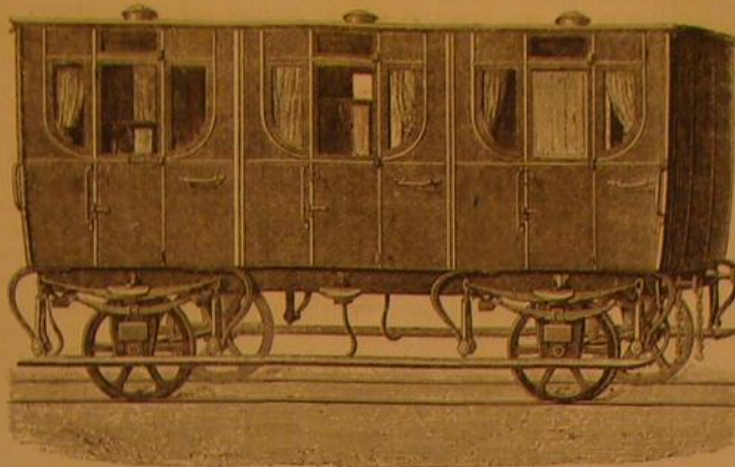


HOSPITAL FOR SICK CHILDREN, GREAT ORMOND STREET, LONDON

THE NEW GIFFARD RAILWAY CARRIAGES.

We recently gave an engraving of the new railway carriage, constructed after the designs of M. H. Giffard, a French engineer, and so built to be free from the oscillating or similar motions common to railway vehicles. While this device excellently answered the objects of its inventor in the respect mentioned, the systems of springs adopted added very materially to the weight of the carriage, thus increasing the labor and expense involved in its traction. To meet this difficulty M. Giffard has devised a new vehicle, which is represented in the annexed illustration, extracted from *La Nature*. The body is entirely separate from the trunk. The springs are of the ordinary leaf pattern. The novel feature consists in the mode of suspending the body from the springs, which is done by connecting the lower ends of the curved iron rods, four of which are fastened on each side of the vehicle, by means of universal joints, to the lower extremities of arms suspended from the ends of the springs. The weight of the carriage is reduced to about one tenth in excess of that of the ordinary car, while all the advantages of immobility and easy riding, described fully in our previous article, are retained.

blocks may be placed on it when it is in position in the mold. These slide down the beveled faces of the post, into the corners of the mold, and close up the spaces through which



GIFFARD'S RAILWAY CARRIAGE.

NEW METHOD OF CASTING STEEL INGOTS.

The advantages of casting steel ingots in groups, from below, that is, filling a number of molds at the same time, from one runner, are so obvious and so great that many plans for casting in this way have been brought forward from time to time. The chief practical difficulty in casting in groups has been to find some entirely satisfactory mode of stoppering the ingots, when the molds have been filled to the required height.

Durfee patented, some years ago, making molds for group-casting closed at the top, with the exception of a small vent hole: a plan that gives a very sound, clean ingot, but necessitates a different mold for each different weight to be cast, and renders it difficult to get out an ingot that may stick in the mold. Ireland uses a plain heavy casting stopper, dropped on the metal after the mold is filled, such as is used in casting ingots of tool steel from crucibles; a stopper of this kind, however, can only be used in parallel molds, made in two parts, bolted or cottered together; and in these parallel molds, even when planed all over, inside and at the joint, the ingots are apt to stick, and the molds, after having been in use for a short time, open at the joints, causing fins on the ingots. Mr. A. L. Holley has patented several modes of stoppering molds, to be filled also from below, but they have not come into general use.

In the plan of stoppering herewith illustrated, the stopper used is a cast iron block, about 2 inches thick, grooved round the edge, as shown in the accompanying sections, and of such a size as just to drop freely into the top of the mold. A small vent hole, about $\frac{3}{16}$ inches in diameter, is drilled through it, and is slightly conical, that the metal may not stick in it. The stopper is fixed in the mold by two cast iron wedges, as shown more clearly in the enlarged plan and section, Figs. 10, 11. To set the stopper in the mold, the latter is dropped over a post of such a height that, when the stopper is placed in the mold, and on the top of the post, it is exactly at the height required. A small shovelful of loam, such as is used in lining steel ladles, is then thrown in, and rammed into the joints by a rammer, 2 inches or 3 inches broad, and about $\frac{1}{2}$ inch thick; the wedges are driven in, to fix the stopper in its place, and the mold is then ready for casting. The loam or mixed clay and sand used should be only slightly dampened, so that it will just cohere when pressed together in the hand. The post is adjusted to the required height by putting packing blocks or rings at its foot, to raise the mold, or by packing under its head, which for that purpose may be made loose and fixed by a set screw in the side. In order to prevent the squeezing down of a fin of loam between the post and the inside of the mold, if the loam is rammed in too hard, or if the rammer is thin, the head of the post should be a pretty close fit in the mold at the height at which the stopper is fixed. For this purpose, several heads should be provided, to fit different molds, or different heights in the same tapered mold; or the top of the post may be made beveled, as shown, Fig. 6, and four small adjustable

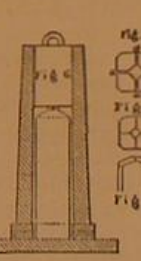
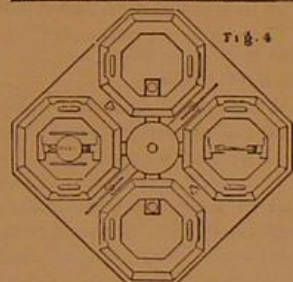
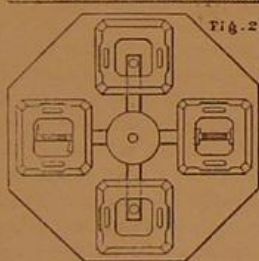
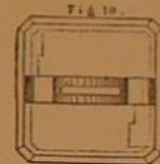
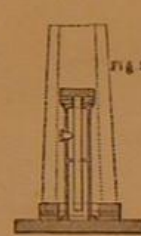
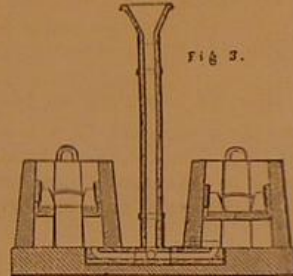
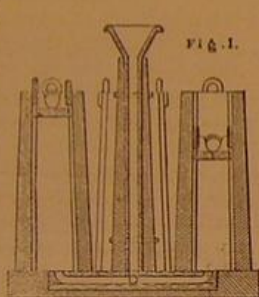
loam might squeeze down. The only openings still left are those at *a, a, a*, Fig. 7, between the blocks; and in arranging the molds for casting ingots, such as those for tires, in which a perfectly smooth top is required, these are closed by laying over them small loose pieces of sheet iron, before dropping the stopper in. Tire ingots may be cast either in the form of solid cheeses, the more usual plan, or with a core, in order to save punching. Stoppers for both these plans of casting are shown in Figs. 2, 3.

The molds when arranged on the base plate are filled through a central runner, with a branch leading into each mold. The central runner is made in two parts, bolted together, or clamped, as shown in the illustration, by rings driven over them; or by rings put on loosely, and tightened up by wedges, in the same way in which the halves of ordin-

chical skill: "Of course I suppose him to have odd pieces of sheet brass of different thicknesses, brass tubing, screws, wood, etc., as, if he has to resort to the shop for everything, he will find it make a very different figure to what mine cost."

I give average dimensions, which any one can vary to suit himself. To begin, procure a piece of oak, beech, or some other heavy wood, $6\frac{1}{2} \times 3\frac{1}{2} \times 1$ inch. At each corner of either end and in the center of opposite side, fix a small round knob to enable the stand to be firm in any position. Next draw a line across the center of the board at right angles to the longest side, and on this line at 1 inch from the center make two mortises, $\frac{1}{2}$ inch in diameter, with center bit (the measurement is to center of mortise), for the uprights, the dimensions of which should be $7\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{2}$ of an inch each, and at the end of each carefully make tenons to fit the mortises. Having rounded off the upper corners, put them in position (none of the parts should be finally fixed until the whole is completed). If properly done, you will now have a space of about $1\frac{1}{2}$ inches between the uprights. Now cut out from board of this thickness a piece of the shape and dimensions in Fig. 1, and in the place indicated in the engraving, and also at about

$\frac{1}{2}$ of an inch from top of the uprights, cut, with a center bit, a hole about $\frac{3}{4}$ of an inch in diameter; through these put a bolt the size of the hole, with a round head at one end and a nut at the other. This bolt should be about 3 inches long. By this you will be able to fix the body in any position. Next plane up very truly a piece of wood $1 \times 1\frac{1}{2} \times 6$ inches long, and through the middle of the widest face make (lengthways) with a $\frac{1}{2}$ inch plow a groove about $\frac{1}{4}$ or $\frac{1}{2}$ of an inch deep, and in another piece of wood, $\frac{3}{4} \times 1\frac{1}{2} \times 6$ inches, make a similar groove, but only $\frac{1}{8}$ of an inch deep; and if you do not intend making a rackwork adjustment, plane a strip of wood so as to move truly in the groove $\frac{1}{4}$ or $\frac{1}{2}$ of an inch in width and 6 inches long, which piece glue in the groove formed in the smaller piece of wood; and the pieces of brass on the sides, as afterwards mentioned, must be put on. If you intend making a rack adjustment, a rectangular rod of brass $\frac{1}{2} \times \frac{1}{2} \times 4$ inches long must be fixed at the end of the upper groove, which is intended to be nearest the object, and in the remainder of the groove should be inserted a strip of wood of the same size; this will save brass. A clock pinion—that which works the count wheel in old case clocks is the best, and can be procured of almost any dealer in old brass, etc.—must be fitted on an iron axle 3 inches long, in the middle of which is a square arbor to fit the hole in center of pinion. This had better be turned in a lathe, the ends just small enough for the pinion to pass over easily, and a small portion the thickness of the pinion (which must not be wider than the groove) left larger in the middle, to be afterwards filed down to fit the pinion tightly. Sometimes a steel pinion can be had with axle already fixed (having formed in this shape a portion of a clock), when none of this work is of course required. Now comes the most difficult part of the job, to file teeth in the rack to fit the pinion, which must be done very exactly, or it had better be left undone and a sliding adjustment used. My rod was of lead, in which the teeth are more easily cut, and although it has been in constant use for two years it is still in good working order; but of course brass is preferable and would repay the extra trouble. In the larger piece of wood, at a distance of $3\frac{1}{2}$ or 4 inches from the end toward the stage, the groove must be deepened for a short distance to allow room for the pinion, and in the best position, to be ascertained by careful measurement, a round hole (the size of pinion, on the opposite side, and concentric with the other hole) the size of the axle; or it may be made larger, and a metal bearing put in on both sides instead of one. You will now have your pinion in the center of the groove, and an inch of axle projecting on either side, on which to fix the knobs or milled heads with which to turn it; but before putting these on, two pieces of brass (Fig. 2) must be cut out, and about $\frac{1}{16}$ of an inch of the upper edge turned at right angles, and a slit made in the sliding top in which this will work, for which purpose the bent edge should be about $\frac{1}{8}$ of an inch above the upper face of the board on which it is fixed, and care must be taken that it is perfectly parallel. The engraving will show the method of fixing. Now put on a pair of milled heads, or any knobs which



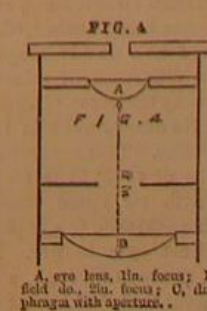
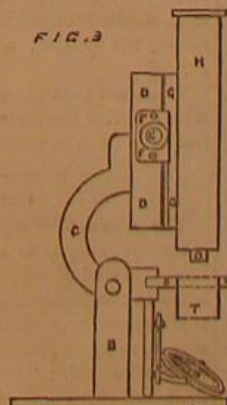
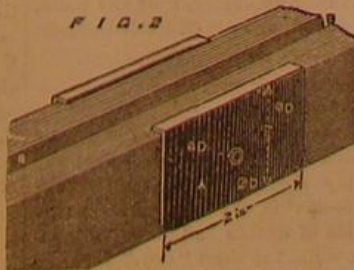
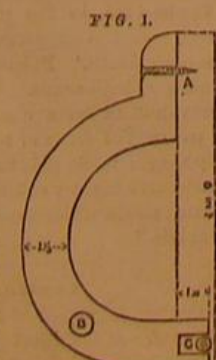
HACKNEY'S METHOD OF CASTING STEEL INGOTS.

any molds for casting steel tool ingots are put together. The funnel-shaped top of the runner is in a separate piece, put in after the lining is completed. The runners are dried by setting them over holes in a thick cast iron plate, heated below by a fire, or by a gas flame; and in order that the lining may dry readily, they should be perforated all over with $\frac{1}{4}$ inch holes, placed pretty closely together. Where there is plenty of crane power, to handle the runners, they are most conveniently made of cast iron, but where they have to be carried by hand, they may be of light wrought iron. Both these forms of runners are shown in Figs. 1 and 2.

A HOME-MADE COMPOUND MICROSCOPE.

A correspondent of the *English Mechanic* sends the following description of a microscope stand, which may be manufactured at a trifling expense by any one having a little me-

times a steel pinion can be had with axle already fixed (having formed in this shape a portion of a clock), when none of this work is of course required. Now comes the most difficult part of the job, to file teeth in the rack to fit the pinion, which must be done very exactly, or it had better be left undone and a sliding adjustment used. My rod was of lead, in which the teeth are more easily cut, and although it has been in constant use for two years it is still in good working order; but of course brass is preferable and would repay the extra trouble. In the larger piece of wood, at a distance of $3\frac{1}{2}$ or 4 inches from the end toward the stage, the groove must be deepened for a short distance to allow room for the pinion, and in the best position, to be ascertained by careful measurement, a round hole (the size of pinion, on the opposite side, and concentric with the other hole) the size of the axle; or it may be made larger, and a metal bearing put in on both sides instead of one. You will now have your pinion in the center of the groove, and an inch of axle projecting on either side, on which to fix the knobs or milled heads with which to turn it; but before putting these on, two pieces of brass (Fig. 2) must be cut out, and about $\frac{1}{16}$ of an inch of the upper edge turned at right angles, and a slit made in the sliding top in which this will work, for which purpose the bent edge should be about $\frac{1}{8}$ of an inch above the upper face of the board on which it is fixed, and care must be taken that it is perfectly parallel. The engraving will show the method of fixing. Now put on a pair of milled heads, or any knobs which



A HOME-MADE MICROSCOPE.

will enable the pinion to be worked evenly, slide the top in its position, and if everything has been done correctly you will have a rack adjustment which will work as truly as in many of the cheap brass microscopes, in fact better than some. Be careful, in screwing on the brass plates, that the screws do not project into and spoil the groove. The best plan for getting the sliding piece to work smoothly on the other is to work them backwards and forwards on each other, and on no account must the faces in contact be either stained or polished, except naturally, although the exposed portions will be much improved in appearance if stained and polished. As regards wood, any that will not split easily and will take a good smooth surface will do. Now fasten the piece of wood with the pinion on the opposite side to the groove, to the flat face of the curved piece of wood (Fig. 1, A), leaving one inch projecting toward the stage (which is to be fixed at B), and the end to which the pinion is nearest is to be placed uppermost. The tube, which may be of brass, zinc, or even brown paper, according to what is most convenient or procurable, is the next thing to be made, and it should be rather greater in diameter than the amplifying lens if the eyepiece is not constructed, and, if so, of a size that the eyepiece can slide closely into. It may be fastened to the sliding piece by means of strips of brass going round it and screwed into the wood, or, what is far better, by two screws through the middle of the sliding piece (in the groove), one side of the tube, and fastening into two small bits of wood inside; or the heads may be inside the tube, and small nuts used to tighten it. The tube, which should be 8 or 10 inches in length, should reach, when the two sliding pieces coincide, to within $\frac{1}{2}$ inch of the opposite side of the curved piece of wood. The stage, which should be a piece of wood $2\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{2}$ of an inch thick, should be let in by one of the shortest sides into the slit, C (Fig. 1), and screwed firmly in that position. Exactly opposite the center of the tube make a dot; and with this as a center and a $1\frac{1}{2}$ inch center bit, cut a hole, into which fit a brass tube 1 inch in length, to fit the apparatus into. Two springs of sheet brass, cupped so as to allow a slide to be slipped in and pressed just sufficiently to hold it in any position, should be fixed at the sides of the stage; or a sliding ledge, on which the slide may rest, may be used instead. Under the stage, in the position indicated in Fig. 3, which represents the completed instrument, a strip of wood, $\frac{1}{2}$ of an inch square and of such a length that when the microscope is placed upright it may touch the base, must be mortised in, on which to fix the mirror, the manner of doing which is shown in Fig. 3, the crank and U-shaped piece being strips of brass screwed so as to be capable of being turned in any direction. The mirror may be either a plain one with two pivots, or, what is better, one of the six-penny reading glasses, which should be unscrewed out of its handle, the slit soldered to act as one pivot and a piece of wire soldered on the opposite side for the other. Now get two pieces of thin looking glass, and get a glazier to cut them to fit the brass rim of the lens, cement them back to back, and fix them in the rim of the lens, when you will have one side plain and the other equivalent to a concave mirror. You have now only to construct your eyepiece and objective to have the microscope complete. For the eyepiece, procure a plano-convex lens 2 inches focal distance, and another 1 inch; fix them in a brass tube $1\frac{1}{2}$ inches apart—convex sides of both toward objective—and in the focus of the eye lens fix a diaphragm, with a circular aperture about $\frac{1}{4}$ of an inch in diameter; and a brass plate with a small hole should be placed between the eye and the eye lens (Fig. 4). The objective, which may consist of a double or plano-convex lens, should have an aperture of about $\frac{1}{4}$ of an inch for a 1 inch power, and smaller for higher powers; it must then be fixed at the other end of the tube, and be sure that it is exactly centered, and its axis coincident with that of the tube. If you have carefully followed these directions you will have a really useful microscope, which will afford you hours of instruction and enjoyment."

Lowe's New Process for Gas.

Mr. G. L. Dwight, of Mont Clair, N. J., sends the following description of this process, which is now in practical use in Utica, N. Y.:

In general terms, the product is the result of a decomposition, by heat, of water and crude petroleum, but it is as different, in its character and quality, as the method by which it is produced differs from all others.

The system of retorts or equivalent vessels, heated externally, has been in all other methods in some degree adhered to. In this, however, it has been entirely abandoned, and the materials for decomposition are introduced directly into the fire itself, by which means there is secured the greatest possible economy of heat; while certain constituents, ordinarily wasted, are utilized as fuel, some being burned, which in other processes are carried forward with no advantage to the product. However trivial this difference of principle may appear, it is proven to be radical by the accomplishment of important differences in result. No other residuum than pure ashes is drawn from the generator. This generator is substantially a small cupola furnace of about $3\frac{1}{2}$ feet internal diameter, built of firebrick, with air space between double walls, which is charged with anthracite to a depth of $3\frac{1}{2}$ feet and driven to the proper heat by a blower. The draft is carried into the base of, and upwards through, a second cylindrical chamber, much like the first, but higher and filled with firebrick laid up with interstices, through which the gases of combustion are carried and ignited, evolving a high temperature. When suitable heat is attained (a dull cherry red in the generator, and a white in the superheater, as the second chamber is termed) the base is closed against

atmospheric air, the valve passage to smoke stack shut, and dry steam is admitted directly into the incandescent coal, a little above the grate bars, while crude petroleum is dropped from above upon the same. The gases therefore are generated in the same vessel at the same moment, and pass together into the secondary chamber.

It will be remarked that the mass of coal is gradually being cooled by the passage through it of the steam; but as the gases escape from the furnace very hot, they do not greatly diminish the heat of the second chamber, which, by its uniformity and high of temperature, equalizes and thoroughly fixes the product. Thence it passes, through the washing and condensing apparatus, onward through the lime boxes to the holder.

In practice at Utica, which is the largest place yet lighted by this system, two generators are employed (though four were set up), being used alternately. No. 1 is heated while No. 2 is making gas, and so on, so that continuity of production is ensured. One generator is used for 30 minutes, and then another, this length of time being, on the whole, the most economical, as the fire is not, during that period, so far checked as to involve delay in re-firing. The mass is then stirred slightly with an iron rod, a small quantity of coal added, and the blast re-applied. Each run gives an average of 3,000 cubic feet. The management of the apparatus is stated to be exceedingly simple, requiring no skilled labor beyond a little experience in judging of heat and in the gaging of the oil flow. In the Utica works, two men by day and night, at laborers' wages, make all the gas required by that city, the coal system having been for some months entirely superseded. Continuous daily operation there has clearly demonstrated that 60 lbs. anthracite, costing \$6 per ton, and 3 gallons petroleum costing 6 cents per gallon, yield 1,000 cubic feet of gas, which, with the labor and time added, makes a cost, in the holder, not exceeding 50 cents per 1,000 cubic feet, for gas of a quality not less than 20 candles. No difficulty is found in maintaining a uniform standard, and no indication of stratification or of deposition in the pipes is met with. The flame is remarkably white and intense, and its combustion perfect. Extreme experimental tests, or (better still) the practical experience of the past winter, at Phoenixville, Pa., where the thermometer sank to 17° below zero, have shown conclusively that this product is less sensitive than coal gas. Mr. Dwight considers himself justified, by the facts, in claiming for the Lowe process the following advantages over all others:

1. Great simplicity of apparatus, and consequent low first cost.
2. Solidity of mechanical construction, whereby the minimum of wear and tear is secured.
3. Ease of management, which largely reduces the labor.
4. The comparative cheapness of materials employed, and their thorough utilization.
5. The high quality of the product, and, for the above stated reasons, its very low cost.

Vertical Motion of Vessels.

Mr. Thornycroft, the well known builder of fast steam launches, proves that at high rates of speed the body of a vessel actually rises above its ordinary load water line, and, as the speed increases, continues to rise still higher. The experiments from which these results were deduced were conducted with the steel torpedo launch lately built for the Austrian government, with which a speed of 19.4 knots was attained. The differences of level were determined by means of three plumb bobs hanging from a bowsprit at various distances in front of the bow, from observations with which the altered water surface was measured, and some exceedingly instructive diagrams made therefrom. From these it appeared that, up to a speed of about twelve knots, the vessel sank more deeply in the water; but on being driven to a higher speed, she seemed to make an almost sudden leap up, and continued gradually to rise above the normal water line as the speed increased.

A Buried Forest.

A man living in Essex county, Virginia, in digging a well recently, at a depth of about thirty feet came upon the trunks of large trees several feet in diameter, which were found upon examination to be cypress. Fearing the water would be injured by the wood, he determined to abandon his well, and dug another some distance off. When he had reached about the same depth he again encountered the trees; and a third attempt, at a still greater distance from the first well, again brought him in contact with this subterranean forest, the trees of which are of great size and well preserved.

There are portions of land in New Jersey, near the coast, where buried trees are also found, and considerable business has been done in unearthing them.

Cable Telegraphing.

The ocean telegraph operator taps the key as in a land telegraph, only it is a double key. It has two levers and knobs instead of one. The alphabet used is substantially the same as the Morse alphabet—that is, the different letters are represented by a combination of dashes and dots. For instance, suppose you want to write the word "boy." It would read like this: "— . . . — . . . — . . .". B is one dash and three dots; O, three dashes; and Y, one dash, one dot, and three dashes. Now, in the land telegraph, the dashes and the dots would appear on the strip of paper at the other end of the line, which is unwound from a cylinder, and perforated by a pin at the end of the bar or armature. If the operator could read by sound, we would dispense with

the strip of paper, and read the message by the click of the armature as it is pulled down and let go by the electric magnet.

The cable operator, however, has neither of these advantages. There is no paper to perforate, no click of the armature, and no armature to click. The message is read by means of a moving flash of light upon a polished scale produced by the deflection of a very small mirror, which is placed within a mirror galvanometer, which is a small brass cylinder two or three inches in diameter, shaped like a spool or bobbin, composed of several hundred turns of small wire, wound with silk to keep the metal from coming in contact. It is wound or coiled exactly like a bundle of new rope, a small hole being left in the middle about the size of a common wooden pencil. In the center of this is suspended a very thin, delicate mirror about as large as a kernel of corn, with a correspondingly small magnet rigidly attached to the back of it. The whole weighs but a little more than a grain, and is suspended by a single fiber of silk, much smaller than a human hair, and almost invisible. A narrow horizontal scale is placed within a darkened box two or three feet in front of the mirror, a narrow slit being cut in the center of the scale to allow a ray of light to shine upon the mirror from a lamp placed behind said scale, the little mirror in turn reflecting the light back upon the scale. This spot of light upon the scale is the index by which all messages are read. The angle through which the ray moves is double that traversed by the mirror itself; and it is, therefore, really equivalent to an index four or six feet in length, without weight.

To the casual observer there is nothing but a thin ray of light, darting to the right and left with irregular rapidity; but to the trained eye of the operator every flash is replete with intelligence. Thus the word boy, already alluded to, would be read in this way: One flash to the right and three to the left is B. Three to the right is O. One to the right, one to the left, and two more to the right is Y, and so on. Long and constant practice makes the operators wonderfully expert in their profession, and enables them to read from the mirror as readily and as accurately as from a newspaper.—*Boston Herald.*

A Suicidal Epidemic.

A recent number of *Chambers' Journal* gives an entertaining article on suicides, from which we copy:

"Sometimes," says the writer, "a person determined to destroy himself will wait months and years for an opportunity of executing the deed in the particular manner he has marked out for himself, and the very inclination to suicide may be removed by withdrawing the particular objects that would awaken the idea. Thus a man who has tried to drown himself will be under no temptation to cut his throat. Example, it is well known, is a powerful cause of excitement to the suicidal act. We were once told by a physician that a hypochondriac patient used to visit him invariably the day after reading the report of a suicide in the daily papers, possessed by a morbid fear of imitating the act of which he read. Sir Charles Bell, surgeon of Middlesex Hospital, was one day describing, to a barber who was shaving him, a patient's unsuccessful attempt to cut his own throat, and, on the barber's request, pointed out the anatomy of the neck, showing how easily the act might be accomplished. Before shaving operations were completed, the barber had left the shop and cut his own throat according to Sir Charles Bell's exact instructions. Sometimes there is an epidemic of suicides, as at Versailles, in 1793, when out of a small population 1,300 persons destroyed themselves in one year; or as in the Hotel des Invalides in Paris, when six of the inmates hanged themselves on a certain crossbar within a month. Very often the disease is hereditary, and at a certain age the members of one family will all in turn evince the suicidal tendency, while even children of very tender years have been known to end their short lives by their own act, from force of example. Curious, too, are the methods of self-destruction, but they are too painful to bear description. A Frenchman once attempted to ring his own death knell, by tying himself to the clapper of the church bell, which thereupon began to swing, and alarmed the villagers by its unwonted tones. All cases of determined suicides are characteristic of confirmed insanity; whereas, in a case of impulsive insanity, the perpetrator will often regret the act before it is completed and endeavor to save his life, as did Sir Samuel Romilly, thus demonstrating that the very attempt may effect the cure of the disordered brain. The months of March, June, and July are the favorites with men, September, November, and January for women, in which they voluntarily end their lives. In youth men hang themselves, in the prime of life use firearms, and, when old, revert to hanging. Women usually prefer Opheelia's 'muddy death.' Poisoning is a method adopted by the very young of both sexes. We have the consoling reflection that, prevalent as brain disorder is in our country, at least eighty per cent of cases of insanity are curable if treated at an early stage; while it is to be noted that it is not pleasurable, productive brain work that does the mischief, but rather the mental strain which results from the high pressure of our artificial life."

Centennial Notes.

The Centennial Board of Finance have secured more than forty-six acres of fine level grain land at Schenck Station, on the Philadelphia and Trenton Railroad, three miles this side of Bristol, for the purpose of making it an international trial ground for reaping machines, steam plows, harrows, rollers, etc., at the Centennial Exposition. The necessary plowing has already been done under the superintendence of the Centennial Bureau of Agriculture.

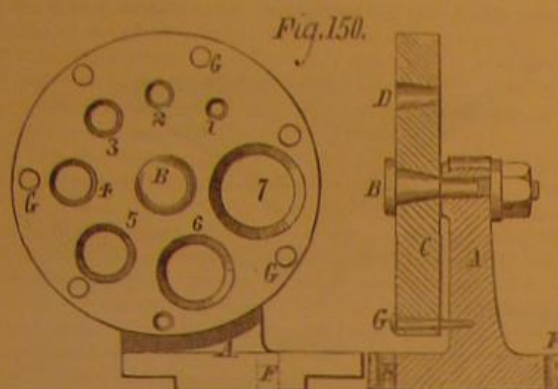
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXXIV.

CONE PLATE FOR BORING IN THE LATHE.

For chucking shafts and other similar work in the lathe (to bore holes in the ends of the shafts, etc.), the cone plate shown in Fig. 150 is the best appliance known to ma-

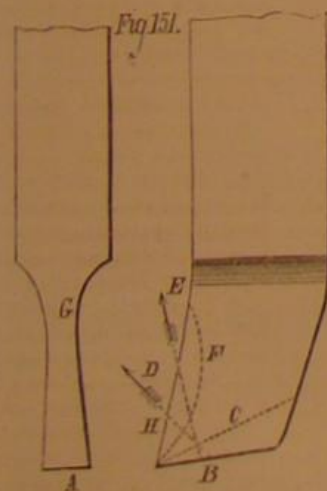


chinitists. A is a standard, fitting in the shears of the lathe, at E, and holding the circular plate, C, by means of the bolt, B, which should be made to just clamp the plate, C, tightly when the nut is screwed tight. The plate contains a series of conical holes, 1, 2, 3, etc. (shown in section at D). The object of coning the pin, B, where it carries the plate, C, is that the latter shall be made to a good working fit and have no play. The operation is to place the shaft in the lathe, one end being provided with a driver, dog, or carrier, and placed on the running or line center of the lathe; and the other end, to be operated upon, being placed in such one of the conical holes of the plate, C, as is of suitable size, the distance of the standard, A, from the lathe center is to be adjusted so that the work will revolve in the coned hole with about as much friction as it would have were it placed between both the lathe centers. Thus the conical hole will take the place of the dead center of the lathe, leaving the end of the shaft free to be operated on. F F are holes to bolt the standard, A, to the lathe shears or bed; and G G, etc., are taper holes to receive the pin, G, shown in the sectional view. The object of these holes and pin is to adjust the conical holes so that they will stand dead true with the lathe centers; for if they stood otherwise, the holes would not be bored straight in the work. In Fig. 155, hole No. 7 is shown in position to operate, the pin, G, locking the plate, C, in that position. In setting the work, the nut on the pin, B, should be eased back just sufficiently to allow the plate, C, to revolve by hand; the work should then be put into position, and the pin, G, put into place; the standard, A, should then be adjusted to its distance from the live lathe center, and bolted to the lathe bed; and finally, the nut on the pin, B, should be screwed up tight, when the work will be held true, and the cone plate prevented from springing. Care must be taken to supply the conical holes, in which the work revolves, with a liberal quantity of oil, otherwise they will be apt to abrade.

SLOTTING MACHINE TOOLS.

Tools for use in slotting machines are divided into two classes, those used by themselves, for holes in which there is not sufficient room to admit a tool post or bar; and short tools, held in a tool post on the bar, and fastened by a set screw or screws thereon provided.

Referring to the first class, which should never be employed if it can be avoided, Fig. 151 is a tool for cutting out a key seat. The edge, A, is the cutting part, the thickness



at G being reduced to make it clear the sides of the key seat. The face, B, receives the force necessary to bend the shaving, which, acting at a right angle to that face, tends (as will be observed) to force the tool deeper into the cut, at the angle shown by the dotted line and arrow, E. Now suppose B to be ground to the angle shown by the dotted line, C; the direction of the force required to bend the shaving would be in the direction of the dotted line and arrow, D; and a comparison of D and F shows that an equal degree of spring would have more effect in deepening the cut of the tool in the case of D than in that of E; and it is this consideration which determines the proper angle of the face, B. It being obvious that the more angle it has, the keener the cutting edge of the tool will be, and the greater the liability to force into the cut; and since the deeper the cut, the greater is the force required to bend the shavings, the tool continues to spring, digging into the work and either bending or breaking itself, or stopping the machine. Hence the face, B, should be made for slight tools, or for tools held far out from the tool post, at about the angle shown above.

The face, H, should, in all cases, be made as shown above, and not hollowed at all in the direction shown by the dotted

line, F, which would not only weaken the tool, but would cause the cutting edge to be badly supported by the metal behind it, and hence to break; and these considerations, as to the shape and angle of the faces, B and H, apply to all descriptions of slotting machine cutting tools, and are of more importance in the class of tools above shown than in tools used in any other kind of machine, because of the great distance they have, at times, to stand out from the holding screws or clamps.

A roughing out tool, held in the tool post without the aid of a bar, should be made as shown in Fig. 151 a, concerning

Fig. 151 a.



line, F, which would not only weaken the tool, but would cause the cutting edge to be badly supported by the metal behind it, and hence to break; and these considerations, as to the shape and angle of the faces, B and H, apply to all descriptions of slotting machine cutting tools, and are of more importance in the class of tools above shown than in tools used in any other kind of machine, because of the great distance they have, at times, to stand out from the holding screws or clamps.

For cutting out a half-round groove, the tool shown in Fig. 152 should be employed. The outline, A, is made as denoted by the dotted line, B, in cases where, from the narrowness of the

Fig. 152.

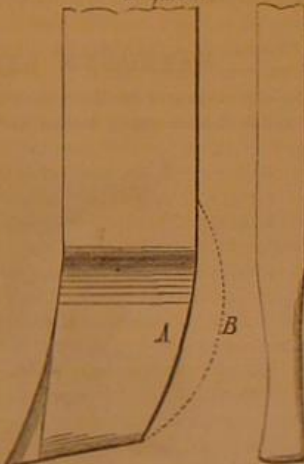
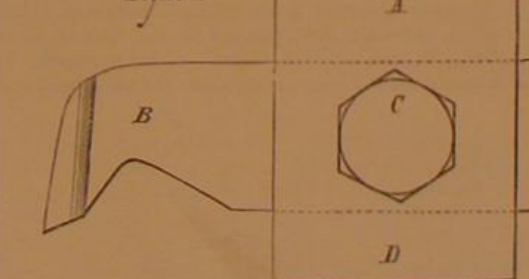
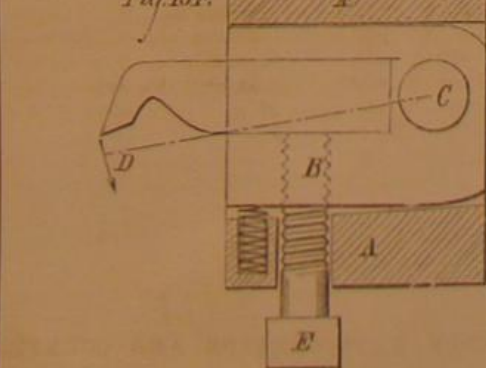


Fig. 153.



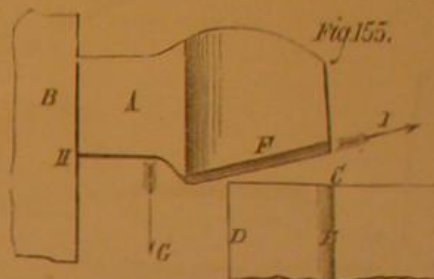
played, their shortness rendering their grinding and forging much easier of accomplishment. Many of these holding bars have small pivoted boxes, similar to that shown in Fig. 154, provided to receive the tool. A is a sectional view of

Fig. 154.



the bar, B is the box, pivoted at C, D is the tool, and E the set screw for holding the same. It will be observed that the set screw, E, screws into the pivoted box, and not into the end of the bar, and that the hole, provided in the end of the bar to admit the set screw, is large enough to permit the set screw to have plenty of play or movement. The object of this and similarly designed devices is to allow the tool to move, in the direction of D, off the pivot, C, and thus to prevent the tool edge from rubbing against the sides of its cut

during the up stroke of the bar, the spiral spring shown being made sufficiently strong to support the box, B, in the position shown, but not sufficiently strong to resist much force exerted upon the tool and in the direction of D. For small or even medium sized work, these devices are very efficient; but for large, heavy, outside work, the bars themselves are too slight, and it is usual to employ a similar device (on a large scale) provided in the tool end of the slide itself. Under these conditions, the slotting machine will perform as heavy duty as either the lathe or planing machine. The writer has in his possession a cutting taken off the outside of a crank at the Morgan Iron Works, which cutting measures 2½ inches and is a full ¼ of an inch in thickness, the tool employed being a knife tool, ground as shown in Fig. 155. B



represents the tool end of the slide of the slotting machine, A the knife tool, C the work, and from D to E the depth of the cut.

The face of the tool is ground off at an angle, in the direction of I, so that the point of the tool shall not break off when it strikes the work, and so that the strain upon the tool and working parts of the machine shall not come upon them too suddenly, and cause them to break, as would be the case were the cutting edge of the tool to strike the cut along its whole length simultaneously. As shown in the engraving, the tool would strike the work at F on the edge only, which would for an instant of time exert only enough resistance to bring all the working parts of the machine to a bearing; and as the tool descended, the strain would gradually increase until the point of the tool reached the work. When the tool is near the end of the stroke, and therefore leaves the cut, it will do so at F first, thus leaving the cut gradually, and greatly modifying the jump due to the recoil of the working parts of the machine when relieved of the heavy strain necessary to drive such a deep and thick cut. The enormous strain placed upon the tool would inevitably break it were it left very hard; it is therefore tempered to a purple.

No other tool can well be used for taking such heavy cuts, because grinding off the face, F, of any other tool would not leave the tool edge sufficiently keen to sever the metal without an excessive amount of driving power, and further because the breadth of the face, F, which sustains the force necessary to bend the cutting, is narrower in the knife tool than in any other, and therefore bends the cutting less, experiencing a corresponding decrease of strain. Cuts of such great depth and thickness cannot be well taken in slotting machines whose slides are operated by a connecting rod or link, because the excessive strain would be apt to force the connecting rod along the slot provided to alter the stroke of the machine; the sliding head is therefore provided with a strong rack on each side, operated by pinions, with suitable reversing gearing attached for varying the stroke.

When operating the feed of a slotting machine by hand, the work should be fed to the cut while the tool is reversing its motion at the top of the stroke, and not while the tool is cutting or at the bottom of the stroke, because, in either of the latter cases, the tool edge would grind against the sides of the cut during the up stroke, which would soon impair the cutting qualifications of the tool.

Tool-holding bars of sizes below about 1½ inches in thickness should be made of steel so as to be strong enough to resist the tendency to spring. For sizes above that, they may be made of wrought iron.

Buffalo Bones.

It is stated that many of the settlers in Kansas, in the valley of the Arkansas, have done a profitable business by gathering up buffalo bones. The prairies for forty miles each way from the railroad have been gleaned over till not a relic of the chase can be found. Heads and ribs are worth \$5 a ton; these are shipped to Philadelphia and ground up into fertilizers. Shins and shoulder blades are worth \$10 a ton, these go to the sugar refineries. The horns are worth \$30; the tips are sawn off here and sent to the factories of umbrellas, fans, pipes, etc.; the remainder is used by the chemists. Bits of hide found hanging to the heads are taken off and sent to the glue factories. Every fragment of these animals is made to serve a purpose.

Electrical Exhibition in Paris.

In the Champs Elysées, in July, 1876, will be held an exhibition of the applications of electricity to industrial and domestic purposes. Information will be given on application at the offices of the exhibition, 86 rue de la Victoire, Paris. A special exhibition of the improvements in railway appliances has been proposed to be opened in Paris next year.

A Snake within a Snake.

While some workmen were laboring in a meadow near Saugus, Mass., recently, they discovered a black snake about five feet long. A closer examination revealed the fact that the tail of another snake was protruding from its mouth, and this was found to be a water adder, which measured nearly four feet.

IMPROVED GRINDING MILLS.

Geared mills with vertical spindles, says the inventor of the improved mills illustrated in the annexed engravings, are going out of use. Their toothed wheels or cogged gears are too rough in running and too expensive, while spindles in a vertical position do not run well, because they cannot be kept thoroughly oiled, and do not lie steadily against their bearings. Almost all the shafting used for driving machinery is now horizontal, with vertical pulleys, and therefore the driving pulleys of grinding mills should obviously also be

The engravings show three different types of mill, the principal points of difference being the construction and mode of adjusting the spring bearings by means of which the pressure of the stones is automatically controlled. The mills are adapted to all varieties of grinding and for every substance, whether wet or dry, hard or tough, heavy or light, brittle, or fibrous.

The strength and durability, necessary to enable these mills to be run safely at a very high velocity, is secured by the employment of the best materials, metal and stone only

From the annexed engraving it will be seen that the ice receptacle, A, is arranged in one end of the space within the counter, from the main portion of which it is separated by an open work partition which admits of the free circulation of air therefrom around the cooling vessels, B. These are supported by top flanges on side strips, so that there is an open space at their sides and beneath them, for the circulation above noted. The coolers are constructed of any suitable material, and in form suitable to the milk or solid articles which they are to contain. They may be used for milk

Fig. 1

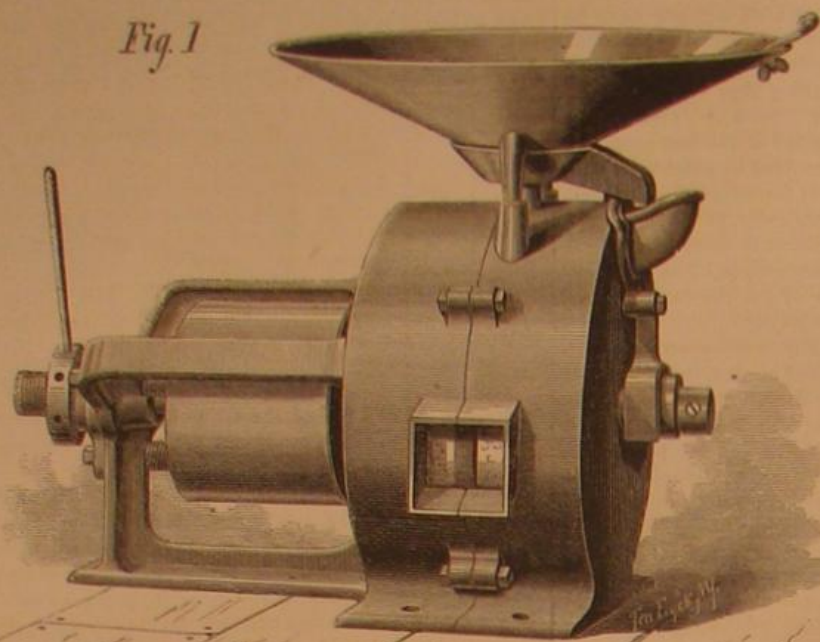
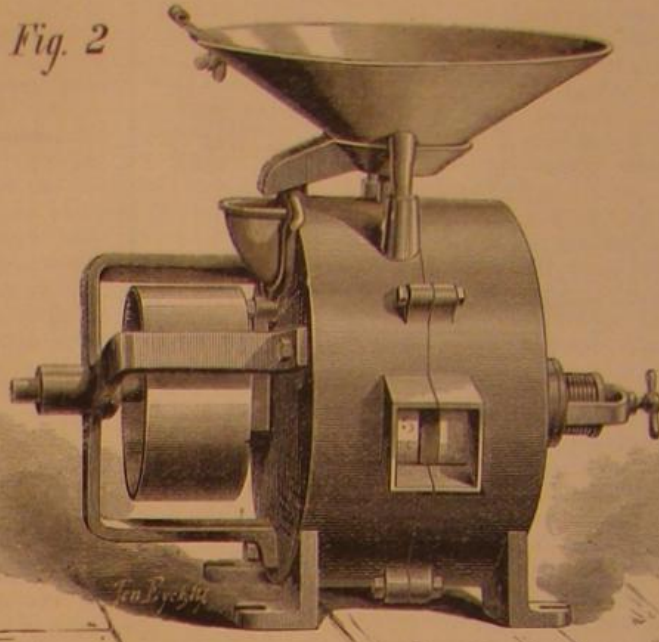


Fig. 2



HARRISON'S GRINDING MILLS.

vertical, in order to be as convenient as possible to set up and put in operation.

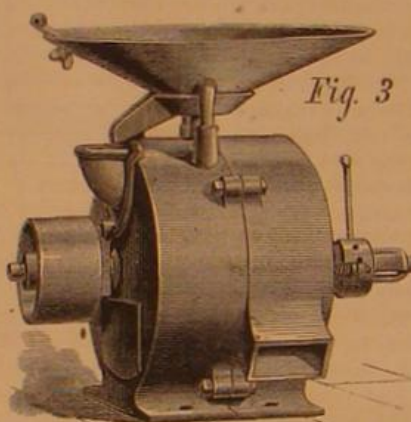
In constructing the mills represented, the horizontal shaft was the inventor's main object; but subsequent experiment showed him other and superior advantages attaching to the form. The machines became more quiet and light running, but ground more rapidly, while their simplicity evidenced that the extensive repairs required in the use of gearing would be avoided. As now made, the mills are compact and convenient to be driven from portable steam engines or horizontal shafting. The boxes for supporting the spindles are four times longer than are usually made, extending almost through the entire mill; and they carry the runner, which is solidly attached to the spindle, in a true plane with the face of the bedstone.

Millstones and the framework on which they are usually mounted are liable to be broken by hard substances passing through the mills, which in many cases have proved destructive to life and limb. To avoid such accident, the inventor constructs his mills so that they may be readily adjusted to any desired strain; and should nails, slugs, or bolts go through the stones, the latter immediately return to their places with such accuracy that no stoppage of the machine is required, but the working position is kept, and all delay avoided.

It is claimed that anything, however hard or ungrindable, which will pass through the eye of the stone will pass out without injury to the stones or mill. In order to accommodate different articles, which require more or less strain in grinding, and each needs a pressure peculiar to itself, the mills are provided with safety springs, which can be readily adjusted or changed to suit. These are also applicable to change of pressure, needed according to the quantity to be ground, as of course it takes more working pressure to grind 50 bushels than 10 bushels of meal per hour. A common working speed for the 20 inch mill is 1,400 turns per minute, and 1,000 turns for the 30 inch mill. The small portable burrstone mills grind 50 bushels of good meal per hour, as regular work, from day to day, and have averaged as high as 80 bushels. This, the inventor claims, is due to the peculiar mode of mounting and dressing the stones, their facility for receiving grain at the eye, and the ease with which the meal passes out of the new discharge spouts. It is due also to the vertical position of the stones, the extraordinary velocity at which they run, and to such an adaptation of speed to grinding surface that, when the meal is once properly ground, it is thrown out and does not clog the furrows and consume the driving power.

The inventor has submitted to us written certificates as to the above mentioned capabilities of his mill. He further states that over 9,000 machines were sold up to the beginning of the present year

being employed in their construction. They are delivered to purchasers ready for use and complete running order.



For further information address the inventor and manufacturer, Mr. E. Harrison, New Haven, Conn.

IMPROVED REFRIGERATOR AND COUNTER.

We illustrate herewith a useful combination of counter and ice box, especially well adapted to the uses of dealers in butter, milk, poultry, and similar perishable staples. The idea is to convert the counter, or rather the unutilized space

lard, butter, poultry, etc., or for either kind of produce alone. The lids of the coolers are hinged together in pairs, and are movable, so that they can be cleaned conveniently. The lid of the ice box is hinged to the center. The cold air from the ice receptacle keeps the coolers at a uniformly low temperature, as no air is admitted to the inside of the refrigerator by the opening of the lids of the vessels. This separate access to each cooler thus necessarily tends to economize the consumption of ice. The cooling effect of the latter is further increased by the passage of the cold drip water over the inclined bottom of the refrigerator to a depressed box in the further extremity of the same, where the water accumulates until it escapes from an adjustable faucet, shown at C.

The slab used to cover the box in winter is represented at D. When the refrigerator is in use, the lid of the ice receptacle, which need be opened for replenishing the contents but once daily, serves as a counter, and a hinged leaf, E, upheld by a brace, augments the space, and answers as a support for the scales.

The present arrangement, among the dealers in Washington and other large markets in New York city, is to pack their goods directly upon the ice when the refrigerator is used as a counter. As this is detrimental to the quality of meats and cannot be beneficial to butter in firkins, especially as that material is so easily affected by impure surroundings, the improved counter and refrigerator above described will doubtless be found an advantageous substitute.

Patented through the Scientific American Patent Agency, by Mr. H. H. Barnes, September 7, 1875. For further information relative to sale of rights and of patent, address the patentee, 1,004 Pacific street, Brooklyn, N. Y.

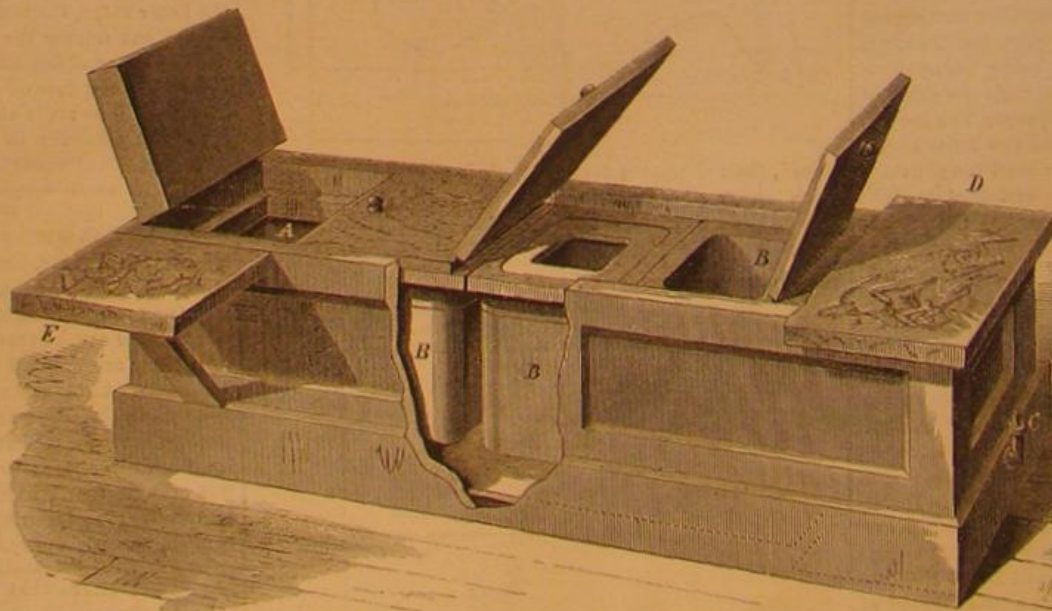
A Microscopical Soiree.

At the recent microscopical soiree of the British Association, 110 microscopes were arranged in classified divisions, devoted to crustacea, arachnids, insects, marine and fresh water fauna, ciliary action, vertebrate circulation, fertilization of flowers, cryptogamia, microspectroscopes, etc. The idea of practically illustrating Sir John Lubbock's "Fertilization of Flowers by Insects" was novel, and so far carried out as to give a vivid idea of the processes to those who were previously unfamiliar with them. The geological division included an exhibition of the perennating oozoon *Canadense*, which must be exhibited again and again to live down the hostility to its animal nature.

BARNES' REFRIGERATOR AND COUNTER.

beneath the same, into a refrigerator. In winter, when ice is not required as a preservative, the refrigerator lids are closed, and a slab of marble or wood placed above. By this arrangement not only does the seller have his refrigerator conveniently at hand, but he is not obliged to find space for the storing of the same when its use is not required. Furthermore he is provided with an ice box of superior construction, which, by an economical employment of ice, refrigerates a large quantity of goods.

The Cincinnati Exposition closed on October 9. In spite of the prevailing business depression, the fair was in every way successful, having been visited by over 350,000 people. There will be no exhibition next year. It is intended to devote \$400,000 to the construction of a magnificent brick building, in which will be held the Exposition of 1877.



ORIENTAL HORTICULTURE.

Our illustration introduces to us a curious phase of East Indian garden scenery. In the foreground is a noble tailpot palm (*Corypha umbraculifera*), the leaves of which are used by the Buddhist monks, prepared in small narrow strips, as books in which to record their sacred writings. The leaves of this palm are used also as umbrellas and sunshades, and everywhere the custom is universal to use them for covering huts and making temporary tents. It is one of the noblest of the palm family, growing to the height of one hundred feet frequently. It only flowers once, and then dies.

A correspondent of the *London Gardener*, in writing of it, says: "I saw a noble grove about three years ago all flowering at one time; they had a truly grand appearance, and would produce some thousands of seeds."

At the left hand, is the sacred bo tree (*Ficus religiosa*). Every temple has one of these in its vicinity, usually a cutting from the ancient tree at Andro Japoor, which was originally planted there by Buddha and his followers, and is said to be one of the oldest trees in the world. The temples are also always located near abundant water, and the vegetation is rich beyond description. With regard to the interest of the Buddhist religion in horticulture, Tennant's "History of Ceylon" says:

"One peculiarity in the Buddhist ceremonial served at all times to give a singular impulse to the progress of horticulture. Flowers and garlands are introduced in its religious rites to the utmost excess. The atmosphere of the wehara and temple is rendered oppressive with the perfume of champac and jessamine; and the shrine of the deity, the pedestals of his image, and the steps leading to the temple are strewn thickly with blossoms of the najaba and the lotus. At an earlier period the profusion in which these beautiful emblems were employed in sacred decoration appears almost incredible; the Mahawason relates that the *ruanucelli dagoba*, which was two hundred and seventy feet in height, was on one occasion festooned with garlands from pedestal to pinnacle, till it resembled one uniform bouquet; and at another time, it and the lofty dagoba at Mehintala were buried under heaps of jessamine, from the ground to the summit.

"The various kings in succession formed innumerable gardens for the floral requirements of the temple. The capital was surrounded on all sides by flower gardens, and these were multiplied so extensively that, according to the rajarat-nacari, one was to be found within a distance of four leagues in any part of Ceylon. Among the regulations of the temple built at Dambenia, in the thirteenth century, was: "Every day an offering of 100,000 flowers, and each day a different flower."

Another advantage conferred by Buddhism on the country was the planting of fruit trees and esculent vegetables, for the gratuitous use of travelers in all the frequented parts of the island.

On the rocks and monuments of India are edicts from the

kings to their successors to continue the good work. One of their edicts, by the king of Magadha in the third century, B. C., commanded that "everywhere, wholesome vegetable roots and fruit trees shall be cultivated, and that on the road wells shall be dug and trees planted for the enjoyment of men and animals."

On the Action of Bromide of Camphor and Borate, Silicate, and Arsenate of Sodium Upon the Germination of Seeds.

M. E. Heckel says: "M. Vogel recently called the attention of physiologists to the curious results of the experiments undertaken in 1798 by Benjamin Smith and Barton, concerning the singular and unexplained property which camphor exercises upon vegetables, and he confirmed those results in their entirety. This observer, in treating the seeds of *lepidium sativum*, of *raphanus sativus major*, of *pisum sativum*, and of some other plants, placed between two sheets of blotting paper moistened with a solution of camphor, noticed that these seeds germinated long before those which had been maintained in ordinary conditions. Filled with these new ideas, and resting upon the fact, well known since the labors of Göppert, of the action of bromine, as an agent capable of hastening the germination of seeds, I asked myself, in the course of some researches touching the action of certain chemical compounds upon the germinative faculty, if the bromide of camphor, which is sometimes considered as a definite combination of bromine and camphor (the bromine replacing one equivalent of hydrogen in the camphor) and sometimes as a simple association of the same components, would present, from the biological point of view which occupied me, the sum of the properties with which the bodies composing it were gifted, or if the new chemical entity would manifest a proper attitude, decided enough to permit of a differentiation, either by the intensity or by the modality of the action, between the body and its components simply associated. With that end in view, I instituted the following experiments at the beginning of April, which have been carried on until now, with the seeds of *raphanus sativus* alone, but which I propose to extend to other seeds. Between several layers of double wadding wetted with water, I enclosed for each experiment twenty radish seeds, and I had care to have all the substances act upon the seeds under like conditions of heat and humidity.

In the first double of wadding I placed 7.7 grains of finely pulverized ordinary camphor; in the second, 7.7 grains of bromide of camphor equally reduced to powder; in the third one, sprinkled with bromine water, 7.7 grains of camphor; in the fourth one, the seeds were sprinkled with bromine water only; in the fifth one, the seeds were surrounded with 7.7 grains of crushed bromide of potassium; in the sixth and in the seventh ones, the seeds were sprinkled with chlorine water and iodine water. Incidentally, I should here say that I confirmed, by repeating the experiments, the experience of Göppert in regard to the activating action of

chlorine, of bromine, and of iodine. These three bodies incontestably hasten germination, and with an intensity decreasing from chlorine to iodine. Thus, iodine water produced germination in five days on an average, bromine water in three days, and chlorine water in two days, and under normal conditions it required at least seven or eight days to obtain the same results. The action of bromide of camphor was still more rapid; in thirty-six hours the rootlets were striking.

In the double of wadding containing camphor alone, the phenomenon required between four and five days. In the third package (containing camphor and bromine water) the seeds germinated the first time thirty hours later than in the case of bromide of camphor, the second time twenty-six hours later, the third time thirty-six hours later. As for the bromide of potassium, it remained without effect, though dissolved in water; the germination was produced in the same length of time as with ordinary water. These experiments, several times repeated, having always yielded identical results, I concluded that the bromide of camphor enjoyed a more considerable action than the sum of the two bodies of which it was composed, taken separately or acting in consort. I should add that the bromide of camphor acts without being dissolved. M. Vogel employed camphor in solution; the same solvent might have been employed to dissolve the bromide of camphor, which is insoluble in water, but without utility, since I obtained the two bodies simply pulverized. It must be admitted that they act by vaporization. I extended my researches to the boron and silicon series; I found the alkaline borates and silicates, employed in small quantities (3.9 grains for 309 grains of water), retarded germination from one to three days, and that with larger quantities (9.02 grains for 309 grains of water) the phenomenon was suspended entirely.

Arsenious acid and the soluble arseniates arrest germination and destroy the embryo, when relatively small quantities are employed (3.9 grains for 1,380 grains of water.)—*Comptes Rendus de l'Académie des Sciences*, 1875.

An Electrical Fish Bait.

In the Paris International Maritime Exhibition there is a small object deserving of notice. It is a platinum wire placed in a bottle and ignited by electricity from a bichromate battery. It is intended to be immersed in the sea, and the light emanating from it is said to attract an immense number of fishes. Experiments have been tried lately on the coast of the Côtes du Nord department with a fishing boat, and have proved very satisfactory, on a bank of sardines. The glass must be green or black, otherwise the fish are frightened by the glare and do not follow the submarine light.

To tin small castings, clean and boil them with scraps of block tin in a solution of cream of tartar.



A BUDDHIST GARDEN IN THE EAST INDIES.

USEFUL AND CURIOUS INVENTIONS.

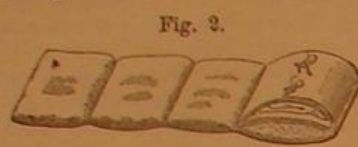
Below we give engravings of a number of ingenious inventions, extracted from the pages of Knight's "New Mechanical Dictionary." These devices, as will be seen, relate to various subjects, the selection being governed either by their novelty or their peculiar adaptation to the various purposes for which they are designed.

KNAPSACKS.

Of these, in Figs. 1 and 2, we give two ingenious examples. Weber's invention, Fig. 1, has a frame which may be changed into a couch, the cover forming a shelter. The central section has jointed and folding sides. Frodsham and Levett's knapsack, Fig. 2, consists of an india rubber casing, made watertight and containing a bag of finely cut cork, so as to convert it into a life preserver. A pocket is made in the rubber casing to contain articles of clothing, thus forming a knapsack, which, when unrolled, becomes a bed, the combined articles serving as a pillow.



Weber's Knapsack.



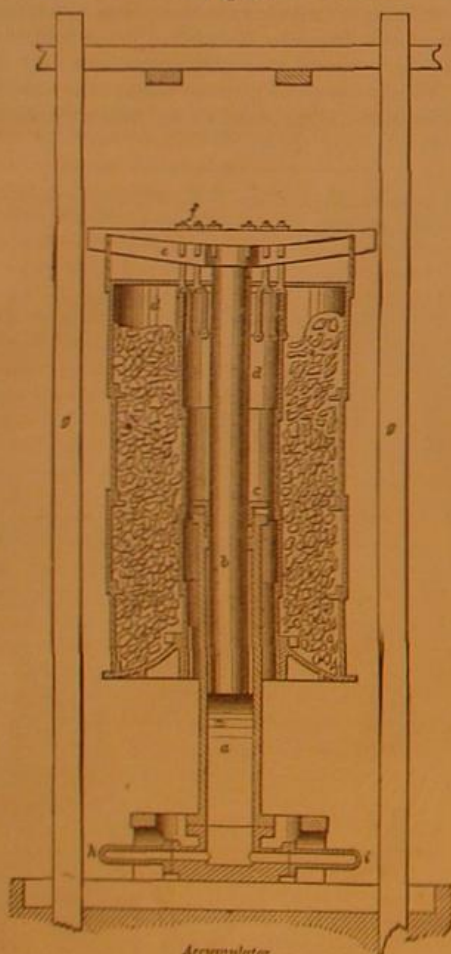
Frodsham and Levett's Knapsack.

A pocket is made in the rubber casing to contain articles of clothing, thus forming a knapsack, which, when unrolled, becomes a bed, the combined articles serving as a pillow.

ACCUMULATOR.

This is an apparatus used in working hydraulic cranes and other machines where a steady and powerful pressure of water is required. As shown in Fig. 3, it consists of a large cast iron cylinder, *a*, fitted with a watertight plunger, *b*, to which is attached a loaded weight case, *d*. Thus a

Fig. 3.



Accumulator.

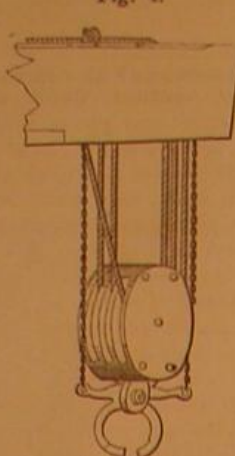
pressure is obtained upon the water in the cylinder, equal to a column of water 1,500 feet high, or 660 lbs. to the square inch. As the water is pumped into the cylinder by the engines through the pipe, *h*, the piston with the weighted case rises, being guided by the strong wooden framework, *g*, and is made to regulate the amount of water pumped in, by actuating a throttle valve in the steam pipe of the pumping engine, which it closes after having reached a certain height. When the cranes, etc., are in operation, the water passes from this cylinder through the pipe, *i*, to those actuating the motion of the cranes, and the weighted plunger naturally descends, always keeping up a constant pressure upon the water. In descending, the same causes the throttle valve to open again, and the water is again pumped in.

AN ANCHOR TRIPPER

of ingenious construction is represented in Fig. 4. The anchor hangs from a clutch ring on the cathead, which is suspended below the cathead. When the fall is cast loose, the block descends,

and the clutch is opened by the chains, which are attached to the cathead and to the projecting levers or prongs on the respective halves of the clutch. A single motion, the slackening of the fall, operates the tripper; the clutch is opened when the chains are made taut, by the descent of the block.

Fig. 4.



Duncan's Anchor-Tripper.

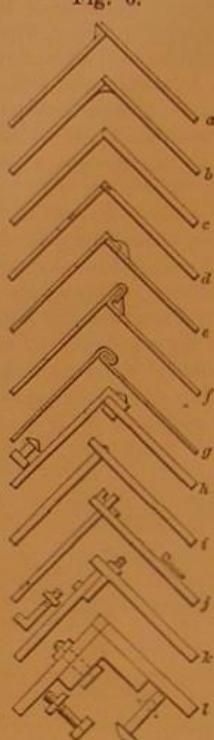
representations of several forms. *a b* are joints which are entirely dependent upon solder; such are used with tin ware and sheet lead. *c* is a miter joint. It is used for thicker metals with hard solders. *d* is a butt joint, otherwise similar to *c*. *e* is a lap joint; the metal is creased over the hatchet stake or by the spinning tool. It requires solder. In the

Fig. 5.



Arcograph.

Fig. 6.



Angle-joints.

Fig. 7.



Angular Gearing.

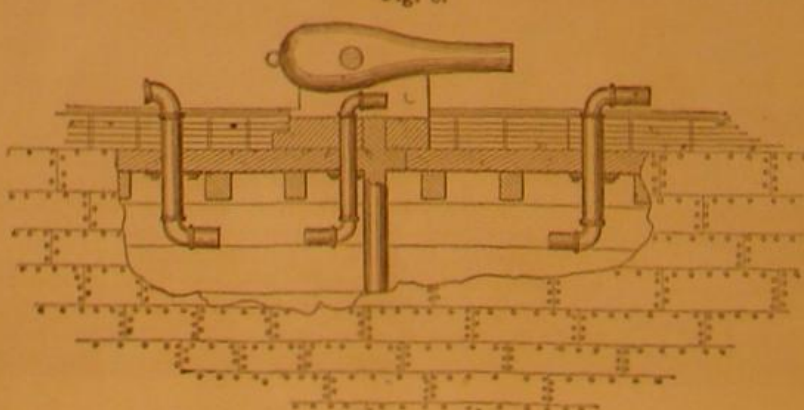
joint shown at *f*, one plate is bent rectangularly, and the other is doubly bent, so as to recurve back on itself, lapping around the edge of the other. It needs solder to keep it from slipping apart. *g* has a fold to each plate; these lock upon each other and require no solder to perfect their hold, although it may be added to make the joint airtight and watertight where the closure is not absolutely perfect. *h* is a riveted joint, one plate being bent to lap upon the other. This joint is called the folded angle, and is common to all kinds of work. In *i* the edge of one plate is formed into tenons which enter mortises in the other, and are there riveted. *j* resembles *i*, except that the tenons are prolonged so as to be retained in the mortises by cotters. In *k* one plate makes a butt joint with the other, and is attached by L-formed rivets or screw bolts, the heads of which are riveted to one plate, while their screw stems pass through the other plate, and are fastened by nuts. At *l* two plates are shown, secured by being bolted or riveted to an angle iron, which is straight or bent into sweeps according to the shape of the object.

In Fig. 7 is represented a mode of

ANGULAR GEARING.

The wheels are quadrilateral, and the speed of the driven wheel is variable. The driving wheel, rotating at regular speed, will impart a quicker rate to the other wheel when the angle of the former is in contact with the flat side of the

Fig. 8.



Stevens' Altiscope.

latter, and conversely. This device has been used in printing presses.

STEVENS' ALTISCOPE.

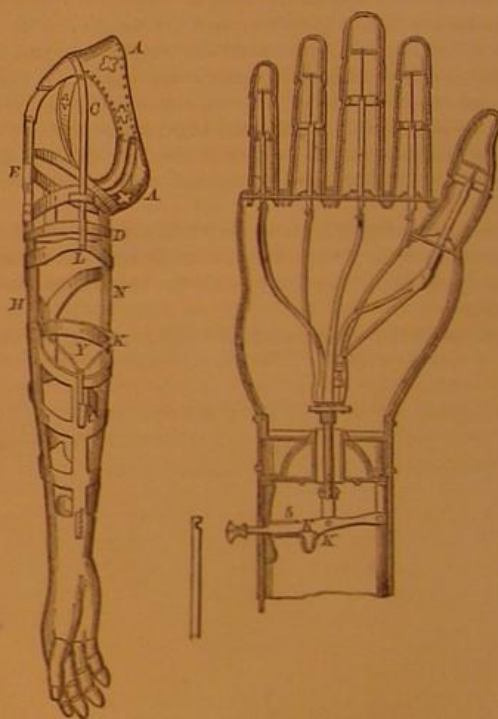
This invention, represented in Fig. 8, affords a means of training guns to a given angle with the axis of the vessel or on an object, while the gunner remains beneath the deck. There is attached beneath the deck, to the pintle of the pivoted gun, a graduated index plate by which its horizontal bearing may be read. A telescopic tube, with two rectangular bends and with reflecting mirrors at the angles, is so placed as to be used from beneath the deck; two of these may be so situated as to form a base of sufficient length to obtain, by simultaneous observation, the distance by triangulation. Two screw propellers, working in contrary directions, rotate the vessel so as to bring the guns to bear on the required point. The upper and lower limbs of the telescopic tube are parallel; the one above the deck is presented toward the object, the other to the eye. The image of the object, after being twice reflected, reaches the eye of the observer, whose body is not exposed. This device entered into other ingenious appliances connected with the Stevens battery.

A large amount of ingenuity and inventive skill has been directed toward the replacing, by mechanical devices, of members of the body lost through accident or disease. In Fig. 9 we give an

ARTIFICIAL ARM.

and hand, in which there are arrangements for moving the fingers and thumb. The shoulder cap is the basis for the various movements. The strap, *C*, is hinged to the cap, *A*, and connected by a rod to the ring, *L*. The straps, *D E* of the upper arm, are also hinged to the cap and the lower part of the upper arm; from the ends of the straps, *D E*, proceed the slotted bars, *N*, to whose lower end the forearm is pivoted. The three straps mentioned are the means of suspension of the arm, forearm, and hand, and the stump of the natural arm within this outer skeleton is the means of imparting motion to the forearm, wrist, and fingers. The ring, *L*, is connected to the strap, *C*, and hinged to the forearm

Fig. 9.



Artificial Arm.

behind the elbow joint; it is guided in its motions by the slotted bars, *H N*, sliding down the said slots as the stump is moved forward, and thereby thrusting upon the point of the elbow and flexing the forearm. Pivoted to the bars, *H N*, near the elbow axis, are the bifurcated ends of the wire, *Y*, which actuates the fingers and thumb, flexing them as the arm bends by means of tension on the tendons, which pass through the metacarpus and then diverge to follow the phalanges. By means of the lever, *K*, the spring slide, *S*, and the notched slot, the thumb and fingers can be connected to or disconnected from the arm and forearm, so as to receive motion therefrom, or otherwise, as may be desired. In the rotary movement of the stump, the upper end of the strap runs on a rod attached to the shield, *A*, under the axilla.

Effects of Stress upon the Magnetism of Soft Iron.

In the physical laboratory at Glasgow University, Sir William Thomson stretched steel and soft iron wire, about twenty feet long, from the roof. An electro-magnetic helix was placed round a few inches of the wire, so that the latter could be magnetized when an electric current was passed through the former, the induced current thus produced in a second helix outside the first being indicated by a reflecting galvanometer. When steel wire was used, the magnetism diminished when weights were attached to the wire, and increased when they were taken off; but when special soft iron wire (wire almost as soft as lead) was used, the magnetism was increased when weights were put on, and diminished when they were taken off. Afterwards he discarded the electrical apparatus; and by suspending a piece of soft wire near a magnetometer consisting of a needle, a small fraction of a grain in weight, with a reflecting mirror

attached, the wire was magnetized inductively simply by the magnetism of the earth, and changes in its magnetism were made by applying weights and strains, the changes being then indicated by the magnetometer.

SCIENTIFIC AND PRACTICAL INFORMATION.

DISCOVERY OF A NEW ELEMENT.

At a recent session of the French Academy of Sciences, M. Wurtz presented a communication from M. Lecoq, announcing the discovery of a new simple body, a metal analogous and allied to zinc and cadmium, and found in blende or sulphide of zinc in Spain. The existence of the substance was revealed by spectral analysis, two lines appearing which could not be traced to any other other element. The lines are situated in the violet, the region in which the brightest zinc lines are found; one is very brilliant and takes, in the table of wave lengths, the 417th place; the other and weaker one has its wave length represented by 405. The new metal has not been reduced from its combinations, so that its physical characteristics remain undetermined. It has been obtained, however, in the state of hydrochlorate and sulphate, and its distinctive features have been so clearly recognized, showing its marked difference from either zinc or cadmium, that there is considered to be no reasonable doubt as to its existence. The discoverer patriotically names the new metal gallium in honor of France.

TESTING POTABLE WATER FOR ANIMAL MATTER.

Most of our readers are already aware of the danger arising from the use of water which contains animal excreta, or other animal matter in a state of putrefactive decay. Although no certain test has yet been found for these matters, it is not difficult to detect the decomposition products which always accompany them, and when the latter are absent we may safely conclude that the former cannot be present. This indirect analysis involves testing for carbonate of ammonia, nitrous and nitric acids, phosphoric acid, chlorine, and sulphuric acid.

The test for carbonate of ammonia is best made with a few drops of corrosive sublimate solution, or a little of the Nessler test. Nitrites are detected by slightly acidifying the water and adding a starch solution which contains iodide of cadmium. To test for nitrates, acidify with a few drops of dilute sulphuric acid, immersing in it for a minute a rod of zinc or cadmium, and then adding the starch and iodide of cadmium. Phosphates are detected with most certainty by a few drops of a concentrated solution of acetate of uranium.

JAPANESE BRONZES.

M. E. J. Maumené writes as follows: We recently received bronzes from Japan, the composition of which presents great interest. Their origin has been well and precisely established; they come from public monuments and from temples of habitation where great luxury reigned, which is attested by the dimension of most of the pieces imported, and which were destroyed during the great religious and political struggle which ended a few years ago.

We had occasion to analyze these bronzes, and here are the most striking results:

	No.1.	No.2.	No.3.	No.4.
Copper.....	86.38	80.91	88.70	92.07
Tin.....	1.94	7.55	2.58	1.04
Antimony.....	1.61	0.44	0.10	"
Lead.....	5.68	5.33	3.54	"
Zinc.....	3.36	3.08	3.71	2.65
Iron.....	0.67	1.43	1.07	3.64
Manganese.....	"	trace	"	"
Silicic acid.....	0.10	0.16	0.09	0.04
Sulphur.....	"	0.31	"	"
Waste.....	0.26	0.79	0.21	0.56
	100.00	100.00	100.00	100.0

The complex alloys thus formed are all of a granulated texture, blistered on the interior surface, full on the exterior surface (which can be readily polished with a file), showing a varied shade, which is sensibly violet when antimony is abundant, red when iron is present, etc.; all the specimens were cast in slight thicknesses, from 0.195 to 0.468 inch, and the molding was well filled. It appears from analysis that these alloys were not made with pure metals, but with entire minerals. We should, says the author, consider these bronzes as resulting from direct employment of copper pyrites and antimonial galena mixed with blende; and the calcination was not always complete, as the presence of sulphur in specimen No. 2 proves.

Antique alloys, Greek, Roman, old French, etc., present indications of the same nature: but we have never observed so great a complication and such clear proofs of the simplicity of metallurgic work.—*Comptes Rendus de l'Académie des Sciences*, 1875.

NEW AFRICAN EXPLORATIONS.

Mr. H. M. Stanley, the reliever of Dr. Livingstone, is now chief of an African exploring expedition fitted out by the New York Herald and the London Daily Telegraph. Letters recently received from him have appeared in those journals, from which the first tidings of his labors may be gleaned. Starting from Zanzibar on the coast, he began a journey of 720 miles to the great Victoria Nyanza lake. His progress was impeded by hostile savages, by the unknown nature of the country, and by the fearful mortality among his followers, 126 out of the 800 men which composed the expedition falling in battle or succumbing to disease; despite these obstacles, however, the march was accomplished in 103 days, an incredibly brief period when it is considered that by the natives the distance is counted as a nine months' journey. Launching his sectional steamer on the lake, Mr. Stanley

began his explorations; and of those undertaken in April and May, the results are now reaching us.

The most important discovery thus far made is the verification of Speke's description of Victoria Nyanza as one great inland sea. This is contrary to the later decisions of many eminent geographers, who believe the lake to consist of a number of small bodies of water united by streams or tracts of frequently overflowed marshy country: a new view upheld by Speke's comrade the explorer Burton, and even by Dr. Livingstone himself. Stanley now, however, demonstrates Speke's account to be strictly accurate, and thus secures to that explorer the fame of being the first discoverer of the true source of the Nile.

PRESERVATION OF MEAT BY COMPRESSED AIR.

We recently described a discovery of M. Bert, relative to preservation of meat through keeping the same in a hermetically sealed compartment under a pressure of several atmospheres. M. Reynoso proceeds a step beyond M. Bert, and announces that, if the meat be removed from the compressed gas after remaining therein for several weeks, it may be exposed to the ordinary atmosphere indefinitely without decomposition. This was accidentally discovered through a fragment of flesh from the compression apparatus being left unnoticed in the laboratory. M. Reynoso finds that the meat dries slowly, keeping its color, odor, and consequently its fleshy taste.

The Relation of Patents to the Various Industries.

At a recent meeting of the New York Society of Practical Engineers, President James A. Whitney delivered an address on "The Relation of the Patent Laws to American Agriculture, Arts, and Industries." Passing over those portions of this address which present, in a concise and forcible manner, the several arguments and authorities in favor of these laws, we would direct especial attention to the following interesting historical and statistical information regarding several important American inventions. "Beginning with the printing press, we learn that the one used by Franklin over one hundred years ago gave but one hundred and thirty impressions an hour; as the result of successive patented improvements, this capacity was so advanced that in the year 1847 a machine had been perfected—the Napier double cylinder press—by which from twenty-five hundred to five thousand impressions an hour could be made—the former of large, the latter of small, newspaper size. It was then believed that with this machine the limit of speed had been reached, and yet the public demand for more newspapers and periodicals was advancing rapidly. It was at this juncture that the American inventor Richard M. Hoe brought forward his improved printing machinery, and, as the result of his genius and mechanical skill, it was soon brought to so great perfection that, in the year 1861, one of the New York papers printed a daily edition varying from one hundred and fifteen to one hundred and thirty thousand copies, all printed in four hours and a half. Though it is not claimed that this was the work of a single press, yet to have accomplished the same work on Napier presses would have required five additional forms of type, each at the cost of one thousand dollars a week, or two hundred and sixty thousand dollars a year. Another kindred invention, and one effecting even a greater relative improvement, was the Chambers folding machine. This was the invention of Cyrus Chambers, to whom the first patent was issued about the year 1859. In the year 1874, seventy-two of these patent news folders, for folding newspapers alone, were in use. Regarding the work accomplished by these machines in the several departments of paper, magazine, and book making, we read: "The cost of running these machines was \$3 a day each, and each accomplished the work of five men. The same work by hand cost \$8.75 per day, being a saving of \$6.75 a day for each machine, and these newspaper folders alone, during the original term of the patent, effected an economy of labor amounting to upward of \$1,165,000. During the same period the paper folders for duodecimo publications saved in labor more than \$353,000; for octavos, more than \$139,000; for quartos, more than \$64,000; and for 32mos, more than \$522,000—making from this one patent alone, in less than fourteen years, a saving of human toil and exertion amounting to more than \$2,243,000. Thomas Silverthorn, the poor mechanic who invented the copper-toed shoe, little knew the significance and value of this simple idea. Through its adoption, it is estimated that from \$6,000,000 to \$12,000,000 are annually saved to the country, and yet the humble inventor had to wait for his good fortune until his patent was extended, when it was bought by a company for \$67,000. Henry Burden, the inventor of the first successful machine for the manufacture of horseshoes, was able to sell a finished shoe, including the iron, for four and one half cents, whereas to make the same by hand would have cost sixteen cents, not including the iron. While the absolute benefit to the public by this invention cannot be calculated, it is known that the gain to the government alone during the late war amounted to \$4,000,000. Under the head of "Profits of Patentes compared with Profits of the Public," the following interesting facts are presented: There is now in common use a little staple for fastening the rods to the slats of Venetian blinds. It has corrugated shanks to hold in the wood without clinching, and for this reason requires so much less iron in its manufacture that in five years' trade, in this country alone, it is estimated that five thousand tons of wire have been saved. Seventy-five tons of these little staples are used in the United States every year, at a yearly saving to the public of \$100,000, while \$20,000 was all that the inventor, Byron Boardman, received as his share. We are forced to pass over without mention many equally interesting and significant facts, of all of which Mr. Whitney makes use in

confirming his views regarding the value of patents in fostering industry by rewarding the inventor, showing at the same time that the gain to the latter is by no means excessive compared with the saving to the public. A closing illustration enforcing this claim, and one which will be readily recognized by the housekeeper, may here be cited: Formerly, when a tin can was soldered up, it was difficult matter to open it, but in 1859 John W. Masury hit upon the idea of making a portion of the cover of very thin metal, which could be easily cut through with a knife. Ten millions of these cans are made yearly. The Borden Condensed Milk Company use ten thousand each and every working day in the year. The invention is largely used in the paint trade, as it enables paint to be put up in liquid form, ready for use, therefore saving the painter's time and trouble in mixing paint. The United States Circuit Court decided the value of this improvement to be not less than three cents for each pound can; but the inventor granted licenses under the patent for a royalty of one quarter of a cent per pound can, that is to say, for every twelve cents the public gained from the invention, the inventor was content to gain one cent."

The above (from *Appleton's Journal*) contains only a small portion of Mr. Whitney's address, which abounds in interesting statistics, exhibiting on the part of the author a remarkable degree of research. We shall take occasion to make further extracts in a future issue.—Eds.]

Subterranean Festivities.

We acknowledge the receipt, too late, however, to enable us to get there, of a ticket to a grand "Basket Picnic and Subterranean Ball," given October 13, 1875, in the bowels of Leavenworth Mountain, within Marshall Tunnel, vicinity of Georgetown, Colorado. Our invitation says:—

"For the information of visitors it may be stated that the elevation of the Tunnel is 9,500 feet above the level of the sea, and the dance hall is 810 feet in from the mouth of the Tunnel, and is 500 feet below the surface. From the mines cut by this tunnel millions of dollars have been taken—

And below this argentiferous floor
Are many, many millions more.

The exercises will be opened by a brief address from Commodore Stephen Decatur.

Guests are privileged to ride on the palatial rock cars from mouth of tunnel to hall.

The festivities will be prolonged until ten boxes of wax candles are consumed."

Effects of Heat on Steel Wires and Rods.

Professor W. F. Barrett has found that, if steel of any thickness be heated by any means, at a certain temperature the wire ceases to expand, although the heat be continually poured in. During this period also the wire does not increase in temperature. The length of the time during which this abnormal condition lasts varies with the thickness of the wire and the rapidity with which it can be heated through. It ceases to expand, and no further change takes place till the heat is cut off. When this is done, the wire begins to cool down regularly till it has reached the critical point at which the change took place on heating. Here a second and reverse change occurs. At the moment that the expansion occurs, an actual increase in temperature takes place, sufficiently large to cause the wire to glow again with a red-hot heat. It is curious that this after-glow had not been noticed long ago, for it is a very conspicuous object in steel wires that have been raised to a white heat and allowed to cool.

The Electric Light as a Military Signal.

The roof of the Siemens-Halske factory at Berlin, was recently the scene of a series of experiments with the electric light, which filled all the streets in the vicinity with a crowd staring with astonishment at a supposed wonderful natural phenomenon, up in the clouds. The apparatus, which gave a light so powerful that ordinary writing could be read by its illumination at a mile distance, was arranged with an inclosed mirror, so that the rays were projected against the clouds, which served as a screen. In front of the mirror the signals were made, and these were repeated, of course on a gigantic scale, in the clouds. The light is to be adopted to the German army for night signaling.

The Force of Expansion.

The boiler stack (60 feet in height) of the Ohio Iron Company, of Zanesville, recently fell with a sudden and heavy crash, killing one of the furnace men instantly. The boiler had just been heated up, after having been cold, when the stack gave way. It appears that the gas flame had destroyed the inside lining of the stack, and had partly destroyed some of the brick and weakened the brickwork, so that, when the stack became suddenly heated again, the expansion resulted in the demolition of the whole structure.

New Oil Car.

A. P. O'Dell, of Oil City, Pa., is the author of a new oil tank car, which, if it fulfils the expectations of the inventor when put to a practical test, will greatly lessen the cost of transporting oil to the seaboard. The tank is swung underneath a platform, which can be used as an ordinary gondola car for carrying freight on the return trip. At present the tank cars have to be returned empty, which is a dead loss in freight.

To render glass impervious to the direct rays of the sun, but not so opaque as to exclude light, powder some fluorspar and mix it with sulphuric acid, and rub the mixture on the glass with a piece of lead. Then heat the glass on some stove or other arrangement by which the fumes can pass up the chimney; and when cool, wash the plate with a dilute solution of potash, and rinse in water.

Important to Inventors and Patentees. REDUCTION IN THE COST OF FOREIGN PATENTS.

Messrs. MUNN & Co. take pleasure in announcing that they have effected arrangements by which the cost of Patents, in all Foreign Countries, for American Inventions is Greatly Reduced, and they are now ready to receive applications for such patents at the annexed rates, which include both Government and Agency fees for all ordinary cases.

Some applications may require a number of drawings, and a specification of unusual length, for which an additional charge will be made. But the annexed very low prices will be adhered to, except in special cases, when the inventor will be notified of any additional cost before any expense is incurred.

CANADA.

The expense of applying for a Canadian Patent is reduced to \$50, currency.

A Canadian Patent is granted for 15 years, divided, if the applicant desires, into three terms of five years each. The expense of applying for the 5 year patent is \$50. Model and drawings required as in this country. American inventions already patented here can be patented in Canada if the application is filed within the one year from the date of the American patent. Caveats can be filed in Canada. Expenses, \$25 in full. Send for pamphlet giving all particulars.

ENGLAND.

The expense of applying for an English Patent, which covers England, Scotland, Wales, Ireland, and the Channel Islands, is \$75, currency, payable in advance, and an additional fee of \$175, payable within 3½ months, to complete the patent. Certain government taxes are required after 3 years. Patents granted to the first person who files in the complete specification and pays the fees, whether he is the original inventor or merely the introducer. For full particulars, send for pamphlet.

FRANCE.

The expense of applying for a French Patent is reduced to \$100, currency, payable \$75 on making the application, and \$25 on arrival of the Patent. A small annual tax is required after the first year. For amount of this tax and particulars about working the patent, see pamphlet. Sent free.

BELGIUM.

The cost of a Belgian Patent, and the conditions, are substantially the same as in France. For full particulars send for pamphlet.

GERMANY AND AUSTRIA.

The expense of applying for Patents in Germany and Austria is \$100 each, payable in advance. Send for pamphlet giving details.

MUNN & Co. obtain patents also in NORWAY, SWEDEN, RUSSIA, SPAIN, PORTUGAL, ITALY, all the British Australian Colonies, including VICTORIA, NEW SOUTH WALES, TASMANIA, QUEENSLAND, NEW ZEALAND, and BRITISH INDIA, on the most favorable terms, and at reduced rates from former charges.

GENERAL REMARKS.

No models required in any of the Foreign Countries except Canada; and sometimes in Prussia, the officials require a model when in doubt about the novelty of the invention, but it is seldom that one is demanded, and never till the application is secure.

All persons who desire to take out Foreign Patents are requested to communicate with the undersigned. They may depend that their cases will secure prompt and careful attention. We have had an experience of nearly *Thirty years* in the business of soliciting American and Foreign Patents; and as is well known, a very large proportion of all patents obtained by American citizens, both in this country and in foreign lands, are solicited through the Scientific American Patent Agency.

To secure a foreign patent, all that is necessary is to write to the undersigned, transmitting the fees and a copy of specifications and drawings. We can then at once proceed. The personal presence of the applicant is not necessary.

A pamphlet, giving full detailed information regarding each country, sent free. Address, MUNN & CO.,

Office of the SCIENTIFIC AMERICAN, New York.

Recent American and Foreign Patents.

Improved Horse Boot.

John B. Hall, St. Paul, Minn.—This invention relates to boots or wrappers for horses' feet, to aid in the cure of diseased feet, and consists in a boot or wrapper applied to the foot, having attached thereto a spring plate to press against sponge on the frog.

Improved Wrench.

Richard J. Welles, St. Joseph, Mo.—The handle is threaded and movable on a screw shank so as to form an adjustable jam nut to the revolving nut, through which the sliding jaw is moved.

Improved Corset.

Daniel H. Horne, New York city.—This corset has bosom-supporting cups of suitable wire gauze, which are connected by sockets with the stays. As the air passes readily through the wire gauze, the corsets are cool and healthy.

Improved Wagon Spring.

Lucien B. Devendorf, Utica, N. Y.—This spring is so constructed as to prevent the box from tipping when getting into and out of the wagon, and which may also serve as a reach in skeleton wagons. The springs are inclined or curved upward from the ends toward the middle, and bent inward so that their middle parts cross each other.

Improved Magazine Fire Arm.

Emil A. F. Toepperwein, Boerne, Tex.—This improved repeating fire arm is contrived with a sliding breech block, which is drawn back by a crank on the right hand side of the gun, connected with a pair of toggle levers, pivoted, respectively, to the breech closer and the breech frames. There is a cartridge lifter below the block, which is thrown up to present the cartridge to the barrel by an arm of the block just before it comes to rest in the backward movement. The shell is partly expelled by stops, against which the lower edge strikes at about the same time, and the new cartridge finishes the work, and it is held in position by a spring, when the lifter drops back, till the breech block pushes it in the barrel. The cartridges are put into the magazine through the opening made by sliding the breech block back, the block being moved not quite far enough to throw up the lifter.

Improved Tripod for Rock Drills.

Joseph C. Githens, New York city.—This is a tripod and clamp for holding the shield, in which the steam cylinder of a steam rock drill moves up and down. It is so constructed as to hold the cylinder securely while the drill is being used, and to enable the drill to be adjusted to work at any desired level and at any desired angle.

Improved Escapement for Watches.

Edouard Bourquin, La Heutte, Switzerland.—This invention is an improvement in the escapement whereby one pallet is made to serve the purpose of the two commonly used, and so arranged that it works with less friction, and is more certain in its action. There are two rows of reversely inclined teeth on the side of the scape-wheel, in combination of a single pallet in the lever. The teeth are arranged to receive and lock the pallet by their points, and give the impulse by their inclines.

Improved Plane Guide.

Walter S. Shipe, Minerva, O.—This invention improves the plane guide for which a patent has been granted to the same inventor under date of January 6, 1874, so that it will work more steadily and accurately, and be readily set to any desired angle. The invention consists, mainly, of a recessed handle extension of the yoke part in connection with a slotted arc piece of the guide strip-connecting plate, the arc piece being pivoted to the yoke and set by a clamp screw thereto. A wire key with bent end is inserted into a hole of the guide strip for being readily available for turning the clamping screw nuts.

Improved Crozing and Leveling Tool.

Samuel S. Steel, of Martin, and George W. Reel, of Woodville Ohio.—The stock of the lever or plane, which is made of segmental form, has a projection on its inner or concave edge, to which the crozing tool is attached by means of studs. The crozing plate has a projection to which the crozing cutter is attached. In using the tool, the thumb is placed on a piece, and spring pins are pressed through the stock, so that their ends bear upon the inner surface of the stave ends, and thereby prevent the crozing bit from cutting while the barrel is being leveled.

Improved Machine for Bending Wire Frames of Bottle Stoppers.

Charles de Quillfeldt, New York city.—This invention relates to a machine for bending rapidly and accurately the wire parts of bottle stoppers, being mainly designed to manufacture the wire lever frame and yoke of the bottle stopper, for which a patent has been granted to the same inventor under date of January 5, 1875. The invention consists of different mechanisms, to which the wire blanks are fed for being bent in consecutive order into the required shape, one wire lever frame or yoke being turned out at each revolution of the driving shaft.

Improved Combination Lock.

Alfred E. Peters, Moncton, Canada.—This invention consists of a spring-acted roller with interchangeable pins, that are acted upon by spring bars depressed by a pin inserted through perforations of the face plate. The springs are engaged by a sliding and toothed spring bar that releases the preceding spring, and secures thereby the return of the spring-acted roller, except when the correct combination is set in regular succession, which prevents the return of the roller and allows the throwing of the bolt.

Improved Colliery Plant.

Rufus A. Wilder, Cressona, Pa.—The coal is dumped into the chutes above the platform. When it is covered with dirt from the mines it is washed, by means of the attached hose, with water under pressure. The fine parts unfit for use, as well as the water, run off below the platform. In this state, the men employed on the platform to assort the coal can easily distinguish the pure from the impure, and cast the latter upon the conveyor, to the rear of the platform, which carries it to the dirt wagons or elevators for that purpose, while the former is separated, if desired, and the lump and such sizes as it is not desired to break are thrown upon the side conveyor, which takes it directly to the loading chutes, while the rest is thrown upon the conveyers in front of the platform and moved to the breakers. Over the breaker is a slotted pipe, which throws a thin stream of water into the breaker, to lay the dust produced by breaking the coal. As the coal falls from the breaker upon the next conveyor, which delivers it to the elevator, it is struck by a forcible stream of water, steam, or compressed air from the pipe under the breaker, to assist in spreading the coal over the surface of the conveyor, and partially separate it from the slate. Along each side of the conveyor, boys or men are seated to pick out impurities. At the end of the conveyor there is a thin opening under a separating plate, to take out small, thin pieces of slate not observed by the pickers, while the revolving rakes assist in moving the coal over this plate to the buckets of the elevator, which take the coal to the head of the chutes. A movable conveyor at the head of the elevator is used to convey and separate the coal, as conveyed from the main chutes to any number of platforms placed parallel to the tracks of the railroad.

Improved Journal Box.

John Schellkopf, Tidoute, Pa.—The object of this invention is to provide a simple form of adjustable journal box; and it consists in a journal box provided with diametrically opposite pivots, in combination with holders upon each side, one of which is provided with a socket or depression which receives and supports one of the pivots of the journal box, and the other of which holders is provided with an elongated depression or mortise, which receives the other pivot of the journal box; by means of which construction the said journal box is free to adjust itself upon its pivots as an axis, and has also an adjustment at right angles thereto, equal to the length of the mortise.

Combined Wheat Drill, Corn Planter, and Roller.

Samuel Brown, Lebanon, Mo.—The invention relates chiefly to hinging the frame that carries the hoppers, to the main frame, in which the revolving roller has its bearings, and providing the roller with cams which operate the seed slides through the medium of levers pivoted to the hinged frame.

Improved Heel for Boots and Shoes.

Robert Vint, Brooklyn, N. Y.—The outer surface of a casing forms an exact extension of the heel portion, while the inner is tapering toward the lower edge to form a rim that guides a conically tapering heel plate of rubber that is attached to cushioning band springs securely attached to the casing. A recess in the stiffening plate may also be used to secure the skates. The heel plate fits exactly into the tapering casing, and has shoulders which serve to form contact with the interior of the casing and give a perfectly level position to the heel plate when depressed by the foot. The under side of the heel plate is made grooved or channeled. When the heel plate is pressed up far enough to be within the extremity of the heel casing, the rim of the same is brought into use, and thereby the wearing out of the heel plate retarded.

Improved Cultivator.

Martin McNitt, Mound Station, Ill.—This invention is an improvement in the class of cultivators whose teeth are attached to pivoted bars, whereby their pitch may be adjusted at will. The improvement relates to the arrangement of the pivoted handles of the implement to act as pawls in conjunction with the ratchet bars, by which the rack bars are adjusted and held in any position.

Improved Cartridge Case for Blasting.

Paul A. Oliver, Wilkesbarre, Pa.—The invention consists of a cartridge shell provided with one or more tubular sections that telescope therein, for adjustment to the requisite length.

Improved Mining Machine.

J. J. Weirrel, Allegheny Township, Pa.—The invention relates to means whereby a coal drill may be conveniently adjusted and operated in the mine, and consists in novel combinations by which a person can drill more closely to, and more nearly with the walls of the mine, thus leaving nothing to be trimmed with the pick.

Improved Baling Press.

Christopher C. Campbell, East Chatham, N. Y.—This invention relates to certain improvements in perpetual baling presses, or presses in which the platen and follower are successively interchangeable, and the operations of pressing and tying are both conducted at the same time, the compressed bale being held in position for being tied, while the box is being filled and the succeeding bale pressed. It consists in the peculiar construction and arrangement of the stop devices for holding and retaining the follower in the rear of the bale, which has been forced into the slotted portion of the box ready for tying, so as to admit of the filling of the box in the rear for a new bale.

Improved Centrifugal Water Wheel.

J. H. Meacham, Petersburg, Va.—The invention relates to turbine wheels adapted to be run by the vertical or centrifugal action of a liquid, and consists in a wheel of conical form, with curved grooves running from apex to periphery of base.

Improved Hat-Brushing Machine.

Simon P. Silver and George H. Swords, Fishkill Landing, N. Y.—This consists of a conical hat-carrying roller and a conical revolving brush, arranged side by side to brush the hat between them, and contrived so that the brush can be swung away from the roller and back again readily, to facilitate the adjusting of the hat body.

Improved Balance Valve.

John F. Allen, New York city, assignor to George T. Hope, Bay Ridge, N. Y., and Charles T. Porter, New York city.—This valve is balanced so that it can be adjusted to any pressure at any time without opening the steam chest. It will lift when a locomotive engine is running after the steam has been shut off, and prevent the piston from pumping air into the boiler by allowing the air to escape from the front to the rear of the piston under the valve. It also acts as a relief valve to the engine in case the cylinder is filled with water.

Automatic Bale-Rolling Attachment for Compressors.

Henry Riesel, Galveston, Tex.—This device is designed especially for attachment to the press known as Tyler's cotton compress, but is applicable to other presses, for rolling the bale, when compressed and bound, from the press to the floor. It consists in a bar provided with two or more forwardly projecting prongs upon its upper end, the spring latch, and the inclined bar, in combination with the follower and the base of the press. When the follower is down in the position to receive the bale, the prongs of the bar rest in the grooves of the said follower, and the bale, when placed upon the follower, rests upon them. After the follower has been raised, the bale compressed, and its bands secured, it is again lowered. As the follower descends, the lower end of the bar strikes against the latch, which stops the said bar, and causes the prongs of said bar to rise against the rear part of the lower side of the bale, and roll or tumble it off the follower. As the follower continues to descend, an inclined bar strikes the latch and pushes it back from beneath the bar, allowing the said bar to drop into place, and the machine is ready to receive another bale.

Improved Sinker for Fishing Lines.

Edward Pitcher, Brooklyn, N. Y.—This sinker is cast with looped wires at each end. The inner extremities of the wires concealed in the body of the sinker are sweived therein.

Improved Farm Fence.

Joseph E. Winters, Fincastle, Ohio.—This invention consists of posts which are set by feet, legs, or spikes, on a rock or block, and connected by slats in zigzag or worm shape, for supporting a light straight paling running intermediately between the posts placed in the front and rear of the same.

Improved Roller Bearing for Speeders, etc.

Samuel Dyer, Natick, R. I.—A bearing plate and a screw are used to attach and support the bearing, the said plate and the bearing being screwed on to a lug under a cup. The removable bearing plate is introduced, so that when worn, it can be easily and cheaply replaced.

Improved Clip for Fellys and Tires.

Robert Ray, Carrollton, Miss.—This invention consists of a metal clip to wrap around the joints of the felly of a wheel for splicing and holding it, and having flanges to clip the edges of the tire and hold the tire on the felly without bolts or screws.

Improved Heater.

Mifflin W. Baily, Pottstown, Pa., assignor to himself and R. J. Baldwin, of same place.—A valve in the hot air passage is so balanced that when the registers in the room to be heated are closed, and but little air is passing up through the opening from the furnace on which the valve is seated, the valve will fall and close the register and open an air inlet above the fire, thus checking the same; but when more air passes by the increased draft caused by more open registers, the increased pressure on the valve will lift it and close a damper, and open an air inlet to increase the fire accordingly, thus automatically regulating the fire by the hot air delivered into the rooms.

Improved Machine for Cutting Roll Paper.

Louis P. Cohen and Ignatz Frank, New York city, N. Y.—This is an improved machine for cutting rolls of any width directly from the roll papers, for telegraph rolls and other purposes; and it consists mainly of movable roll-clamping standards provided with one or more revolving ring-shaped heads carrying the cutting knives that are fed forward simultaneously by suitable mechanisms.

Business and Personal.

The Charge for Insertion under this head is \$1 a Line.

Dry steam dries green lumber in 2 days, and is the only Cheap House Furnace. R. G. Bulkeley, Cleveland, O.
 Hoadley Portable Engines. H. H. Allen & Co., New York, Sole Agents of this best of all patterns.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. F. Fiske & Co., New Haven, Ct.
 Wanted—The best Machine for painting Horse shoe Nails. William Morehouse, Buffalo, N. Y.

Perfection of Hay Rakes, Friction Self-Dump, without Ratchets, Gears or Springs. Half interest in U. S. Patent for Sale. C. La Due, Ballston, N. Y.

Saw Teeth Indicator—Showing improved form for fitting teeth on saws for use in different kinds of wood, &c. Sent free for 50c. E. Roth, New Oxford, Pa.

The Newspaper Agency of Messrs Geo. P. Rowell & Co., New York, is becoming quite celebrated over the whole Union, extending their business facilities to every part of the country, and doing their business in a prompt, efficient, and satisfactory manner with their tens of thousands of customers. Those who have advertising business with this journal are referred to them.—[Leslie (Mich.) Herald.]

Wanted—Proposals for diminishing cost of running two pairs of 30x45 Woodruff High Pressure Engines—one pair running at 60, the other at 65 revolutions, 60 lbs. steam. Address Box 3029, New York.

For reduced prices of Surface Planers and Mitre Dovetailer's Machines, send to A. Davis, Lowell, Mass.

"Patent," or Universal Worker—Best combination of Lathe, Drill, Circular, and Scroll Saw. E. O. Chase, 7 Ading Street, Newark, N. J.

Good Manufacturing Sites and opportunities at Bridgeport, Conn. Address John F. Noble.

For Sale or Trade, Cheap—A half interest in a Machine and Repair Shop. J. A. Campbell, Farmington, Iowa.

Speed Indicator, \$2.00; Drill Gauge, 1 to 60, \$1.00. By mail. Samuel Harris & Co., 45 Desplains St., Chicago.

The best Varnishes used in this country are those made by Hyatt & Co., New York. They are better, cheaper, and more satisfactory than any of the imported Varnishes, and are everywhere demonstrating their superiority. Send for their circular.

For Sale—Milling Machine and 3,000 Cold Rolled Rods 5 in. long x 9-16. Myers, 309 Centre St., N. Y.

Blake's Belt Studs are the best fastening for Leather or Rubber Belts. Greene, Tweed & Co., 18 Park Place, New York.

Scale in Boilers Removed—No pay till the work is done. Send for pamphlet. Geo. W. Lord, Phila., Pa.

Suction & Blast Fans, Wood-working Machinery, &c. D. J. Lattimore 31st & Chestnut St., Phila., Pa.

To Manufacturers—Pure Lubricating Oil, Sample Package (24 gals.), \$1. Send to Geo. Allen, Franklin, Pa.

Educational Lantern Slides—Send for Catalogue to Prof. W. A. Anthony, Cornell University, Ithaca, N. Y.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

To Purchasers of Engines, Boilers, and Machinery—Special and important information may be obtained, and special inducements will be offered, by addressing Todd & Hafferty Machine Company, Paterson, N. J., or No. 10 Barclay St., New York.

For Sale, cheap—One 60 H.P. Boiler, 40 Engines and Boilers. Address Junius Harris, Titusville, Pa.

Steam and Water Gauge and Gauge Cocks Combined, requiring only two holes in the boiler, used by all boiler makers who have seen it, \$15. Hillard & Holland, 62 Gold St., New York.

Amateurs and Artisans, see advertisement, page 221. Fleetwood Scroll Saw, Trump Bros., Manufacturers, Wilmington, Del.

Electric Burglar Alarms and Private House Annunciators; Call, Servants' & Stable Bells; Cheap Telegraph; Batteries of all kinds. G. W. Stockly, Cleveland, O.

Walrus Leather Wheels for polishing all Metals. Greene, Tweed & Co., 18 Park Place, New York.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

\$5,000 invested in a valuable invention will give large returns.—A. D., 353 Morris Avenue, Newark, N. J.

Price only \$3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

Small Tools and Gear Wheels for Models. List rec. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Peck's Patent Drop Press. Still the best in use. Address also Peck, New Haven, Conn.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

All Fruit-can Tools, Ferracute Wks., Bridgeton, N. J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 479 Grand Street, New York.

Temples and Oilcans. Draper, Hopedale, Mass.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Steam Pumps 1 to 8. Injectors. Steam Traps and Damper Regulators on trial. Send for Circular. A. G. Brooks, 422 Vine Street, Philadelphia, Pa.

Magic Lanterns and Stereopticons of all sizes and prices. Views illustrating every subject for Parlor Amusement and Public Exhibitions. Pays well on small investments. 72 Page Catalogue free. McAllister, 49 Nassau St., New York.

Water, Gas, and Steam Goods—New Catalogue packed with first order of goods, or mailed on receipt of eight stamps. Bailey, Farrell & Co., Pittsburgh, Pa.

For Sale—Large lot second hand Machinists' Tools, cheap. Send for list. I. H. Shearman, 45 Cortlandt Street, New York.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$6, with good Battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

The Baxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Brass Gear Wheels, for Models, &c., on hand and made to order, by D. Gilbert & Son, 213 Chester St., Philadelphia, Pa. (List free.) Light manufacturing solicited.

"Lehigh"—For Information about Emery Wheels &c., address L. V. Emery Wheel Co., Weisport, Pa.

American Metaline Co., 41 Warren St., N. Y. City.

Genuine Concord Axes—Brown, Fisherville, N. H.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by G. W. Army, 148 North 3d St., Philadelphia, Pa. Send for Circular.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

Notes & Queries

A. P. can cement leather to wood by using good glue.—C. F. S. will find a recipe for a red marking ink on p. 129, vol. 28.—G. W. H. will find a good recipe for mucilage on p. 251, vol. 31.—H. D. P. will find directions for gilding moldings on p. 347, vol. 31.—G. H. R. will find a recipe for hair wash on pp. 267, 268, vol. 31.—A. W. P. will find a formula for fulminating powder on p. 90, vol. 31.—W. B. and D. A. R. will find directions for proportioning cone pulleys on p. 100, vol. 25.—N. H. H. will find a recipe for filling for millstones on p. 251, vol. 31.—G. W. will find directions for removing peach stains from linen on p. 283, vol. 31.—C. A. H. will find directions for gold and silver plating on p. 405, vol. 32.—J. R. can caseharden his plow moldboards by the process described on p. 42, vol. 33.—F. D. T. will find explanations of the egg-hatching process in the *Science Record* for 1874.—W. R. H. will find directions for grinding a parabolic mirror on p. 276, vol. 30. Silvering glass is described on p. 234, vol. 30.—W. B. I. will find directions for preserving cloth goods from mildew on p. 90, vol. 31. Dyeing wool black is described on p. 75, vol. 32. Dyeing feathers on p. 299, vol. 31.—W. F. R. will find directions for mounting chromos, etc., on p. 91, vol. 32. Cleaning gilt frames is described on p. 27, vol. 31.—W. R. H. will find directions for making fruit jellies on p. 281, vol. 26.—J. C. will find directions for exterminating moths in fur on p. 388, vol. 29.—C. M. W. should read the *Scientific American*, and he will not then waste his time on the perpetual motion nonsense.—H. B. B. will find a description of the hydraulic ram on p. 209, vol. 31, and one of the construction of windmills on p. 241, vol. 32.—C. S. will find a formula for the dimensions of a fly wheel on p. 288, vol. 28.—C. E. F. will find a full explanation of the ball dropped through the earth coming to rest on pp. 138, 250, vol. 31.—C. H. S. can color paraffin with any aniline dye.—H. Y. will find that the proportions of a fly wheel are given on p. 288, vol. 28. The temperature of compressed air is discussed on p. 123, vol. 33.—H. B. can galvanize iron by the process given on p. 347, vol. 31.—A. Y. S. can waterproof canvas by the process described on p. 347, vol. 31.—E. H. P. is informed that the maximum pressure of steam depends on the maximum temperature. See p. 81, vol. 29.—G. F. G. will find a description of the carving pantograph on p. 95, vol. 33.—C. W. M. will find directions for making plaster of Paris on p. 399, vol. 29.—C. T. S. can clean rust off an engine by the method described on p. 267, vol. 33.—J. L. H. should not run the risk of spoiling her hair by using nostrums, which are always deleterious.—A. A. D. can make battery carbons by the process described on p. 35, vol. 33.—W. R. should apply to Seth Green, Esq., Rochester, N. Y., for the best method of stocking a stream with trout.—E. H. will find a description of lap and lead on p. 101, vol. 32. Crucibles are described on p. 300, vol. 31.—J. F. W. will find a recipe for axle grease on p. 90, vol. 31.

(1) J. A. M. asks: How can I clean stone ware jars that have had muriatic tin crystals in them, so that they can be used for fruit, etc.? A. The tin may be removed by muriatic acid.

(2) J. M. H. says: The phenomena referred to on p. 193, vol. 33, can be easily and satisfactorily explained by supposing that the boiler in the first case was quite hot and not of very large size, but of thick iron; and the water being introduced—not very rapidly—the small quantity became heated intensely, producing the 190 lbs. pressure indicated. In the other case, it is probable that the boiler was not so much heated as supposed, or the boiler iron not so heavy, or both, or the water may have been introduced much faster than in the first instance. If the boiler was not very hot and the water was introduced quite rapidly, it would have had precisely the effect stated. The first water introduced would be converted instantly into steam, which was suddenly condensed by the rapid cooling of the boiler and its contents by the working of the pump. These are the several conditions which, I think, would, separately or together, have produced the results stated. A. Our correspondent is entitled to especial commendation for the clear and satisfactory explanation here given. Of course the causes of such occurrences must be matters of theory to a great extent, but J. M. H.'s views are very reasonable.

(3) J. P. M. says: Having had a conversation with the late chief engineer of the United States Navy, he says tallow or grease of any kind should never be used in the cylinder of any engine, only a little pure beeswax on the piston rods. Ought we to stop using tallow, as we now do? A. If you are sure that the tallow is pure, you may continue to use it without fear. But in general, we think it is preferable to use good oil.

(4) A. B. C. asks: There are two boilers in Rensselaer county, N. Y., which are running without safety valves or steam gages. Is there any law to prevent this? They are old boilers, but have recently been repaired. A. We do not think

there is any law, and we can scarcely believe that any one would be foolishly enough to carry much pressure under such circumstances. We wish you would send us further particulars. If the owner of the boilers is running them in entire ignorance and carelessness of the pressure, you will be doing good service by sending us his name for publication. We may add that, in the absence of a special preventive law, the owner of these boilers can be prosecuted on the complaint of any one who thinks that he is conducting his business in a manner that is dangerous to the community.

(5) J. A. D. asks: How can I polish wrought iron? A. Warm your goods till they are unbearably hot to the hand; then rub with new clean white wax. Heat the goods again so that the wax may soak in them; then rub them over with a piece of serge.

(6) G. R. asks: Is there a practical way of determining when an engine is precisely on the center, independent of the guides? A. Strike on the end of the crank a circle of the same size as the crank pin; then (for a horizontal engine) place the crank pin as near the center as the eye will direct, then place a straight edge with one end resting on the crank pin and the other even with the corresponding diameter of the circle. Upon the straight edge rest a spirit level, moving the crank till the level stands true. If, however, the cylinder is not set quite level, first place the spirit level on the piston rod, note how the bubble stands, and then move the crank pin till the bubble of the spirit level, applied as directed, stands as upon the rod.

(7) F. H. D. asks: 1. Is there any difference in the tractive power of a locomotive drive wheel when the crank goes over or under the axle in ascending a grade? A. No. 2. Is the leverage on the axle the only leverage there is in ascending a grade? A. Yes, as we understand your question.

(8) C. A. asks: Why does a ball, fired from a barrel 6 inches long, fail to go straight to its mark at 10 yards distance? A. The barrel is too short to throw a ball with any degree of accuracy to the distance you mention. The resistance of the air to the ball at such a distance also causes deviation.

(9) J. W. K. says: I have been told that some planters in Louisiana employ electricity in the process of purifying cane juice. The juice itself is said to form part of the battery. Is this so? A. We have never heard of such use of electricity, and do not think the statement can be correct.

(10) C. S. R. asks: 1. How can I put a point of metal or iron on a worn-out metal plow point, in a common smith's fire? A. The remains of the old steel or the plow will show the shape of the weld. Use shear or cast steel, using borax as a welding compound; be careful not to overheat the steel. 2. How can I temper cold chisels, and drills for drilling iron and other metals, and stone? A. You will find directions for tempering drills and cold chisels for metal, etc., in "Practical Mechanism," No. 4, p. 21, vol. 31. To temper cold chisels for stone, heat the chisel in a charcoal fire, and temper to a brown color.

(11) E. A. K. asks: What can be added to a tempering solution that will give the steel a bright silver color without impairing the tempering qualities of the solution? A. Nothing.

(12) F. B. M. asks: How can I test gold with acid, and what kind of acid is used for that purpose? A. The touchstone used for that purpose is a piece of black basalt, or even black slate, over which the gold to be tested is drawn so as to leave a streak of the fine particles upon the surface. This streak, of course, remains untouched when moistened with nitric acid; but if a streak of any base alloy (of copper and zinc, for example), made to imitate gold, be made upon the touchstone, the nitric acid will immediately dissolve it. The acid employed in this test is generally mixed with a minute proportion of muriatic acid (98 parts by weight of nitric acid, of specific gravity 1.34, 3 parts hydrochloric acid of specific gravity 1.173, and 25 parts water. The streak is not apparently affected by the acid if the gold is not below 18 carats fine; by making several streaks in succession, or by grinding off a portion of the surface upon the touchstone, any error arising from the thin external coating of fine gold may be avoided; a feather or glass rod serves for moistening the streaks with the acid. In order to determine by the touchstone the proportion of gold which is present in the alloy, the streak is compared with that made by a series of touch needles, composed of alloys containing gradually diminishing quantities of gold. In experienced hands the quantity of gold may thus be ascertained, with an error of not more than one part in a hundred.

(13) G. B. asks: 1. Will a copper ball, made hollow and perfectly tight, float on the water inside a steam boiler with the steam at any desired pressure? A. Yes. 2. Will the heat of the steam injure a brass or steel spring? A. Yes. The injury to a well made spring will be very slight, however.

(14) B. T. P. asks: Please give me directions for tinning wrought iron wire. A. Clean the wire, cover it with a solution of muriate of zinc, and dip into melted tin.

I wish to send some dead birds 1,500 miles. How can I prepare them so as to prevent decomposition? A. It will be best to pack them in ice and sawdust or tan bark.

(15) N. A. W. asks: What are hyperbolic logarithms? A. The hyperbolic logarithm of a number is the power to which it is necessary to raise the quantity 2.7182818, in order to produce the given number.

(16) J. J. M. says: A Hunter's screw has a lever 51 feet long. The distance between the threads of larger screw is 1 inch, and between

those of the smaller, $\frac{3}{4}$ inch. How much weight can a man whose power is represented by 175 lbs. move with such a screw? A. Disregarding friction, the relation of the force to the weight is about as 1 to 1,290, that being the proportion between the distances passed over by each in the same time.

(17) J. A. McC. asks: Is there any kind of steel that may properly be called a natural production? A. Steel is an artificial production, in the sense in which that term is ordinarily employed. There is no native steel.

(18) F. B. asks: Upon a railroad car in rapid motion, I let fall a ball striking the floor. A friend says that the ball will strike at precisely the same point that it would if the car were standing still. I say the projective force given to me and the ball by the engine ceases to act upon the ball after it leaves my hands until it strikes the floor, hence the floor is a curved line. A. Your idea is correct, but the time of descent is so slight that the curve is practically a straight line.

(19) J. B. F. says: I have a pair of cylinders, $2\frac{1}{2}$ inches bore x 4 inches stroke, and a boiler with 169 tubes of half inch internal diameter; outside shell is 18 inches in diameter by 28 inches high. I want to run a boat 30 feet long by $\frac{5}{8}$ feet beam. 1. What will be the size of a propeller suitable for this engine and boat, pressure of steam being 150 lbs.? A. Use a propeller of from 28 to 30 inches diameter and of 3 to 3- $\frac{1}{2}$ feet pitch. 2. What speed could be obtained with the above? A. Probably from 6 to 7 miles an hour.

(20) C. J. A. says: 1. I have a muzzle-loading rifle that carries a $\frac{1}{2}$ oz. round ball, and a 1 oz. conical ball; and with the same elevation of sight, same kind of patch, same charge of powder, and righted at same object, it will throw the conical ball nearly twice as far as the round one. Why is this? A. The conical ball, on account of its shape, encounters less resistance from the air than the other. 2. In shooting over water for a thousand yards or more, does it cause the ball to fall more than it would over the same distance of land? A. No.

(21) W. H. L. asks: What is the most simple way to make a battery for plating? A. See answer to F. C., on this page.

(22) J. T. H. asks: Who is Darwin, and what is his doctrine? A. He is an English naturalist, and his theory is that all animal forms have a common origin. This is commonly known as the theory of evolution.

A friend says that if a thimbleful of gunpowder be confined in a solid block of steel of 4 feet cube, and ignited, it would burst the steel. I say it would not. Which is right? A. You are.

Suppose I have two tubes with 4 inches of water in one and 10 inches in the other, and I put 1 inch of water more into each tube, will this last inch create any more pressure at the bottom of one tube than the other, the tubes being the same size? A. Yes, as we understand your question.

Will a 3 horse engine do the same amount of work that 2 good horses do? A. An engine exerting an effective horse power can do more work than an ordinary horse in a given time.

(23) F. O. says: The floor of my verandah is made of tongued and grooved boards, and painted over. The boards have shrunk, and water leaks through in rainy weather. I have filled the space between the boards with putty, but would it not be best to cover the whole floor with canvas or duck, tacked on and covered with paint? A. Try asbestos cement, which is procurable from the manufacturers of heavy iron skylights.

(24) J. C. asks: What is the proper way of setting picket fence posts? The posts are $3\frac{1}{2}$ feet above ground, tapering from 5x5 inches to 5x3 inches. A. It depends upon what kind of picket fence you wish to build. If the rails are to be sunk into the sides of the posts, in the usual way, and the pickets extend above the top of the posts, set the latter so that they will appear of uniform width from top to bottom when viewing them from the front or back; set the front side of the post perpendicular, and let the incline be entirely on the back.

(25) W. A. asks: Has anything been invented of the nature of a looking glass for discovering anything at the bottom of deep water? A. Marine telescopes for this purpose have long been in use. Some of them are provided with lamps.

(26) N. K. B. asks: Can you give a formula for finding the area of an inscribed regular polygon, when the perimeter of polygon and area of circumscribed circle are known? Can you give formulas for finding the number of its sides? Are the data sufficient when only one polygon will answer the conditions? A. We do not think that direct formulas could be given, but the solution might be made by the aid of properly constructed tables.

(27) A. B. S. asks: 1. Where was the first railroad built in the United States? A. From Milton to Quincy, Mass., in 1826. 2. Where was the first in the South? A. The Baltimore and Ohio railroad was commenced in 1828, and 15 miles were opened to travel in 1830.

(28) A. L. M. asks: What is meant by the number of inches of water used in driving a turbine wheel? A. It refers to the size of the aperture, as generally employed.

In a recent issue you say one requisite for an artesian well is that it should be surrounded by mountains or high land. If so, how does it work in a level desert? A. The high land in such a case is at a great distance.

Can you explain how logarithms are calculated? A. You will find the formula, in as simple terms as it can well be expressed, on p. 283, vol. 32. The whole subject is well treated in Law's "Logarithms," Weale's series.

Would hickory sawdust do to make paper pulp of? A. You should address a wood paper manufacturer.

How is the angle for bevel gearing found? I have a plan for finding it which, if not identical with yours, I will communicate. A. We should be glad to see your method. It is quite a simple problem.

(39) C. B. B. asks: What method is used to obtain the brilliant polish usually observed on steel watch chains, buttons, etc.? A. Use first emery (on belts), then crocus, and lastly rouge or polishing powder.

(30) M. says: I want a 50 horse power boiler, but can get from none of the makers satisfactory information as to what constitutes a horse power. Makers of tubular boilers rate their boilers by the number of square feet of heating surface that they allow to a proportionate amount of grate surface, and they range all the way from 10 to 22½ square feet. We are thus led to infer that a horse power is merely a nominal thing. But there must be something definite that constitutes in all cases a horse power in a boiler. The makers of some sectional boilers claim that the evaporation of 30 lbs. water into good dry steam per hour constitutes a horse power, therefore the evaporation of 1,500 lbs. of water per hour will give me a 50 horse power boiler. This seems like something tangible, but is it correct? Must a boiler evaporate that amount per hour in order to fill the requirements, and should a boiler that falls short of doing this be rated less? A. There is no standard for the horse power of a boiler. The proper way to rate the capacity of the boiler is by the number of lbs. of saturated steam that it will furnish in a given time, as, for instance, an hour.

(31) J. W. F. asks: Please give me directions for crystallizing pears, cherries, etc., to produce articles equal to the French fruits. A. Wash carefully, and then dry, dip in thin gum arabic, and sprinkle with finely granulated sugar.

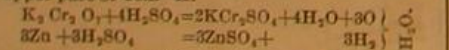
(32) J. N. P. says: "The Catechism of the Locomotive" gives the following rule for calculating the average or mean pressure when steam is used expansively in the cylinder: Divide the length of the piston's stroke in inches by the number of inches at which steam is cut off; the quotient is the ratio of expansion; find the hyperbolic logarithm of the ratio of expansion, add 1 to it, and divide the sum by the ratio of expansion, and multiply the quotient by the mean absolute steam pressure in the cylinder during its admission. The result will be the mean absolute pressure during the stroke." Why do I have to add 1 to the logarithm? A. It is the result of a mathematical investigation too long to be given here, but which you will find explained in works which treat of the theory of the steam engine. 2. How do I find the hyperbolic logarithm of a number? A. To find the hyperbolic logarithm of a number, multiply the common logarithm by 2.30255.

(33) G. B. asks: What can I use to form a hard transparent varnish for paper, that will stand handling and cleaning with water? A. We think that good dammar gum in turpentine will give satisfactory results.

(34) F. C. asks: I. How can I construct and use the simplest battery that can be made for gold and silver plating? A. Put a little sulphate of zinc in a jar of water; place a piece of sheet copper, to which a wire is soldered, at the bottom of the jar, and suspend a piece of zinc at the top. Connect the zinc with the object to be plated. The wire from the copper, which should pass through a glass tube in the jar, is then connected to the other electrode in the plating solution. A few lumps of blue vitriol must be dropped in the battery after it is set up, and more added from time to time, but care must be taken that the blue line does not quite reach the zinc. From one to three cells will be required. 2. Would an unglazed flower pot do for a diaphragm? A. It is probably baked too hard.

(35) E. G. F. says: A friend asserts that a locomotive will pull more than it will push. I contend that its power is equal in both directions. Which is right? A. You're.

(36) A. S. G. asks: 1. What is the chemical reaction in the Grenet battery? The fluid is sulphuric acid, water, and potassa bichromate. No gas is perceptible, but a little vapor condenses on upper part of cell. A.



2. In using a small induction coil I find that, on bringing my finger near one pole of outer coil, sparks pass, seemingly from the finger to the coil. I can feel nothing from the other pole unless the circuit is made through me. Changing the direction of primary current seems to make no difference; the same pole receives sparks, and the other is indifferent. How is this? A. Appearances seem to indicate that one end of the coil is not properly insulated from the base. 3. What is the object of the pole changer on induction coil? A. Convenience in reversing the direction of the current, which is often desirable in experimenting with Geissler tubes and for cutting the battery out of circuit.

(37) S. H. L. asks: Is there any process by which ivory, exposed to the atmosphere, may be made to retain its original whiteness? A. Cover it with some transparent protecting varnish.

(38) P. K. W. asks: 1. If a filter be built of brick in a cistern closed at the top, and covered with water, will not pumping out of the filter draw more water into the filter? A friend claims the pumping does not help to draw the water in the filter, that it only runs in of its own accord. A. Your friend is right. 2. I claim that air can be forced in the filter until it will exceed the pressure of the water outside the filter, and keep the water out. Is this so? A. Unless the top of the cistern be airtight, you cannot force air into

the filter to a greater pressure than that of the atmosphere without; and if it is airtight, the water will still enter the filter as high as the top of the spring, or until it traps it. If the spring is in the top of the filter, the water will entirely displace the air, and fill the filter, no matter what is the pressure.

(39) J. S. S. asks: How much power is required to run a 3½ feet burr, to grind 6 bushels of meal per hour? A. From 4 to 5 horse. It would be more economical, however, to use a smaller mill for this limited amount of work.

(40) C. B. B. says: I have a toy steam engine, and the engine, which screws on to the boiler, is rusted in so that I cannot unscrew it. How can it be unscrewed? A. Heat the connection in a gas flame.

(41) W. W. says: I read, on p. 187, vol. 33, in reply to G. D.: "It is likely that the law of your State, forbidding the sale of goods manufactured under your patent without a seller's license, may be enforced," etc. As letters patent under the law of Congress are to grant unto the patentee, his heirs or assigns, for the term of 17 years, the exclusive right to make, use, and vend his invention throughout the United States and the Territories thereof, will not State legislation, which imposes conditions and burdens on the rights thus guaranteed, in effect abrogate a law of the general government? A. Any State law which imposes special taxes upon patented goods, or aims to interfere with the free exercise of a patentee's privileges in the sale, manufacture, or use of his patent or invention, is invalid. This has been so decided by the United States Courts. On the other hand it has also been held that States have a right to impose equal taxes for the support of their local governments: have a right, for example, to tax their own citizens and all other persons who vend goods within the State. All vendors are treated alike, and the vendor of patented goods is not excused from such taxation.

(42) E. M. R. recently asked: "Why does water shorten a rope?" One of our learned professors charged with the answering of this query gave the following reply: "We were under the impression that wetting a rope exposed to strain caused it to stretch." The absurdity of this answer has been noticed by several of our correspondents. Everybody knows that the wetting of a rope exposed to strain or when not exposed to strain causes it to shorten. This is doubtless due to capillary attraction, by which the water is drawn in between the fibers with such force as to push them apart, thus causing a longitudinal contraction of the rope. The energy of the contractile force developed by wetting strained ropes is often usefully applied, and there have been many remarkable examples. C. L. T. tells that he was riding on a train when the locomotive got off the track; it required lateral movement of two inches for replacement. No appliances were at hand except a large dry rope. This was attached to the locomotive and to the trunk of a neighboring tree, then strained as tightly as possible. All hands were set to work to wet the rope, which quickly began to contract, and soon the locomotive was on the rails again. J. A. T. says: In the army a man is always supposed to be left in charge of a certain number of tents, to loosen the stay ropes in case of rain; and I recollect, upon one occasion when this precaution was neglected, a heavy rain coming on, all the posts to which these guys were attached were drawn out of the ground by the shortening of the ropes, and the tents were soon flying before the wind. B. says: All housekeepers have an experimental knowledge of the contractile power of wetted clotheslines in drawing the rope posts out of perpendicular.

(43) L. K. L. says, in reply to a query as to the maximum speed ever attained by steamboats: The Daniel Drew, the Mary Powell, and the Chauncey Vibbard, Hudson river steamers, are the three fastest steamboats in the world, remarkable time having been made by all. I have been informed that the Daniel Drew has made 25 miles per hour. The Mary Powell has beaten this, having made 27 miles an hour. But best of all, and I got it from good authority, the Chauncey Vibbard has run from West Point to Newburgh, 10 miles in 20½ minutes, or at the rate of a little less than 30 miles an hour.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Coast of Texas. By F. W. R.
On Steam Boiler Phenomenon. By W. B., and by P. K.
On Gravity on the Earth and the Moon. By F. C.
Also inquiries and answers from the following:
J. C.—R. K. T.—J. C.—J. S.—J. B. H.—E. B.—C. A. A.—J. S. B.—W. H. R.—L. F.—E. W. J.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells aneroid barometers? Who is the best steam pressure gage? Who makes telescope objectives? Why do not makers of ships' compasses advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be

observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH
Letters Patent of the United States were
Granted in the Week ending
September 28, 1875.

AND EACH BEARING THAT DATE.

(Those marked (r) are renewed patents.)

Addressing machine, A. Baker	168,079
Alarm, etc., W. S. Watkins	168,200
Ash pan, J. M. McFelim	168,168
Awning, A. Ingels	168,257
Awning, blind, J. David	168,256
Bed bottom, spring, Oothoudt et al.	168,279
Bed bug trap, E. G. Watkins	168,306
Bed, sofa, J. B. Harlow	168,155
Bee hive, D. Latchaw	168,261
Bee hive, J. P. Peeler	168,283
Beer and ale, making, J. Matthews	168,288
Bell punch, H. E. Towle	168,195
Blinder, temporary, N. S. Otis	168,179
Blind, inside, J. Bryan	168,221
Boiler feeder, V. D. Anderson	168,077
Boiler, wash, F. Mackie	168,266
Boiler-covering composition, Webber & Stedman	168,308
Book holder, L. A. Moulton	168,276
Boot and shoe heel protector, L. W. Juxton	168,224
Boot jack, M. A. Richardson	168,107
Boot shank spring, T. C. Walker	168,301
Boring machine, D. Minich	168,170
Bottles, etc., molding, J. N. Fort	168,149
Brake ejector, G. Westinghouse, Jr.	168,119
Bridges, cover for chord of, M. Lassig	168,260
Bridle blinker strap, Easton & Scott	168,241
Brush handle, paint, G. W. Schermerhorn	168,187
Brush, water, H. T. Helmbold	168,093
Buckle, W. C. Downs	168,228
Burner, lamp, G. Stobwasser	168,295
Bustle, R. Biering	168,130
Button holes, forming, J. Kenny	168,161
Cake steam washer, D. Garrick	169,138
Calculating machine, E. D. Barbour	168,080
Cane and umbrella, Harris & Kindermann	168,097
Car coupling, C. Maus	168,270
Car coupling, L. Sibley	168,190
Car coupling, S. Ustick	168,197
Car, sleeping, C. E. Lucas	168,098
Car starter, T. Murtagh	168,172
Carpet lining, C. Amazeen	168,076
Carriage, child's, R. G. Elder (r)	6,657
Carriage coupling, S. E. Foster	168,246
Chair, spring rocking, S. Fallon	168,148
Chairs, foot rest for, J. H. Travis	168,298
Chimneys, ventilator for, P. Mihan	168,169
Chopping block for meat cutters, H. P. Rankin	168,256
Churn, J. C. Baker	168,123
Churn, F. H. Hogg	168,218
Cigar, Wilcox & Carr	168,310
Cigar boxes, lock for, H. Silberman	168,112
Cigar mold, F. C. Miller (r)	6,662
Clock work, electric, D. Rousseau	168,185
Clothes dryer, Osborne & Hay	168,178
Clothes pounder, S. M. Allen	168,206
Clothes pounder, French & Lash	168,247
Coffee mill, R. L. Webb	168,307
Coffin, F. S. Haden	168,230
Compound, anti-incrustating, H. Burgess	168,222
Cooler, milk, L. C. Palmer	168,104
Corset, L. D. V. Warner	168,304
Cotton cleaner, A. C. Pearce	168,282
Cradle, J. B. Nelbach	168,173
Cream of tartar, purifying, A. Reiser	168,287
Cultivator, J. A. Thompson	168,296
Cultivator and harrow, I. P. Pickering	168,181
Disinfecting composition, etc., C. H. Bowen	168,219
Door check, E. S. Grauel	168,151
Doubling and twisting machine, J. F. Wicks	168,309
Dredging apparatus, W. H. Newton	168,278
Dry goods stand, revolving, J. J. Bisel	168,151
Eaves trough, C. A. Codding	168,231
Engine governor, J. W. Mathieson	168,165
Engine governor, marine, J. Everding	168,147
Engine, portable, J. Uhr	168,117
Engine, rotary, Reily & Waldo	168,184
Engine, rotary, J. C. Titus	168,114
Engine, steam, E. V. O'Keefe	168,102
Engines, valve for pumping, W. H. Harrison	168,251
Equalizer, draft, E. Graham	168,248
Excavation brace, Dunn & Stillman	168,088
Explosive, cap protector, F. A. Canfield	168,225
Eye glass, J. T. L. Anderson	168,122
Faucet, beer, A. L. Bobet	168,132
Faucets, attaching, J. S. Morton	168,171
Fence post, Latcher & Smith	168,097
Fire plug signal, G. H. Dougherty	168,229
Floor cloth, plastic, F. Walton	168,199
Furnace, N. L. Newcomb	168,174
Furnace, smoke burning, S. A. Ford (r)	6,666
Furnace heat regulator, A. H. Tingele	168,297
Game apparatus, A. Miller	168,274
Garden implement, J. Christy	168,234
Gas apparatus, P. W. Mackenzie	168,265
Gas apparatus, C. F. Schuster	168,230
Gas, etc., generating carbonic acid, H. Veigt	168,200
Gas works, tar gate, J. M. Slaney	168,191
Generator, sectional steam, Walker & Pratt	168,198
Grain binder, J. H. Whitney	168,120
Grain dryer, A. Nash	168,101
Gun lock, J. O. Scott	168,188
Harrow, J. C. Williams	168,111
Havester, R. H. McCormick	168,271
Hat bodies, stretching, J. G. Meeker	168,272
Hat-punching roll, J. Nutt	168,178
Heater, lunch, M. Bradley	168,133
Heater, school room, J. M. Reddy	168,106
Heddl frames, securing bars, L. J. Knowles	168,085
Hoisting machine, H. N. Prout	168,105
Hoisting apparatus, W. Turner	168,186
Horses, detaching, J. Carpenter	168,277
Horses jumping, etc., preventing, G. D. Chisholm	168,082
Horseshoe blanks, rolling, W. D. Young	168,206
Horseshoe nail machine, D. J. & S. Farmer	168,244
Hose, vulcanizing, J. B. Forsyth	168,087, 168,088
Husking pin, G. Armstrong	168,078
Ice cream carrier, H. W. Wymann	168,203
Indicator, water, F. Millward (r)	6,668
Ink, carmine printing, C. J. and C. Briedbach	168,134
Iron, manufacture of, A. C. Lewis	168,262
Iron, melting and treating, W. Schleicher, Jr.	168,292
Jack, ratchet carriage, C. P. Willis	168,312
Key ring, G. W. Jopson	168,288

Knife polisher, A. M. Delfart	168,237
Knife sealer, J. H. Clapham	168,088
Knitting machine, D. Bickford	168,216
Ladder, firemen's, M. Cronin	168,238
Leather, beating, J. H. Hussey	168,140
Leg, artificial, Collins & McCalls	168,156
Lever power, portable, W. F. Hale	168,140
Link, studded, C. A. Chamberlin	168,153
Lock, combination, C. D. Judd	168,094
Lock for cigar boxes, H. Silberman	168,112
Locomotive spark arrester, W. G. Van Buskirk	168,299
Loom take-up, H. Carstadt	168,228
Lubricating device, G. A. Sawyer	168,109
Lunch heater, M. Bradley	168,133
Mast hoops to sails, attaching, C. S. Barnard	168,127
Metal machine, shearing, I. Hann	168,090
Milk, testing, A. Meucci	168,273
Nut lock, A. E. Harris	168,156
Oil, compound resembling linseed, A. Rieder	168,108
Offer, for crank wrists, C. Kurth	168,168
Oleaginous seeds, treating, A. B. Lawther	168,164
Ore stamp, Ferguson & Jones	168,245
Organ bellows, operating, G. Beach	168,212
Ornamenting and marking wheel, F. Tucherfarber	168,115
Packing for steam tubes, W. A. Lighthall (r)	6,661
Pan, baking, L. A. Frisbee	168,089
Paper tube machine, L. Smith	168,193
Pasteboard, manufacture of, G. W. Russell	168,186
Piano stool, E. I. Seavey	168,110
Picture hanger, C. M. Smith	168,113
Pictures for transferring, oil, W. Kuehn	168,096
Pillow, G. T. Barker	168,126
Pills, manufacture of, J. Dunton	168,240
Pipe tongs, A. McDonald	168,166
Pipe tongs, G. Selden	168,291, 168,292
Pipe, hanger, gas, G. W. Blake	168,217
Pipes, machine for punching, O. B. Olmsted	168,176
Piston rod stuffing box, J. M. Scarie	168,189
Pitman connection, S. B. Howard	168,254
Planter, seed, A. M. Kanouse	168,259
Plastering, corner bead for, G. P. Atherton	168,207
Plastic compound, F. B. Duffey	168,096
Plow, W. H. Daniels	168,235
Plow reversible, M. B. Hubbell	168,157
Pots, attachment to coffee, S. S. Hoover	168,253
Poultry coop, J. Shepard	168,111
Press hydraulic attachment, S. Hughes (r)	6,667
Prisons, construction of, Cook and Heath	168,232
Pump, A. N. Parkhurst (r)	6,669
Pumps, air valve for, Smith and Collins	168,192
Purifier, middlings, A. F. Ordway	168,177
Railroad frogs, welding, O'Leary and Turner	168,108
Rake, horse, J. J. Squire (r)	6,670
Range, cooking, T. Groom	168,152
Roof, fire-proof, A. B. Mullett	168,277
Roofing compound, J. A. Craig	168,142
Rubber from waste, M. W. Beylikgy	168,129
Running gear, G. Burge	168,136
Saddle tree, H. Cruikshank	168,145
Safe door, Walton and Hemler	168,118
Saw frame, buck, P. B. Towle	168,194
Saw gumming machine, etc., H. A. Kimball	168,162
Sawing machine, F. M. Carnahan	168,226
Screw thread die, Beddow and Jackson	168,214
Screws, making metal, A. W. Gifford	168,150
Screwing machine, cast-iron, B. P. Pratt	168,192
Sewing machine, ruffler, W. H. Conners	168,241
Shaft tug, A. F. Morse	168,275
Shearing metal, machine for, I. Hahn	168,090
Ship yards, truss for, Jordan and Stevens	168,159
Shoe dressing, etc., Brown and Whiteside	168,220
Sign, D. D. Young	168,204
Sleigh, R. B. Parks	168,180
Soap, bleaching, P. Burns	168,223
Soda fountain, F. T. Paine	168,280
Soda water, draft tube for, J. C. Wharton	168,201
Spark arrester, W. Halsted	168,091
Spark arrester, W. G. Van Buskirk	168,299
Speaking tube, Campbell and Creighton	168,157
Spike and nail extractor, J. Passeno	168,281
Staves, machine for jointing, B. Barker	168,125
Stilt, F. Beaumont, Jr.	168,213
Stove, W. Burrows (r)	6,663
Stove, cooking, G. Comstock	168,084
Stove, heating, M. Roberts	168,289
Street sweeping machines, J. Edson (r)	6,658
Table, advertising, J. M. Plessner	168,254
Table, extension, Hantsche and Wagner	168,154
Table, folding, H. Baldwin	168,124
Table, kitchen, J. C. Ricketts	168,288
Tag fastener, T. P. Marston	168,267
Telegraph, automatic, T. A. Edison	168,243
Telegraph keys, L. S. Crandall	168,145, 168,144
Telegraph printing, E. Gray	168,219
Telegraph transmitter, etc., T. A. Edison	168,242
Thill coupling, W. Katon	168,160
Thill coupling, B. C. Walter	168,303
Thrashing machine, teeth, J. W. Waterman	168,305
Toy building block, G. H. Chinnock	168,229
Toy figure, articulated, C. H. Chinnock	168,230
Track lifter, G. W. Hunter	168,235
Trap and bend, Adee and Foley	168,121
Truss, L. T. Lubin	168,264
Tube, sheet metal, J. C. Mulligan	168,100
Tunnel, O. B. Dowd	168,146
Valve gear, H. J. Behrens	168,215
Valve grinder, L. P. Law	168,262
Vehicle axle, E. Ball	168,208
Vehicle hub, E. Ball	168,210
Vehicle spring, W. Beers	168,128
Vehicle spring, R. Walker	168,202
Vehicle wheel, E. Ball	168,209
Vehicle wheel tire, E. Ball	168,211
Ventilator for chimneys, P. Mihan	168,169
Wagon, E. Huson (r)	6,660
Wagon, ice, C. Rauch	168,183
Wagon reach, A. B. Wroth	168,212
Wash board, E. S. Heath	168,252
Washer and separator, gold, B. Tyson	168,116
Washing machine, D. B. Pond	168,283
Water, aerated sea, J. Matthews	168,269
Water trap, W. A. Butler (r)	6,664
Water wheel, H. Wilson	168,202
Wet stop mechanism, T. Isherwood	168,158
Well boring machine, R. H. Metaker	168,069
Whiffletree, P. McGlew	168,167
Windlass and capstan, D. N. B. Coffin, Jr.	168,189
Windmill, Stephens and Shay	168,294
Wrench bar heads, forging, O. C. Burdick	168,135

DESIGNS PATENTED.

8,663.—GLASSWARE.—J. C. Gill, Pittsburgh, Pa

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIII.—No. 19.
(NEW SERIES.)

NEW YORK, NOVEMBER 6, 1875.

\$3.20 per Annum.
[POSTAGE PREPAID.]

A POWERFUL CRANE.

Messrs. James Taylor & Co., of Birkenhead, England, have recently constructed and erected five large cranes, one of which was sent to Australia, the others being established, one at Greenock, two at Glasgow, and one at Dundee. Our engraving represents the last-named machine. It is nominally a 70 ton crane, but the test load is 90 tons, and the makers have no fear of putting 100 tons on it. It has already carried 80 tons, lifting that load with only two thirds of the allowed pressure of steam, and lowering on the brake with a nicety that would enable the most delicate adjustment of its load, in case of its being used in erecting marine engines, to be made with confidence.

The crane will deposit its load a clear distance of 40 feet from the face of the quay wall, or 56 feet from the center of the pedestal of masonry on which it is fixed. The head of the jib is 60 feet in perpendicular height from the coping of the pedestal.

The main features of construction are in the arrangement, by which the center post gives way to a central pin, only subject to direct upward tension, the whole crane acting as a lever to raise it vertically. The fulcrum is the ring of 60 rollers running on the cast iron and steel roller race on the top of the stonework, eight or nine of which at a time take the thrust at the foot of the jib, and constantly change as the crane revolves; and the resistance is the weight of the masonry secured by six massive radiating holding-down bolts by which the central pin is anchored.

The hoisting, says *Engineering*, from whose pages we select the engraving, is effected by two barrels, winding simultaneously the two ends of the chain, which lead from the barrels to pulleys on the jib head, thence drop to and rise again from the gin block, the middle or loop of the chain being on a fixed compensating pulley hung fast close below the jib head. The gin block weighs 4 tons. The winding barrels are grooved right and left, by which an even distribution of strains on the crane framing is secured. There are three speeds of lift, besides a separate crab with a single chain for light lift up to 10 tons. The hoisting engines are a pair of vertical direct acting engines with cylinders 10 inches diameter and 16 inches stroke.

The revolving is effected by a pair of smaller independent horizontal engines. The boiler is a vertical one, very large in proportion to the work to be performed, and is fed by an injector. All the valves and levers are easily within reach of one engine or crane driver. Wrought iron predominates in the structure, and is obviously the best material for the framing, the jib, the center pin, and all such important parts of the machine.

New Deodorizer.

A working man named Wilkes, residing at Bloxwich, England, has patented an intercepting process which does away with the necessity for sewers—so far as refuse matter is concerned—altogether. The vital principle of Wilkes's patent consists in effectually dividing the liquid matter from the solid. This is gained by the division of the receiving pan into two parts. The next point arrived at is the effectual

deodorizing of both liquid and solid. Liquid matter is allowed to flow into a receptacle filled with a powder. This powder so effectually absorbs the moisture and kills any effluvia that, notwithstanding the fact that the receptacle examined had been in use for some months, no offensive odor of any kind whatever was discernible, even under the most critical testing. Solid matter is received into a receptacle which may either be made in the form of a movable pan or

at the end so pure as to allow of its being used for scouring purposes. Whatever alkaline, greasy, or solid particles of any kind there may be are left behind amongst the powder in the tanks. The tanks in their turn are emptied, and a valuable manure secured.—*Birmingham News*.

Sewer Gas Dangers.

It is rarely that so striking an instance of the dangers of sewer gas as that reported by Dr. Trask, of Astoria, N. Y., in a recent number of the *Medical Record*, is brought to public notice. This physician states that a lady patient, shortly after confinement, was attacked with severe symptoms of fever and acute peritonitis. On the same day her son became sick with a severe continued fever, a week after a servant was taken with a similar malady, and so on through the members of a family of ten persons, only two of whom were excepted. After investigating every possible source of the epidemic, the doctor became convinced that it was due to the escape of mephitic gases from the mains of the house, and a long search finally brought to light an imperfect joint, which allowed the noxious emanations to pass up between the plastering and wall of the parlor. The family shortly afterward removed to another house, and here the health of all the members greatly improved; but on the other hand, the lady again became a sufferer with a chronic ailment. Another search, after she had undergone a tedious convalescence, proved that her illness was due to the same cause as before, this time produced by the choking up by ice of a soil pipe adjacent to her apartment. The medical aspects of the cases are peculiar, though not intelligible to the general reader. The report will, however, serve a good purpose if it suggests to people the overhauling of their drain pipes at once. During the winter, when pipes are easily blocked by frost, joints are liable to break or loosen and gases to escape, so that the present is the time to see that the entire house system is in perfect condition.

Molasses Manure.

We learn from *La Sucrerie*

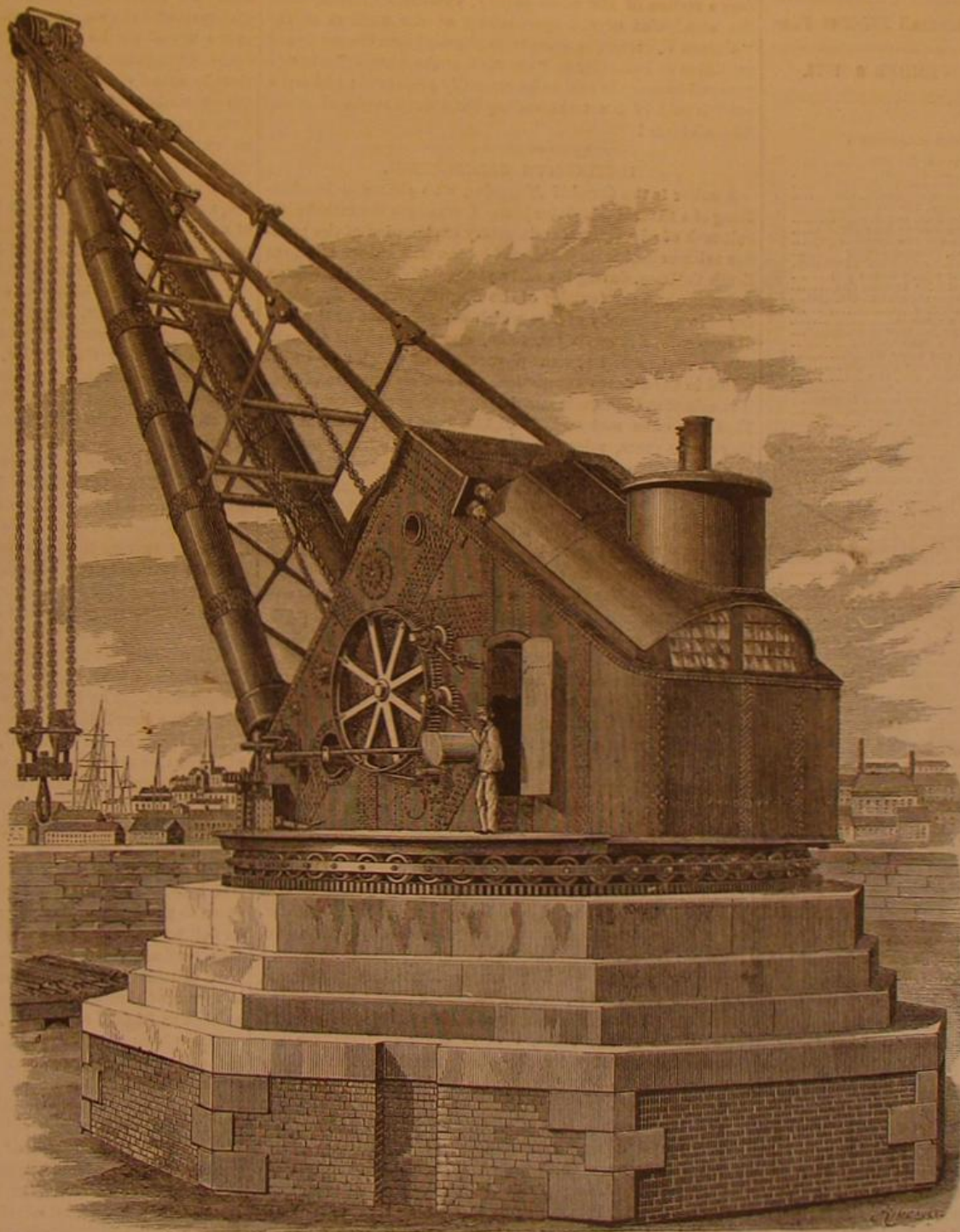
Indigène that, in consequence of the low price of beet molasses, attempts are being made in France to introduce it in the place of manure. It is used either in a liquid form, diluted with seven parts of water, or as a powder; and just at this moment it is cheaper than ordinary manure, while it contains all its essential elements in equal abundance. As soon, however, as the cold weather comes on, the molasses will again be required for cattle-feeding purposes, and will probably rise to a price at which it would be useless for manure.

While tunneling into the side of Mount McLellan, Colorado, recently, the explorers came upon ground solidly frozen ninety feet from the surface. The question is how the frost got in, as there was no crevice through which it could enter.

IRON may be cemented in wood by dropping in the recess prepared in the latter a small quantity of a strong solution of sal ammoniac. This causes the iron to rust, rendering it very difficult to extract.

TAYLOR & CO'S STEAM CRANE.

a fixed chamber, to be emptied periodically. On the solid matter the powder is sprinkled either mechanically, as in the case of Moule's earth closets, or by hand. In either case, no odor whatever can be detected. When the receptacles are full, they can be emptied either by day or by night, for there is no unpleasant smell perceptible. The refuse matter is taken away, and laid in heaps to dry. After this, it is pulverized, and can be sold as a most valuable manure at as high a rate as \$26 per ton. The manure itself, when ready for transport, has the appearance of fine cement, and it is also devoid of odor. With reference to the powder spoken of, it is simply the result of calcining the contents of vegetable refuse and ashpits. It is much more effective than dry earth, and costs a mere trifle. The patent also embraces a very ingenious method of dealing with slops taken from the house, whether greasy water, soap-suds, or whatever they may be. The great feature, in short, throughout the system, is to obviate the necessity for anything in the shape of sewers. The apparatus for disposing of slops consists of a very simple set of filters, the water in its passage percolating through two small tanks filled with the powder, and exuding



Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

A. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included.....\$3 20
One copy, six months, postage included..... 1 60

Club Rates.

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included..... 2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXIII, No. 19. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, NOVEMBER 6, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

Air and spirits (51).....	299	Lathe, power for (39).....	299
American Science Association (7).....	299	Life-saving device.....	299
Ammonia, to make (47).....	299	Locomotive engineers, etc. (38).....	299
Answers to correspondents.....	299	Locomotive engineers, the.....	299
Aphelion, the earth's (3).....	299	Locomotive, the Weston.....	299
Arctic explorations, recent.....	299	Magnetic files, etc. (75).....	299
Astronomical notes.....	299	Magnetization of limonite.....	299
Baldness, premature (46).....	299	Magneto-electric machine (19).....	299
Batteries, construction of (16).....	299	Mattress, life-preserving.....	299
Battery, effluence of (15).....	299	Mechanical engineers' education.....	299
Bells, repairing (45).....	299	Metal tube for heating (33).....	299
Bird pepper (71).....	299	Microscope objectives, etc. (14).....	299
Boats, paddle wheels for (2).....	299	Milk, solidified.....	299
Brakemen, a lesson for.....	299	Molasses manure.....	299
Business and personal.....	299	Mortising and boring machine.....	299
Calculation, instinctive.....	299	Mountains, the origin of.....	299
Campfire (29).....	299	Opacity and color (8).....	299
Collars, watertight (13).....	299	Paint and water glass (56).....	299
Cementing iron to wood.....	299	Paper boats, etc. (41).....	299
Cementing leather (67).....	299	Patent decisions, recent.....	299
Chimneys, bad draft in (25).....	299	Patents, American and foreign.....	299
Cockatoos, black.....	299	Patents, official list of.....	299
Copper and ammonia (72).....	299	Patents, ribbons on (44).....	299
Cork-leather, a new fabric.....	299	Perfume, new.....	299
Cranes, a powerful.....	299	Phosphorus lamp, the (65).....	299
Deodorizer, new.....	299	Phrenology a science (40).....	299
Diving bell and grapnel.....	299	Pigeon post, a transatlantic.....	299
Drying yeast (61).....	299	Poppy red dye.....	299
Earth pits.....	299	Psycho mystery, the.....	299
Electrical condensers (16).....	299	Railway, new elevated.....	299
Electric annunciators (17).....	299	Refrigerating machine, Teller's.....	299
Electric force and magnetism.....	299	Rope, strength of.....	299
Electro-magnets, charging (15).....	299	Rope, weight of (24).....	299
Electro-magnets, slow (76).....	299	Saw teeth, trimming.....	299
Electro-plating (34).....	299	Sewer gas dangers.....	299
Engineer's profession (73).....	299	Smoke condenser, new.....	299
Engine for sawing (21).....	299	Smoke stack, proportions of (36).....	299
Explosive compound (69).....	299	Soap, soda (52).....	299
Evolution, the goal of.....	299	Speculum metal (11).....	299
Fibers, pineapple and banana.....	299	Steel ingots, casting large.....	299
Fire pots, whitening (37).....	299	Steel manufacture, the Sheffield.....	299
Fireproof rug, a (15).....	299	Steel process, the Bessemer.....	299
Fireproof safes, filling for (59).....	299	Stone arrow heads (74).....	299
Fish plates, railway, securing.....	299	Stove brick (66).....	299
Flowerpots.....	299	Teeth, killing nerves of (57).....	299
Flux for alloys (1).....	299	Telegraphy in India, quadruplex.....	299
Food to work, the relation of.....	299	Telescope lenses (6, 9, 10, 11).....	299
Frozen soil, deep.....	299	Thermometer difficulty, a (63).....	299
Fruit preserver, a (23).....	299	Too much of a good thing.....	299
Gage pipes, water (20).....	299	Two ferriering pictures (40).....	299
Garters, electric (43).....	299	Varnish for paper (55).....	299
Gases, absorbent powers of (48).....	299	Varnish, paraffin (49).....	299
Glue, hardening (58).....	299	Walls, thief-proof (12).....	299
Gold, coloring (64).....	299	Water motor, noise (26).....	299
Hair, removing (78).....	299	Water power for sawing (27).....	299
Harness blacking (62).....	299	Waterproof cloth (54).....	299
Heater for dwellings, steam.....	299	Water supply (31).....	299
Horse power, nominal (5).....	299	Water wheel power (40).....	299
Houses, new, occupation of.....	299	Wheatstone, Sir Charles.....	299
Iguana family, the.....	299	Wire gages (16).....	299
Induction coil (30).....	299	Writing on gold (60).....	299
Inventions patented in England.....	299		
Iron, writing on (50).....	299		
Joints, universal (25).....	299		
Lathe power connections (38).....	299		

THE GOAL OF EVOLUTION.

"Her 'prentice han' she tried on man,
And then she made the lassies, O!"

So the gallant Burns sang of mother Nature, intending to compliment the lasses. Had he lived till this more scientific age, he might have stayed his hand, or else have had the lasses fashioned first. The handiwork of Nature seems to have lost care or cunning toward the last.

In the details of the skeletons of the other animals, says Professor Cleland (in his address as Vice-President of the Department of Anatomy and Physiology at the late meeting of the British Science Association), one sees the greatest precision of form; but there are various exceptions to this neatness of finish in the skeleton of man. Witness the variations of the breast bone, which, especially in its lower portion, is never shapely, as it is in the lower animals; witness the coccygeal vertebra, which are the most irregular structures imaginable; even in the sacrum and the rest of the vertebral column, the amount of variation finds no parallel in other animals. In the skull, except in some of the lower forms of humanity, the *dorsum sellæ* is a ragged, warty, deformed, and irregular structure, never exhibiting the elegance and finish seen in our poorer relations. The curvature of the skull and the shortening of its base, which have gradually increased in the ascending series of forms, have reached a degree which cannot be exceeded; and the nasal cavity "is so elongated vertically that, in the higher races, Nature seems scarcely able to bridge the gap from the cribriform plate to the palate, and produces such a set of unsymmetrical and ragged performances as is quite peculiar to man." Other examples of similar conditions, he tells us, will occur to every student of human anatomy.

Thus it would appear that man, the highest product of evolution, is physically the least perfectly finished. His bony framework is more open to variation than that of the lower types of the animal world. This fact would seem to indicate a certain newness of character, as though Nature had not yet had time to settle down to stereotyped forms of

human detail. To some it might also hint of possibilities of further development, perhaps of the evolution of human or superhuman, yet animal, types which may surpass the present human as that does the antecedent brute. Professor Cleland, on the contrary, sees in them curious indications rather of the "formative force nearing the end of its journey." Animal life, he thinks, has reached its preordained climax in humanity, and that the future progress of evolution is to be traced from man, not to other animal forms yet to appear, but through his physical (qy. psychical?) nature into the land of the unseen.

The reasons for this sudden spring into ether do not clearly appear, the only hint of a physical basis for it lying in the observation that the variations of structure which have been noted are principally to be found in the head, the part of the body most closely connected with the development and expression of the mental character.

Just here we may note a singular circumstance in connection with the present stage of discussion in regard to the possibilities of human progress, individually and collectively considered. Last year, from the standpoint of matter, Professor Tyndall traced the line of individual evolution into the infinite azure, where personal identity is lost; and half mankind were set by the ears in consequence. This year, before a section of the same society, Professor Cleland, from the standpoint of the speculations of the authors of the "Unseen Universe," argues from physical data the continued evolution of humanity in "the land of the unseen," wherein personal identity is said to be eternally preserved: and not a word is said of his transcending the strict domain of scientific inference!

INSTINCTIVE CALCULATION.

A writer in the *Cornhill Magazine*, who claims to be something of a natural calculator himself, attempts the rather difficult task of advancing a satisfactory explanation of the peculiar arithmetical feats performed by the well known engineer Zerah Colburn, during his early youth. Mr. Colburn was an American and the founder of the English journal, *Engineering*. In a biography of him which we published at the time of his death, five or six years ago, we mentioned his remarkable mental precocity, some phenomena of which may be recalled in the present connection. When eight years of age, it is said that Colburn instantly answered such questions as: Find the cube root of 268,335,125, how many seconds are there in 48 years, raise 8 to the sixteenth power, and others of similar difficulty, which even the most expert of mathematicians would have been unable to solve by any mere mental process. In looking for parallel cases of children with like abilities, we find three others, something regarding each of which it is well to note before passing to the consideration of the possibility of an explanation.

In 1839, Vito Mangiamela, a Sicilian boy eleven years of age, was examined by Arago and several other eminent members of the French Academy of Sciences. To him, questions equally knotty with the above were given, and these together with such posers as: "What number complies with the following propositions: that if its cube be added to five times its square, and then forty-two times the number and the number forty be subtracted from the result, the number is equal to zero." To this the boy gave the correct answer, (five) just as the questioner had repeated the sentence for the second time. An earlier case is that of Jedediah Buxton, a child almost totally uneducated. Of him it is related that if he heard a sermon or other speech he instinctively counted the words; if a period of time were mentioned in his hearing, he computed the seconds; or if he walked over a piece of ground his mind was busily employed in calculating the number of inches. He solved mentally such a problem as: How many cubical eighths of an inch are there in a quadrangular mass which measures 231,145,789 yards long, 5,642,732 yards wide, and 54,965 yards thick? And besides, he possessed the curious faculty of being able to suspend his calculations at any point, turn to other subjects for any length of time, and yet resume his mental work at the proper place. Like Mangiamela, he could give no account of how he accomplished his task.

The last instance is that of George Parker Bidder, who subsequently became a noted English civil engineer. His gift lay more in a natural taste for figures than through the instinctive calculating power which Colburn, Mangiamela, and Buxton possessed. He accustomed himself to count up to 1,000,000, and thus became familiar with large numbers. He besides was an inventor, and devised new arithmetical processes. From all accounts it would seem that, his was an acquired power, aided of course by natural genius, and this view finds further corroboration from the fact that in after life, Bidder retained his abilities, while the other three individuals lost theirs. In 1856 he gave an account of how his operations were worked, which goes still further to show them to be the results of acquired skill, more especially as neither Colburn, Buxton, or Mangiamela were ever able to give any explanation whatever of their mental processes. Bidder, therefore, is hardly to be considered in conjunction with them.

To return now to the *Cornhill Magazine* writer and his theory, the latter is essentially that the calculator does not regard the numbers set before him as abstractions, but rather as definite groups of concrete objects, as, for example, dots. The mental process required then to multiply 24 by 3 is to picture 24 as two columns of dots of ten each, and one column of four. To multiply by three, the imperfect columns are imagined as brought together, making one column of ten, and two over. The one is added to six columns pictured at the same time, making seven columns of ten, and one of two, that is, 72. We need not explain the supposed

method of division, as it is essentially similar; for we believe the objection will at once occur to the reader that this plan cannot answer for dealing with great numbers, as it can in no wise be conceived that any mind can form a perfect picture of millions multiplied or divided by millions. It is very possible for the mind to be trained so as to conceive detail to an astonishing degree; and imagination, in conjunction with memory, in some people will reproduce scenes with every feature intact, of which only the most salient characteristics would remain fixed in the average mind. Robert Houdin, the French conjurer, could walk quickly past a shop window once, and then name every article in it, and the size, color, and position of each. This was purely acquired, though Houdin had the ability to make the acquirement in the beginning. Every artist who produces a design draws upon the same faculties; so do skilled chess players, who are able to play a dozen or more games at once; so do musicians, who can hear a harmony or melody by looking at the printed score. All of these instances we should class with Bidder, but not with Colburn or the other two mentioned.

What Turner was in color and Mozart in music, we believe Colburn and his peers to have been as regards numbers. Turner's perception of gradation of color—not mere light and shade, but color—was instinctive, purely inborn. He felt color, not outlines or form; and no one, before or since, in that respect has ever approached him. Mozart felt music; at the age of six he could compose difficult harmonies; he could distinguish accurately and instantly announce variations in sound equal to one sixty-fourth of a tone. Now no one pretends to explain Turner's coloring or Mozart's music from a mental standpoint, for the simple reason that there is no explanation. Both artists were born with wonderful gifts, gifts as inexplicable to their possessors as they are to the average man; and there the matter rests. Colburn, Buxton, and the Sicilian boy had a like sensation of the relations of numbers. They went through a kind of calculating process, probably as instinctively as Turner handled a brush to place his colors, or Mozart moved his fingers to grasp the chords of the harpsichord or organ. This mental operation, we believe, however, was unconscious cerebration; and the same genius or instinct, or whatever term by which we may agree to designate the faculty, which rendered it unnatural for Turner to make inharmonious contrasts, or Mozart to strike discords, prevented Colburn and the others from false calculation, and caused them to feel, as it were, the relations of numbers.

PINEAPPLE AND BANANA FIBERS.

It is from the fiber of the pineapple that the natives of the Philippines weave the celebrated web *nipis de piña*, considered by experts the finest in the world.

In his travels in that promising but badly managed Spanish colony—all Spanish colonies are badly managed, for that matter—the German traveller Jagor had the good fortune to witness the process by which the fiber is prepared.

When plants are intended for the growth of fiber, the fruit is not allowed to ripen, the leaves thereby taking on a larger development. The fiber is separated by hand. A leaf is placed on a board on the ground, with hollow side upwards. Sitting at one end of the board, a woman holds the leaf firmly with her toes and scrapes its outer surface with a potsherd, using the rounded edge of the rim.

The scraping reduces the leaf to rags, disclosing a layer of coarse fiber running lengthwise of the leaf. This is dextrously lifted up and drawn away in a compact strip; after which the operator scrapes again until a second fine layer is laid bare. Then turning the leaf round, she scrapes its back down to the layer of fine fiber, which she quickly draws to its full length away from the back of the leaf. The fiber is then washed, dried in the sun, combed, and sorted. It is from material thus crudely prepared that the *nipis de piña* is woven, of such exquisite fineness that robes of it are valued as high as \$1,500, at Manila.

The pineapple fiber is also exceedingly strong: a cable 2½ inches in circumference has been known to endure a test strain of over 6,000 pounds.

Another noted fiber, Manila hemp, takes its name from the chief city of the Philippines. It is not hemp, however, but the fiber of a species of banana, which does not differ greatly from the edible banana, and is probably a variety of the same species. Thus far, according to Jagor, the serviceable fiber has been exclusively obtained from the southern portion of the Philippines, all attempts to make its cultivation profitable in the western and northern provinces having failed. A species of banana grows in great luxuriance in Western Java, but it has not been utilized as a fiber plant to any great extent. Great efforts have been made in the Celebes to cultivate this fiber, but Bickmore repeats that it has been abandoned in favor of coffee, which is found to be far more profitable. For domestic purposes, the banana fiber—known to commerce also as *abaci*—is made use of in many tropical countries, and in time will doubtless be largely supplied; but for the present the supply comes, as already stated from the Philippines.

The plant thrives best on the shaded forest-covered slopes of volcanic mountains, such as abound in Albay and Camarines: on level ground not so well, and on marshy land not at all. The plant requires, on an average, three years to produce its fiber in a proper condition. For the first crop only one stalk is cut from each bunch; later on, the new branches grow so quickly that they can be cut every two months. In full growth the yield is 30 cwt. to the acre, whereas from an acre of flax not more than 4 cwt. is obtained. After the plantation is once established, the plants flourish without any care or attention, the only trouble being to collect the fiber. One plant may yield as much

as two pounds of fiber, but the average is not more than a pound; on indifferent soil much less.

Several grades of fiber are derived from different parts of the leaf stalk, the edges yielding the finest. The fiber, which lies next the surface, is stripped off by hand in broad bands, and then softened by being drawn backwards and forwards between a broad bladed knife and a block of wood. One worker cuts up the stalks, strips off the leaves, and attends to the supply; the second, frequently a boy, spreads out the strips of fiber; the third draws them under the knife. The coarse fiber is called *bandala*; the finer, *lupis*. The former is chiefly used for ships' rigging; the latter is employed in weaving. The three finer grades of *lupis* are further softened before weaving by being pounded in a rice mortar. Generally the first or finest sort is worked as wool with the second as warp, and the third as warp with the second as wool. The fabrics so woven are nearly as fine as the *nipis de pina*. For purity, flexibility, and color, the finest of these banana stuffs are said to compare with cambric as cardboard does to tissue paper. According to Jager the finest stuffs require so great an amount of dexterity, patience, and time in their preparation, and are consequently so expensive, that they cannot compete with the cheap machine-made goods of Europe. Their fine warm yellowish color also is objected to by European women accustomed to linen and muslin strongly blued in the washing. By the rich half castes, however, who understand the real goodness of their qualities, they are highly appreciated. In the regions where abaca is cultivated, the entire dress of both sexes is made of coarse banana cloth called *guinara*. For foreign markets, still coarser and stronger fabrics are prepared, such as crinoline and stiff muslin, used by dress makers.

It is as an article for exportation, however, that the fiber is of the most importance commercially. In 1871 over 600,000 cwt. were exported, nearly three fourths coming to this country. It is very largely used in the manufacture of paper.

THE ORIGIN OF MOUNTAINS.

Mountains have been explained by two widely different suppositions. One is that they are due to sediments deposited under water from the erosion of a wasting continent, which by upheaval have become mountains. The other is that they are due to uplifts, as the result of lateral pressure caused by shrinkage of the earth's interior. For the last fifteen years or more, these conflicting views have each been held by geologists of undisputed authority; and "when doctors disagree, who shall decide?" is the old question which remains still unanswered. This uncertainty in all moral reasoning, when we have to balance probabilities, is a great source of discomfort to the youthful student; and in perhaps no department of human inquiry is this more true than in the field of Science, for what is highly probable today may be shown in the light of advancing Science to be highly improbable tomorrow. And in reply to the oft-repeated question of the young student: "What is the use of learning as truth today what may be rejected as error tomorrow?" it may be said that all the successive theories of advancing Science are stepping stones which may eventually lead to the undoubted truth. We see use in taking the first faltering and ill-advised steps in any avocation, though we soon reject these for others more conducive to the end desired.

Without attempting a decision, we propose in this article only to state some of the main points in the arguments *pro* and *con*, and leave all to decide for themselves as to which is the more reasonable.

We would naturally conclude that, if mountains are due to lateral pressure, they would be formed by the uplifts or elevations of the earth's crust. But this is seldom the fact, for several reasons. According to Professor Dana, many if not all mountains have their origin in the bending down of the crust. As the crust subsided, the trough was kept full of water, which continually deposited sediment. This deposition about kept pace with the rate of subsidence. In this manner, many of our mountain ranges were, in the earlier ages, taking the initiatory steps in the process of mountain making. As the crust subsided and was covered to a great depth with an accumulation of eroded material, it would be weakened by the earth's internal heat. An addition of several thousand feet of sediment to the surface would bring a given degree of heat so many thousand feet nearer the surface. This would often be sufficient to soften or melt the sustaining crust, which would then yield before the lateral and vertical pressure combined, and cause the crusts on the sides of the trough to fold over and approach each other above it, thus crushing the sedimentary beds into a narrower space, with the necessary result of elevating the crushed and folded strata in the middle.

The Appalachian chain illustrates the fact that one mountain system may be formed by several successive depressions, accompanied with the deposition of eroded material. Professor Hall attributes the cause of mountain making to sedimentary accumulations, which, by their weight, are sufficient to cause a depression in the crust. Thus, by the addition of 40,000 feet of sediment, the crust would sink the same number of feet. Then, by a subsequent elevation of the crust, the accumulated strata would be raised into a mountain, independent of lateral pressure. He just reverses the idea of Dana, by making the subsidence a consequence of sedimentary accumulations, instead of the accumulations a consequence of subsidence. To this Dana objects, because "the earth's crust would have to yield like a film of rubber to have sunk a foot for every added foot of accumulation over its surface, and mountains would have had no standing place."

Another reason why the elevations due to lateral pressure

do not produce the high mountains appears in the fact that, when a series of strata is sharply bent upwards—forming an anticlinal—the outer strata are fractured and strained apart, while the strata which are bent downwards—forming a synclinal—present to the surface a firm and compact mass. This can be clearly shown by making a sudden bend in a walking stick. The fibers of the outer curve will be torn asunder, leaving a splintered and ragged surface, while on the inner curve they will become unusually dense and firm. The fractured edges of the anticlinal curve are in a favorable condition to be worn away by water, while the compact surface of the synclinal, though forming the valleys, where the greatest amount of running water would act upon it, suffers but little erosion. The consequence is that the elevated strata are worn away even below the level of the original valleys, and the latter become the elevations. This can be proved by noticing that the strata visible on the sides of most valleys and hills are not parallel to the sides, but are nearly at right angles to them.

The mountains formed by depressions of the crust were far more common in the early history of sedimentary deposit, for the crust was then comparatively thin, and hence more yielding to lateral pressure. But after the crust became thickened beneath by the cooling of the earth, and more rigid by the accumulation of strata above and by previous plication and solidification, the mountains formed were largely due to uplifts of very wide extent carrying the stratified deposits with them. Our Rocky Mountain system was formed by these uplifts in the tertiary age, and it is probable that coral island subsidences in the Pacific Ocean accompanied the continental elevations.

The adherents to the accumulation theory—among whom are Hall and Hunt on this continent, and Scrope and Lyell in Europe—have noticed that, in mountainous districts, the elevations are less than the aggregate thickness of the strata, while in non-mountainous sections the heights correspond to the thickness of the strata. If the latter were equally true in mountainous districts, the Appalachian Mountains would attain a height of forty thousand feet. Mr. Hall holds that these barriers are due to original deposition of materials, and not to any subsequent forces breaking up or disturbing the strata of which it is composed; and that upheavals and contortions of strata are only accidental and local. In this view he is sustained by Montlosier and Jukes. He also claims that the direction of mountain elevations is determined by accumulations along the sides of oceanic currents or shore lines. Dana, on the other hand, considers the northeast and northwest trends of most of the mountain and shore lines on the globe to be the result of cleavage in the earth's crust, and to indicate lines of weakest cohesion, like cleavage planes in crystals.

The accumulation theory supposes that, after a vast amount of material has been deposited in successive strata under water, a great continental upheaval brings the whole mass high and dry above the water line; and the present mountains are the stratified deposits which have escaped denudation by the action of frosts and floods. We have good illustrations of this process of erosion in the Missouri River valley, where the elevated land is being constantly washed away, forming deep ravines and abrupt ridges, and is carried into the muddy Missouri, and deposited in the deltas at the mouth of the Mississippi, thus adding constantly to the territory of Louisiana. As Egypt is said to be a gift of the Nile, so Louisiana is a gift of the Missouri. The effects of erosion, on a small scale, can be seen on the sides of deep railroad cuts, where miniature mountains and valleys are formed by the washing of water as it runs down their slopes.

Professor Le Conte opines that these opposing theories result from the loose use of the word mountain. He treats the whole subject under the two heads of mountain formation and mountain sculpture, and claims that the true mountain chain, or the convex plateau which constitutes it, is due only to foldings of the crust, and that those elevations which are left by the erosive action of water are not mountains, but simply sculptured continental elevations.

The effect of shrinkage and of erosion can be fairly seen on a small scale by the following artificial contrivance: Take a well filled bladder or toy rubber balloon, and cover it completely with several successive coatings of tallow, glue, plaster of Paris, or other substances that will harden after they have been put on in a plastic state. These will represent the stratified crust. Then by withdrawing some of the air from the bladder, which will answer to contraction of the nucleus, the crust will become rigid, furrowed, and fractured by lateral pressure, like the crust of the earth. Now by allowing a well regulated stream of water to flow over the surface of this, we can see many of the phenomena of erosion, like those apparent on the earth's surface.

Sir Charles Wheatstone.

This distinguished inventor died in Paris, France, on the 20th of October last. He was born at Gloucester, England, in 1802, and in early youth was engaged in the manufacture of musical instruments. With the object of improving upon these, he was led to study the laws of sound; and thus imbibing a strong taste for physical science, he proceeded to the investigation of the phenomena of optics and subsequently of electricity, on the velocity of which he published papers in 1834, detailing many very striking and new experiments. In the same year he was appointed Professor of Experimental Philosophy at King's College, London.

Previous to this time William Fothergill Cooke, in Heidelberg, Germany, had completed his first telegraphic invention, based on the electrometer form, had followed it with two me-

chanical telegraphs, and soon after came to England to introduce the telegraph system on railroads. His efforts at first pointing towards success were, however, nullified by a pneumatic signal apparatus, to which the railway people gave preference; but instead of being disheartened by his failure, the inventor began new experiments, regarding which he sought the advice of Faraday. The latter referred him to Wheatstone, and then, in 1837, began that partnership which has sent the names of the two inventors to posterity, indissolubly linked. It was Wheatstone's great learning, combined with Cooke's inventive genius, that evolved the succeeding discoveries in the telegraph. "Mr. Cooke," says Brunel, "is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the electric telegraph as a useful undertaking, promising to be a work of national importance; and Professor Wheatstone is acknowledged as the scientific man, whose profound and successful researches have already prepared the public to receive it as a project capable of practical application."

Invention now rapidly followed invention: the first was a discharger and secondary circuit to be applied to Cooke's original alarm; then combinations of all the various improvements; then a new mechanical telegraph, Wheatstone's work; then another telegraph, having a revolving index hand on a fixed dial, a new device of Cooke's; besides others, all devices of remarkable ingenuity, and the subjects of several patents in England. On the 12th of June, 1837, the inventors received their first English patents, and on the same date obtained an American patent on the electro-magnetic telegraph. This, however, was of no benefit to them, as the apparatus was never practically employed in this country, Professor Morse's instrument, as is well known, being the chief one in use from 1844 to 1846.

Wheatstone was a Fellow of the Royal Society, and twice received the medal of that association for his discoveries. Both himself and his co-laborer Cooke received the honor of knighthood in recognition of their public services.

SCIENTIFIC AND PRACTICAL INFORMATION.

POPPY RED FOR ARTIFICIAL FLOWERS.

Thin cotton tissues are brushed over with a mixture of corallin lake ground up with water and thickened with gum, 75 grains of calcined magnesia per quart being added before use.

NEW PERFUME.

The local committee in Tahiti have sent to Paris the odoriferous bark of a yet undetermined plant, known over the Society and Pamotons islands by the name of *marie*. It can be advantageously employed in the preparation of the perfume known as new-mown hay.

SOLIDIFIED MILK.

A sample of condensed milk, weighing about 1 cwt., has been exhibited at the rooms of the Society of Arts, London, and an interesting experiment made thereon. This mammoth piece of solidified fluid was prepared by Hooker's process. It had been exposed to the action of the air for four years and three months, yet its quality was still so excellent that in a few minutes it was resolved, by churning, into good fresh butter. The trial was only one of a series made at the International Exhibition, South Kensington, and elsewhere. In each case the same satisfactory results were obtained.

QUADRUPLIX TELEGRAPHY IN INDIA.

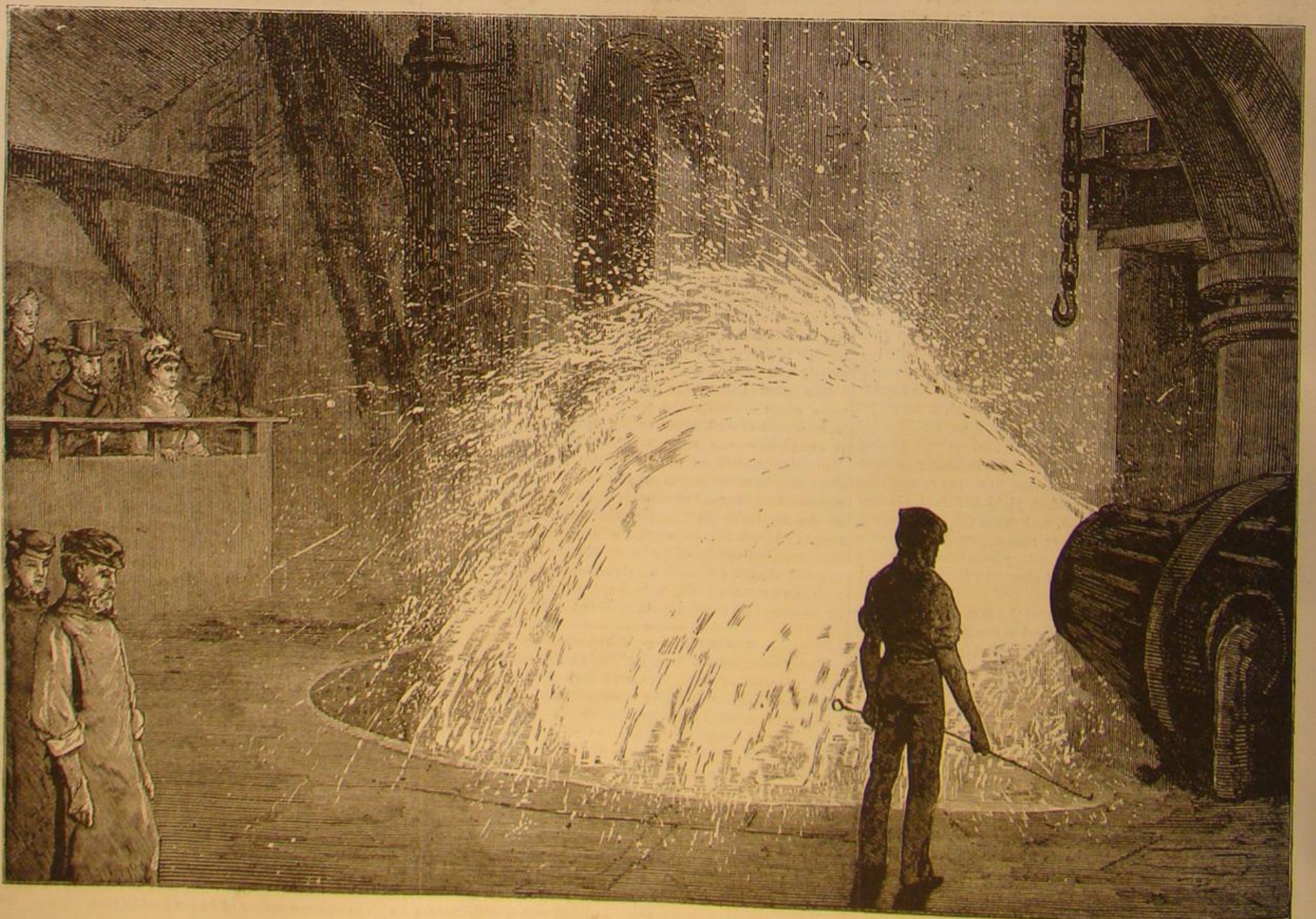
It will interest our readers, says the *Indian Daily News*, to learn that quadruplex telegraphy—that is, the art of sending four messages, two in each direction, simultaneously, by means of one wire—has this week been accomplished on the Madras Railway Telegraph. The system which Mr. Winter, the telegraph engineer, invented in March last, proved perfectly successful on eighty miles of line, and its extension to lines of greater length is simply a question of additional condensers and battery power. The principle of sending two messages simultaneously in the same direction, on which this quadruplex system depends, was successfully worked between Salem and Madras on April 16, but unfortunately other duties prevented Mr. Winter's carrying out the duplexing of this principle until the last few days.

THE WESTON LOCOMOTIVE.

A new engine, built by the Baldwin Locomotive Works of Philadelphia, has been put on the Boston and Albany Railroad for trial. A saving of fuel of generally over 30 per cent is claimed. This is effected by means of a peculiar firebox. In most locomotives, the long flues or pipes connecting the furnace with the smoke stack are directly opposite the door, and much of the fine coal is caught by the draft as soon as thrown into the furnace, and comes out of the smoke stack in the form of dust and sparks. With this boiler, however, the invention of a man named Weston, a firebrick arch over most of the furnace keeps down much of the fine stuff, and what does escape has to pursue a zigzag course through a consuming box—where the particles are stopped, and even the smoke is consumed—in front of which are the flues, only six feet long instead of a dozen, as in an ordinary engine. This much for economy of fuel; and to provide still more for comfort, the smoke stack contains an arrangement by which what few sparks do get that far are carried off to the ground by pipes running beneath the engine. The locomotive is higher than most, and is extremely well proportioned. This is rather a small one, having a cylinder 16 inches in diameter, with a stroke of 22 inches, and driving wheels five feet in diameter. H. B. Klinger, who has it in charge, has been running it on the western end of the road, and comparing its work with that of the company's engines, with an average saving of 46 per cent in fuel.



CASTING LARGE STEEL INGOTS FOR HEAVY ORDNANCE.



THE BESSEMER STEEL PROCESS.—EMPTYING A CONVERTER

THE SHEFFIELD STEEL MANUFACTURES.

Most of our workers in iron are familiar with the name of Thomas Firth & Sons, of Sheffield, England, whose tool steel bears such a high reputation in this country. Mr. Mark Firth, the head of the firm, is this year Mayor of Sheffield, and has signalized his term of office by presenting the people with a magnificent park, paying the whole expenses (over \$500,000) from his own pocket. The park was recently opened, with great rejoicing, by the Prince and Princess of Wales, who took an opportunity of inspecting several of the most remarkable of the steel works of the very grimy and very prosperous city.

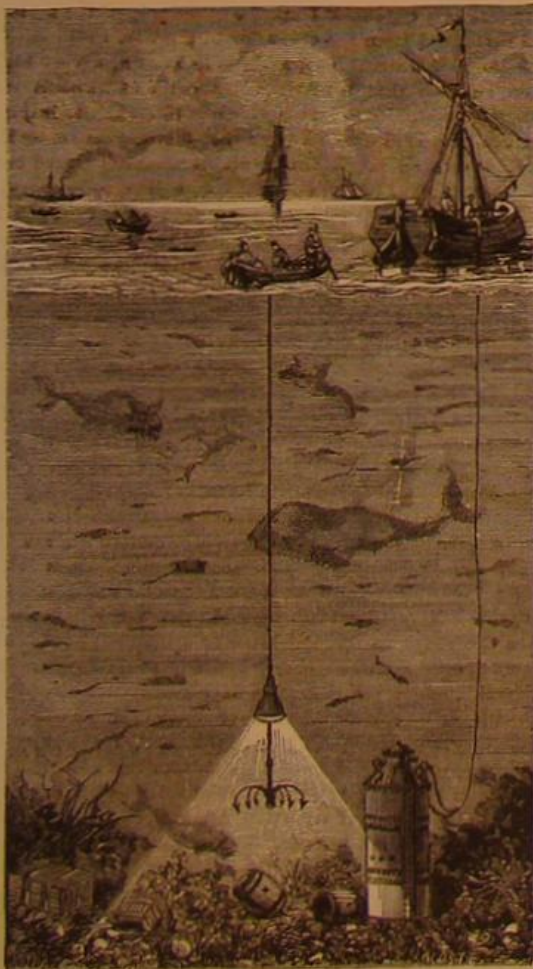
Our first engraving represents a scene in Messrs. Firth's works. An ingot for making the interior tube of an eighty ton gun is being cast, the gun, as we have already explained, consisting of a tube of fine steel surmounted by welded coils of wrought iron. The steel is melted in crucibles, which are brought to the founding pit on wheeled trucks, as shown in our engraving. By this means, ingots of nearly any weight and of the highest purity can be readily cast; and they are then forged into shape by immense steam hammers. We have frequently spoken of the large hammer, erected at Woolwich for welding the iron coils on these large cannon. This implement cost about \$250,000, and the falling portion weighs 40 tons, its force being increased by the use of steam to give it additional velocity. Messrs. Firth have recently erected a similar hammer in their works at Sheffield. But the greatest of all is being built at Krupp's works at Essen, where \$1,000,000 is being expended in building the largest hammer yet conceived, even in this age of Cyclopean wonders.

It is found that tubes for ordnance must be of pure steel, but softness of the metal is a requisite, a hard metal being too brittle to sustain the concussion of the large charges of powder used in these guns. The milder steel is tenacious, and has been proved to be almost indestructible by wear.

The Bessemer steel process is very largely carried on in Sheffield, the works of Sir John Brown & Co., Vickers & Co., and many others being largely in this manufacture. The second engraving on the opposite page represents the emptying of a Bessemer converter of its charge, after the metal has been brought to the required condition by the injection of the air blast. The proportion of carbon present in the metal is ascertained by the spectroscope, the moment for stopping the blast being ascertained by the use of that instrument with marvelous nicety.

DIVING BELL AND GRAPNEL.

We have already described M. Toselli's grapnel for raising heavy and valuable articles from the bed of the sea; and we now publish an engraving showing some recent improvements and new uses for this very ingenious apparatus. A diving bell, constructed of iron and bronze and weighing 3½ tons, is used; it is about 4 feet in diameter and 14 feet in height. The diver enters at the top, the lid on the dome being raised for the purpose, and the upper part is wholly out of the water when the bell floats, which gives an easy entrance to and exit from the apparatus, the bell not needing to be suspended by a crane. When the diver has entered the



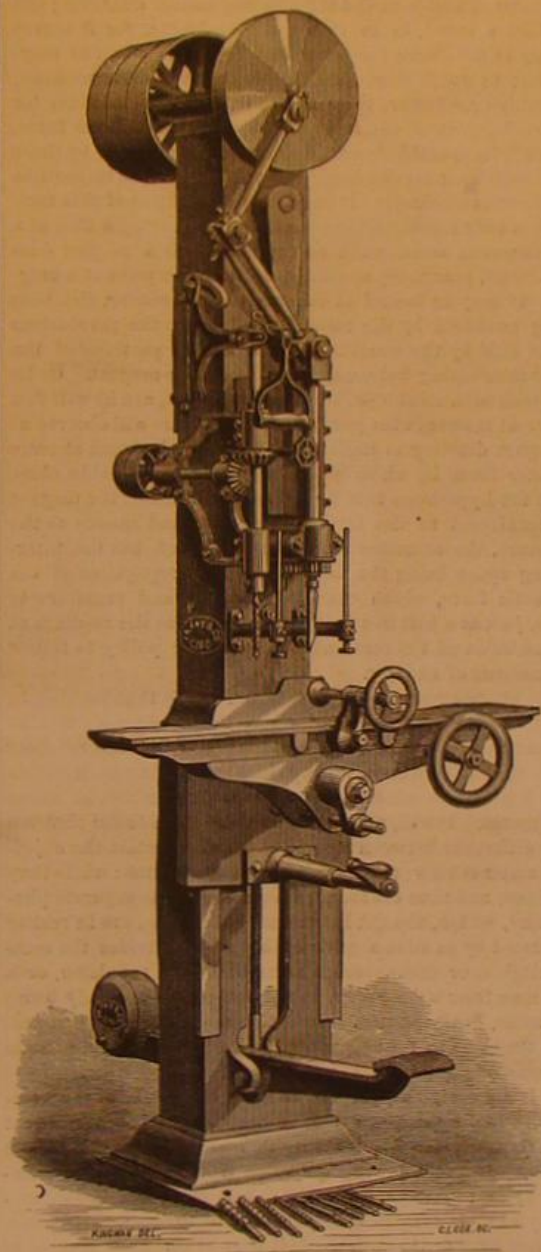
bell and closed the lid, he descends by allowing the water to enter the lower part of the cylinder, and he can come to the surface by ejecting the water by means of a pump placed inside the bell. Thus no rope or tackle is used, and the only necessary connection between the bell and the attendant boat is a telegraphic wire, shown in our engraving.

At a distance of 5 feet from the bottom of the bell are placed bullseye glasses, guaranteed to resist a pressure of 60 atmospheres, equivalent to over 300 fathoms of water. At a depth of over 55 fathoms, the darkness is such that artificial light is necessary, both for taking observations and for directing the operations of the grapnel, which is provided with a submarine lamp. The bell is made double, the space between the circular walls being a magazine for fresh air; and two men can remain all day in the bell without further supply from above. Ample arrangements are made for absorbing the products of respiration.

The whole system seems to be complete and efficient, and in employment for coral, pearl, and sponge fishing, as well as for wrecking and salvage purposes, it will probably be found very valuable.

J. A. FAY & CO.'S MORTISING AND BORING MACHINE.

The operation of mortising is one which has, to a large extent, engaged the attention of producers of woodworking machinery, and the numerous difficult problems in connection therewith have been solved only by actual experiment. Of the various systems in use for mortising in wood, the verti-



cally reciprocated chisel has obtained a preference. Other systems, such as rotating tools of various designs, are in use for special purposes where the same results could not be produced, or the stuff be conveniently handled, with the reciprocating mortising machine.

The class of work for which a machine of the above-mentioned nature is wanted has a governing influence upon its construction. In one case the bed may have a vertical adjustment to receive the thrust of the chisel, which has a fixed distance to travel without any variation in its terminal points; and in another the bed may be in a fixed position, and the chisel be brought down from its highest position, where it has no reciprocating motion, to the depth of the mortise and full length of the stroke. An excellent example of the latter method, or variable stroke mortiser, is given in the accompanying illustration of a mortising and boring machine for agricultural, wagon, and cabinet work, recently brought out by the well known wood tool builders, J. A. Fay & Co., of Cincinnati, Ohio, who call it their No. 3½ mortising and boring machine.

This machine has for its support a cast iron column of strong section and substantial base. The driving shaft, carrying the pulleys and crank wheel, is placed at the top of the column, and revolves in self-oiling bearings with heavily bolted caps to receive the impact produced by the chisel blow. The treadle is connected by a rod to a short crank on the back end of the shaft to which the radial arm in front is keyed. This radial arm is connected with the central joint of the intersecting rods which connect the chisel stock with the pin in the crank wheel. By depressing the treadle, the radial arm is thrown out, which draws the central joint nearly into the vertical line drawn through the center of the dri-

ving shaft, and this produces the full stroke of the chisel with all the variations from a stationary position. There is attached to the short crank on the radial arm shaft a frictional slide, which receives the force of the stroke of the chisel, thus entirely relieving the foot of the operator from its effects.

The attached boring apparatus is set to the center line of the chisel, and will bore to the full depth of the mortise. It is driven from a pulley on the shaft at the top of the column, and has tight and loose pulleys so that it can be stopped while the chisel is operating. The bed is of a compound character; the timber can be moved upon it the length of the mortise, or the bed can be moved with the timber clamped to it, by means of a rack and pinion and hand wheel in front. There are stops for holding down the stuff, and necessary arrangements for adjusting to different sized mortises. The bed can be adjusted to any desired angle and mortises with the same facility as to a right angle.

An important feature in this machine is the positive automatic reverser for the chisel, which is operated simultaneously with the raising of the chisel from the mortise. This being done at the end of the mortise, the chisel is thereby placed in position for finishing.

Further particulars can be obtained by addressing the manufacturers, J. A. Fay & Co., Cincinnati, Ohio.

THE PSYCHO MYSTERY.

We make the following extract from a letter to a gentleman in Boston, from Mr. J. A. Clarke, one of the inventors of the curious automaton Psycho, which of late has attracted much attention in London. Some time ago we mentioned this subject and noted the apparent discovery of the trick by an American gentleman, who suggested that the figure was worked by an air blast through the hollow glass pedestal. This suspicion was confirmed by one of the exhibitors declining to close the aperture previous to the operation of the automaton. It now appears that this test is freely permitted, so that the mystery of how the figure works remains as great as ever. We leave the (of course *ex parte*) statement of Mr. Clarke to the consideration of our readers without further comment, only reserving to ourselves the opinion that a solution to the puzzle certainly exists, and that that solution will be forthcoming should Messrs. Maskelyne and Cooke see fit to submit their trick, on this side of the Atlantic, to the crucial test of proverbial Yankee 'cuteness.

"Several years ago," says the writer, in substance, "it occurred to me that there was a good opening for a conjuring invention which should be really original and should baffle the profession as well as the public. After very many designs, I finally adopted the principle now embodied in Psycho, and I believe it is a completely new application. I made a rough model of the mode of working, and by accident was brought into communication with Mr. J. Neville Maskelyne. Mr. Maskelyne, possessing extraordinary ability in designing and constructing mechanical subtleties, has marvelously worked out my ideas; and Psycho is so much the fruit of mutual contrivance that all the parts may be said to be the



joint invention of us both. We designed an isolated figure, perfectly removed from any possible connection with anything or anybody outside, with no communication (mechanical, electrical, magnetic, pneumatic, hydraulic, or otherwise) conceivable from the stage, back, sides, roof, or elsewhere,

yet controlled by our influence, so that the figure moves when and in whatever manner desired."

To show diversity of effects, we make the figure calculate numbers and play whist. But it is adapted for many other things that we may choose to set it to; and it works precisely as if there were a person inside, and yet there is nothing beyond the mechanism. The audacious part of the invention is that a maker of automata, or other person, is allowed to see and feel all the inside of the figure, so as to satisfy all senses that there are no spaces concealed by optical arrangement or otherwise. The chief difficulty was in demonstrating to the public that the automaton is really insulated from all connection with the stage or with the performer; and it is sometimes exhibited in one way and sometimes in another. It is placed upon a hollow glass cylinder 24 inches in height, as shown in the engraving, or upon the carpet or upon a loose wooden stand, with legs to keep the automaton from the floor. Another way is that the glass cylinder is set loose upon a small wooden stool that is set loose upon another wooden stand, and the legs of the latter are set loose on glass pianoforte insulators.

The audience are at liberty to go upon the stage and handle and examine all the parts as much as they please, and anybody may remain close to it while it is in operation, and see and feel that no threads, or wires, or any other things connect any parts of the apparatus with the outside.

I should say that a single pillar, instead of a solid glass pillar or two glass pillars, was adopted, because a former invention worked by one piece of glass sliding or revolving inside another, while the appearance was that of a single solid piece; and to suspend Psycho by cords would suggest electricity.

Thus it will be seen that the arrangement precludes the theory of a Mr. Coffin, from America, who published an explanation representing that air is forced into or down out of the glass. If it were, how could it produce the great number of movements which Psycho performs? Besides, it will act just as well in any private room as on a public stage. It does not require any contrivance under or behind a stage which cannot be worked in a private room.

The figure sits upon a small box; the latter is much larger than it need have been, for we did not know how much space the mechanical movements would require. Were another box to be made it would be much more compact.

Psycho has worked twice a day (half an hour each time) since the middle of January last, and nothing has ever got out of order beyond the wearing of a few of the cords by which the counterpoise weights are suspended over a pulley.

As at present exhibited, the performance is as follows: The audience names two numbers, and Psycho multiplies them together and shows the answer (one figure at a time) by opening a little door in a small box and sliding the figure in front by a movement of its left hand. The audience give it a sum in division, and it shows the answer in the same manner. Then three persons go on the stage, inspect Psycho and the apparatus, and, sitting at a side table, play a game of whist. The thirteen cards for Psycho are placed, upright and singly, in a quadrant rack over the range of the figure's right hand. The arm has a radial motion horizontally to find any card wanted, and Psycho lifts the card and holds it up in view of the audience. It lifts the card up repeatedly, or keeps it up, at command of any person among the audience. The figure then covers the card to be played. Mr. Maskelyne then takes the card to the table, and calls out the names of the cards as the player plays them; and sometimes he retires from the figure and card table, to show that Psycho goes on with the game independently of the conductor. After the game, it tells, by movements of its arm, the state of the game and the number of tricks in its favor. Psycho shakes hands with the players, and answers questions by ringing a bell. It also takes part in some usual card tricks.

An infinite number of effects may be produced, but the above are sufficient to show in general what Psycho does."

He closes his letter by saying: "I hope this general description will enable my friends in America to understand and appreciate some of the merits of the automaton card player."

Correspondence.

The Electric Force and Magnetism.

To the Editor of the Scientific American:

On pages 229 and 260 of the current volume of the SCIENTIFIC AMERICAN, I observe that two of your readers take some exceptions to certain of my assertions in respect of terrestrial magnetism and the electric force. I cannot do better, in continuing the discussion of these interesting subjects, than reply in explanation and further elucidation.

There is every reason to believe that magnetism, so to speak, is a crystallization of the electric current.* This expression may at first glance strike the reader as somewhat singular; but after ten years of almost constant practical experiment in this branch of the science, I am unable to advance any more expressive or significant proposition than is compassed by this phrase. Electricity and magnetism are, as we know, interconvertible, and the great difficulty with electricians is to draw between them a distinguishing line; for, paradoxical though it may seem, while one is the other, there is so marked a dissimilarity that we cannot reasonably overlook the difference. With all deference to those who believe that my statement "that the earth is not a great magnet, but that the phenomena of the magnetic needle are due to the electric earth currents which flow at right angles to the earth's axis" is contradictory, because the earth, being

surrounded by such currents, is as much a magnet as the magnetic needle, I see no reason why the statement should be qualified. For these reasons, susceptible of easy proof:

That if the earth were a great magnet, the phenomena of the magnetic needle would not exist.

That even those scientists who accept the magnetic theory are forced to acknowledge that a very complex system of magnets indeed, in the earth's interior, instead of the earth being a great magnet, is necessary to account for the phenomena of the magnetic needle. (In a discussion of magnetism, we should obviously confine ourselves within distinguishing lines, otherwise we might confound the attraction of gravitation with magnetism. We have no right to formulate a generality, but should individualize details and branches.)

That it is impossible for the earth to be magnetized (I use the word in its distinctive sense) by the electric earth currents encircling it. The utmost that can be urged is that those portions of the earth's surface which are traversed by the electric currents are magnetic; but even this would be an erroneous hypothesis, for it is in the atomic action or condition alone that magnetism exists and is, and this atomic action is transferable to and through any matter whatever; and air, like a metal, is in this sense magnetic, for it serves merely as the conductor or medium for propagation of magnetism; to which conductor the magnetic force is confined, and which conductor, the same thus being the medium for the propagation of the force, obeys the action of the force, which is inseparable from the conductor, bound to it by those links which render the magnetic or electric force impossible without the conductor. If one desire illustration of this fact, he need only repeat the experiment of revolving a disk of a non-magnetic metal, such as copper, which a magnet does not attract, practically speaking, between the poles of a magnet. It may be heated in this manner to redness, the heat being produced by the resistance offered to the revolutions of the disk by the condition of the atomic particles of the space intervening between the poles of the magnet. Or he may seek for a solution of the magnetic effect, and he will find sufficient answer in the phenomenon which he will observe of a magnet drawing to itself a magnetic metal placed at some distance from it, which phenomenon is explainable alone upon the hypothesis that the atomic condition of the magnet is transferred to the intervening space and thence to the armature, the armature only being attracted, but the intervening space being the medium for the propagation of the magnetic force, which causes the magnet and armature to unite, just as a belt in a machine shop acts as the medium of transmission of the force which causes one pulley to follow the motions of another.

The electric force or the magnetic force is thus nothing in itself; it cannot exist without a so-called conductor; and as all substances are more or less conductors, we have clear proof that the electric force, which is nothing in itself, is merely a certain condition of the atomic particles of those substances. It will, upon close inspection, be found that the only difference between me and those who sustain the objection under review relates to a question of terms; while they combine, and thus confound, I have sought to separate phenomena, which, though intrinsically the same, are in reality separated by as wide a gulf as that which divides the sects in religion, or distinguishes attraction from repulsion, or a live man from a dead man, in the latter case the body being the same, dead or alive. To define the differences and present the same in terms plain and forcible is a purpose soon to be accomplished.

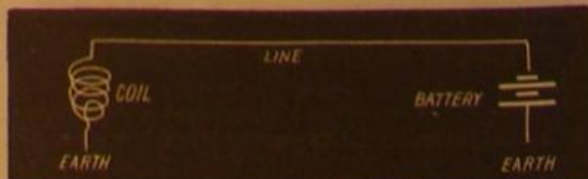
It is my design at present to reply especially to the communication upon page 260, in which your correspondent frankly confesses his inability to realize the circumstances set forth in the following quotation from a past communication by me: "When one pulls a bell cord, and instantaneously a bell is rung in a distant room by the molecular transmission over or through the bell wire of the force applied at the cord, does not one realize that he is as veritably, as wonderfully, and by a similar molecular motion transmitting it by applying a battery to a telegraph wire, and thus setting the atomic particles in motion?" Your correspondent acknowledges that in the case of the bell cord one can easily realize the disturbance of the atomic particles from ocular demonstration, but he adds: "In the case of the telegraph, he sees no motion, either where the force is applied or where it is taken off, even when the force so applied is very powerful." If I could have your correspondent on my premises for an hour, I am confident I could clear his mind of doubts by a few practical exhibitions; but as I shall probably never have that pleasure, I am constrained to resort to the example of argument and the logic of stated facts.

In the first place, he assuredly would not deny the verity of a proposition upon the ground that it is incapable of ocular demonstration. By so doing, he would deny the confirmed theories of the propagation of light, sound, and heat; for, taking an example, one can never have ocular demonstration that so many million light waves are necessary to produce a certain color, and so many another color, or that so many waves or vibrations of matter are necessary to produce a certain sound. Now I am enabled positively to assert that the propagation of the electric force is by molecular action, that the electric force is a certain active condition of the atomic particles of matter, for, unlike your correspondent, I have had ocular demonstration of this molecular action. It was not my design to allude to experiments I am now conducting until such time as I should be able to lay a mass of absolutely convincing facts before your readers, and I cannot even now enter into a statement which not only requires careful preparation, but would be premature, in view of the incompleteness of detail which would result from a

presentation previous to such time as that in which the necessary instruments can be prepared for observation and accurate measurements be taken. I could not undertake the task at present without injustice and risk to myself; but I can promise that a series of interesting and novel facts shall be forthcoming within the next two months which will for ever set at rest all conflicting theories in respect of the electric force. But leaving out of the question these new developments, I trust that I can satisfy your correspondent by other proof. He says: "The wire terminates in a coil, and inside of this coil, entirely separated from it, is a bar of metal, and entirely separated from this is the bell lever. Now it is difficult to conceive how the mere molecular disturbance of the wire causes a like disturbance in the bar, which again causes the same in the bell lever or armature. If the motion were transmitted directly to the bell lever by a material connection, as in the first case (the case of the bell wire and bell cord), then there would be no difficulty in understanding this application of the theory." It should be well known that magnetism is the result of induction, for it is a well settled fact, thus: that a current of electricity moving in the vicinity of a magnetic metal extends to that metal "tubes" (convenient term) of electric force which magnetize the metal. This fact is so well established that discussion is out of the question, and it is apparent that this can only be the case upon the hypothesis that the intervening space or substance partakes of the nature of the electric action of the conductor, by which means a transfer of force is effected; for it must be borne in mind that no substance whatever is a non-conductor of the electric force, the conductivity simply differing in degree in different substances. For this very reason a current of low tension, that is, a current which has not sufficient electro-motive force to leap a very short length of a poor conductor, such as wood or air, in preference to traversing a very long good conductor, will enable a telegraphic signal to be transmitted a proportionally greater distance than a current of greater electro-motive force, the maximum of which electro-motive force is secured in an induced current or in frictional electricity. Thus with a Grove or a carbon battery, the elements of which are of considerable proportions, a current may be transmitted from New York to Chicago, automatically, at the rate of twenty-five words per minute; but by reducing the size of the elements one half and doubling the number of elements, a speed of fifty or more words per minute may be obtained, because we have increased the electro-motive force of the current while decreasing its quantity, and the current has therefore greater tendency to leap the wire, that is to say, to follow a short poor conductor to the earth through wood, glass, or air, in preference to following a long good conductor for an immensely greater distance, thereby in great measure preventing that elongation of a signal, which is inimical to rapid transmission over a long circuit. But this merely illustrates the point, at which I wish to arrive, that any current of electricity whatever has its direct and inductive circuit, and that one pole only of a battery put to a wire will give a circuit, without regard to whether the other pole of the battery or the other end of the wire be connected to the earth, as can be demonstrated by sufficiently delicate instruments, markedly when the atmosphere is moist, the reason being that the atmosphere acts as a conductor from the other pole of the battery to the earth, and from the other end of the wire to the earth.

The induced current has, as is well known, a very high tension, so high that it may reach a point at which it will not traverse a hundred feet of wire in preference to leaping to earth, and it is also well known that the magnetism which actuates the bell lever is the resultant of this induced current. The effect of induction should be understood precisely the same as we understand imparted heat. For instance, if we bring a heated body near another, the heat will be imparted from the one to the other. In precisely the same manner, when we bring an electrified body into proximity with another body, the latter partakes of the electrification of the former. By what means? Precisely as the cold body partakes of the heat of the warmer body, or the warm partakes of the cold of the colder body, by means of the intervening substance, to which the atomic conditions of the heat and the cold are imparted. Your correspondent will doubtless now realize that what is termed insulation or isolation, in respect of the electric force, is really no insulation or isolation at all, but a poorer connection, the inferiority of which may be compensated by the electro-motive force of the current. Therefore, contrary to what he supposes, it is not "difficult to conceive how the mere molecular disturbance of the wire causes a like disturbance in the bar, which again causes the same in the bell lever or armature;" it is only difficult to conceive how the case could be otherwise; and, as Mr. Marckley says, "if the motion were transmitted directly to the bell lever by a material connection, then there would be no difficulty in understanding this application of the theory." It will be apparent from the foregoing that there is the most direct material connection, the tubes of force extending from the coil to the bar, and from the magnetic bar to the armature, by means of the intervening substance, air or other.

Not only is this the fact, but the magnet and armature



may be dispensed with altogether, and your correspondent will be able to witness an ocular manifestation. Let him construct a circuit as shown in the engraving.

* Electric current, like electric potential, will some day be positively defined—a convenient term.

Now as he closes the circuit at the battery, the coil will contract, that is, the various convolutions will draw together. It makes no difference of what kind of metal the coil be composed; and here we have an ocular demonstration, not safe to repudiate, although it clearly only demonstrates the divisible or indivisible fact, either that the current renders each convolution attractive, or that the current alters the atomic particles in a manner, or that both results are effected. These experiments may be varied in many ways.

But if more direct ocular demonstration be needed, the coil may be omitted; and it will be found that every time a current is transmitted over a wire, markedly an iron wire, it is increased in length and decreased in size by transverse contraction, showing that its volume undergoes no change. Note the similarity of this result to the effect upon an elastic substance stretched out; the volume is the same, but the form is changed, and we know that we have changed, by our stretching, the molecular structure.

The above was Joule's experiment. But I need not dwell at present upon the fact that the electric or magnetic force exists in and is a certain action of the atomic particles of matter, when it is so well known, and has been so prominently shown by Tyndall, that, when magnetization is suddenly effected by completing an electric circuit, an ear close to the bar hears a clink, and another clink is heard when the circuit is broken. The condition therefore continues without clinks corresponding to the electric force waves during the continuation of the circuit. Therefore, to give a single reason, I term the magnetic effect a crystallization of the electric current.

W. E. SAWYER.

New York city.

Life-Saving Devices.

To the Editor of the Scientific American:

I have lately read some articles in your esteemed journal on torpedo boats. Cannot such life destroying apparatus be converted into life-saving ones, by substituting (for the torpedo) lines, and other apparatus, and conveying them to the shipwrecked?

H. J. F.

The Education of the Mechanical Engineer.

We are indebted to Professor R. H. Thurston, of the Stevens Institute of Technology, for a copy of an address, entitled "The Mechanical Engineer: his Preparation and his Work," delivered before a recent graduating class of the above named college.

As a *resumé* of what a mechanical engineer ought to know, it is the best production we have ever met with, and we especially commend the extracts below given to all who contemplate devoting themselves to that great and useful calling. It is hardly necessary to remark that the speaker had particular reference to the Stevens Institute course, through which his audience of graduates had just passed. To these young men he talks as follows:

"You have been taught here, not only a course of pure mathematics, such as was formerly prized principally for the mental training which it gave, but you have been led to make useful applications to those problems of practical, every day life and work which, while no less valuable as intellectual gymnastics, give development to good common sense, and which assist to make the man as symmetrical as the gymnast and as skillful as the world's best workers. You have not only been given a set of useful tools, but you have been shown how to handle them. But the greatest value of these acquisitions, as aiding you professionally, will be seen later in life, when, perhaps after years of hard work and of severe competition, you may have arrived at the height of professional practice, and when you will begin to meet with those exceptional problems, difficult of solution by all, and soluble by very few. It is then that you will see most plainly the advantages of this early and extended preparation, and will learn that success in these exceptional cases may make you leading men in your profession. You will find multitudes doing ordinary work well; but between the leaders, success in competition is won by overcoming great and rare obstacles. Great fields of application lie before you in the new and yet undeveloped science of thermodynamics, and in its application to the theory of heat engines and to practical problems of inestimable importance. Those of your comrades who have preceded you have shown you where to look for them.

"In the laboratory you have pursued the study of chemistry. You will have frequent occasion to apply your knowledge of this science, and to put in practice that adroitness in manipulation which you have here acquired.

"Metallurgy offers you a score of attractive fields for its application and for study and most valuable research. You will be sometimes called upon to examine new materials processes, and industries in the course of professional practice. When this occurs, study the subject cautiously, critically, and thoroughly, deceiving neither yourself nor your client. That later science, physics or natural philosophy—I like the old name best—has been opened to you with all the completeness that these collections of delicate and wonder-working apparatus and the knowledge and skill of your accomplished preceptors could secure. The beautiful phenomena of optics have become familiar to you by frequent observation; and their occasional exhibition in this hall on a grander scale has assisted to impress upon you their characteristics. You have yourselves read, in a ray of light, the composition of a complex metallic alloy, and of the salts of every kind collected in the laboratory of our President, and you have, in the same curious way, seen the constitution determined of the sun and the farthest stars.

"The sciences of heat and of the chemico-physical phenomena of evaporation and combustion and of thermodynamics will find daily application in your work, which affords a field, not only for the use of that theoretical knowledge obtained from the text books, but for the exercise of all that familiarity with the laws and the facts of the sciences which is secured by actual manipulation and personal attention. They will demand such methods as you have practised in the physical laboratory, where you were not simply told how the thing was done, but were shown how to do it for yourself. The design and construction of heat engines, the study of special applications of thermotic principles, and sometimes their theoretical investigation, are now the occasional tasks of the engineer, and may, after a time, become yours. They are every day arising more frequently and assuming higher importance.

"The study of modern languages has pleasantly varied your course. You have been prepared to make your own all of those splendid treasures of scientific learning which have so long enriched the French, and all of the inestimably valuable literature of engineering of which German literature is now so prolific. In both languages, as in the English, you will find the periodical literature most immediately useful, as presenting you with the latest discoveries, the subjects of most direct importance, and the views of contemporary authorities.

"Your studies of history and of English literature have been by no means the least important part of this preparatory training. This branch of your education is not only necessary, as of frequent use, but it is a most satisfactory and thoroughly enjoyable portion of your knowledge. These studies, however, are by no means to be regarded as giving you purely ornamental accomplishments, or as furnishing only entertainment for hours of leisure. You will have daily occasion to apply them usefully. The power thus acquired of expressing thought, and of stating facts with elegance, precision, and conciseness, is an important element of an engineer's success. A report made to a client, worded carelessly, expressed in vague terms and with orthography not beyond criticism, sometimes casts a dark shade over the professional reputation of a really talented, experienced, and reliable man. A specification so drawn as to be capable of double interpretation may subject one or both of the parties to the contract to serious annoyance or to great loss of time and money.

"You have given a large part of your time, during these four years of study, to the acquirement of a knowledge of the principles of engineering and to the practice of the arts which are in daily application in the practice of the profession. You have, from the beginning of your course, studied the theory of the graphic art and the geometry of machinery. You have spent such an amount of time in the drawing room, copying well known plans, and designing new forms of mechanism, that you have become familiar with every principle of common application in graphic construction, and every detail of ordinary draftsman's work. You will find this skill, in sketching your plans, in making accurate drawings, and in reading the drawings of others, of daily use and of incalculable value to you. Without this power of comprehending plans existing only on paper, you would be absolutely crippled in your efforts to advance yourselves. Without the ability to sketch rapidly and draw readily and accurately, you would have the greatest difficulty in securing the prompt and thorough working of your own schemes. You have mastered the fundamental principles of applied mechanics and of mechanical construction, and have become acquainted with the nature and uses of the materials with which you are to work. You can, I presume, make a stronger lever of a built beam than could Archimedes. The water wheel, the mariner's compass, gunpowder and nitro-glycerin, the telegraph, the chronometer, the steam engine, the printing press, the spinning frame and the loom, and a thousand other inventions seem already perfected. Yet, some one, whether man of science or working mechanic or educated engineer, none can tell, will yet rival Fourneyron, and give us better turbines, will find a means of giving us safety in navigating iron ships, will excel Frodsham in making accurate timekeepers, will give us better printing presses, will supersede the spinning frame and the loom, and will earn a greater fame than Watt by giving us, in some new motor, a means of approaching that theoretical efficiency to which no heat engine has approximated.

"Who has greater reason to aspire to fame and fortune in these coming years of such noble competition than have you? The development of the natural resources of this broad land of ours will afford ample opportunity for the application of your knowledge and the practice of your art, and for the employment of every faculty, natural or acquired, that you may possess, and in whatever way your inclination may prompt, and to any extent that ambition may urge, and that your strength and endurance may permit. Take hold of the work which offers itself, never standing idle, waiting for something more perfectly satisfactory, and do the work as promptly and skillfully as possible, and you will ultimately find that no man need complain that opportunities do not present themselves. Your competitors possess the advantages of training in the rough school of the world, of a knowledge of men, of business methods, and of the rights and the wrongs of daily experience. They have had hard knocks and become callous, or have learned by dint of long practice, and by natural tact frequently, to evade them, and to push on without giving a thought to their scars. They will have the advantage of you at first, for these experiences are essential to early success. They may smile at your book knowledge, and may sometimes even deride your more precise methods and scientific ways; but—bide your time! Make

yourselves masters of all the accomplishments, and seek to acquire all of the knowledge, of these rough and ready but untaught competitors, never refusing to give them a liberal reward from your own stores of information, should they ask it."

We shall publish some more extracts from this interesting address in our next issue.

The Relation of Food to Work.

Dr. Du Chaumont, in a recent lecture, said that up to a quite late date there was an absence of any satisfactory theory as to the relation of food to work, and it was supposed that bodily force was due to a chemical change in the muscles themselves, and that the nitrogenous matter in food repaired the waste. But the researches of Joule, Playfair, Frankland, and others, on the conservation of energy, have led to the conclusion that active force is produced chiefly by the potential energy stored up in the carboniferous food, and set free by oxidation. Hence it was seen that to credit the chemical changes in the muscles with the origination of force in the body was not more philosophical than to credit the force exerted by a steam engine to the wearing away of its wheels and pistons.

The lecturer then proceeded through a large number of elaborate calculations, based upon actual observation, for the purpose of showing the ordinary amount of productive work of which a man of average height is capable, and its equivalent in foot tons—a foot ton representing the amount of force required to raise one ton one foot high. It appears that the work done in walking three miles an hour is equal to about one tenth the work done by direct ascent. Three hundred foot tons is a fair day's work for a man of average height. This would be equivalent to walking fifteen miles in a little over five hours. A hard day's work would be equivalent to walking twenty-four miles in eight hours. Dr. Parkes mentions an extreme case, in which a man in a copper mill did as much as 723 foot tons in a day, his average work being 443 foot tons. The ordinary work of a military prisoner is 310 foot tons. The velocity at which work was done, and the consequent resistance, greatly affect the quantity of potential energy required for its accomplishment. For the production of any amount of what may be termed productive work, a much larger amount of potential energy has to be expended. Professor Haughton, of Dublin, has calculated that, of the total potential energy produced in the body, 260 foot tons are required for the action of the heart. Then the animal heat absorbs from 2,000 to 2,500 foot tons, or more.

According to Helmholtz, about five times as much energy is used in the internal work of the body as is expended in ordinary productive work. In the case of severe work, the proportion of internal work to productive work is still greater. Supposing the work performed by a man to consist of walking, the most economical rate, both as regards the amount of food required to sustain it, and the amount of potential energy expended on the body itself, is about three miles an hour. Both above and below that speed there is a decrease in the amount of active work as compared with the non-productive energy. A man walking fifteen or sixteen miles a day, or doing an equivalent amount of work in another form, would require 23 ozs. of food, composed of albuminates 4.6 ozs., fat 3 ozs., starch 14.3 ozs., and salts 1.1 ozs. This would yield a potential energy of 4,430 foot tons, and 300 foot tons for productive work. A mere subsistence diet for a man at rest would be 15 ozs., but with this amount a man would lose weight. About 7,000 foot tons a day of potential energy is about the greatest amount which is possible as a permanency. This would yield 600 foot tons of productive work. These calculations apply only to men in health.

Magnetisation of Ilmenite (Titanic Ironstone).

Dr. T. L. Phipson says: "Some fine specimens of ilmenite having been sent to my laboratory from Norway, it seemed a good opportunity to investigate the magnetic properties of this mineral. The composition of that which served in my experiments was: Titanic acid, 24.60; protoxide of iron, 72.10; Fe S₂, 2.06; manganese, trace; silicic acid, 1.24. Total, 100.

Its specific gravity was 4.8, and it acted with tolerable energy upon the magnetic needle. From the inspection of this action, I concluded that it was possessed of a very considerable number of poles in close proximity to each other, so that scarcely two closely adjacent parts acted in the same manner upon the north pole of the needle; hence it was evidently built up by a mass of crystals. An elongated rectangular piece of this mineral was separated by a blow of the hammer; it measured 1½ inches in length and was about ¼ inch broad. This was placed upon a table and submitted to magnetization by friction with good magnets for upwards of an hour. It was then found to have a pole at each extremity, which it certainly had not before, and was accordingly suspended to a piece of silk, and hung up in a quiet corner of the laboratory. It pointed constantly towards the north, and returned to that position when deviated. It continued to do so for some weeks; but one morning I found it pointing east-west, or nearly so; it had lost its acquired magnetism entirely, having retained it for rather more than a month.

This loss occurred rather suddenly, and I believe that it coincided with a magnetic storm of some intensity which happened about the time. If these experiments could be continued by some who have more time to devote to them, they might lead to some interesting results. It is possible that some minerals that show action upon the needle might be made magnetic in the above manner."—*Chemical News*.

IMPROVED STEAM HEATER FOR DWELLINGS.

We illustrate in the accompanying engraving a new low pressure steam heating apparatus, for which is claimed the advantages of high efficiency, reduction of first cost, safety, and simplicity of management. It is, besides, self-regulating, and is so constructed that a constant circulation of the water in its steam-generating space is maintained.

The steam and water drum, A, surmounts an annular series of tubes, B. The latter are of peculiar construction inside, as shown in Fig. 2, to which we refer more particularly further on. Within the ring of tubes is the fuel magazine, C, which is fed from the top by removing the cover, so that a constant fire is maintained in the grate below. The magazine also serves as a deflector for the heat, directing it against the tubes. At D is a ball safety valve, placed so as to blow off at five pounds steam pressure, and at E is the delivery pipe for the steam, conducting the latter to the radiators in other apartments. Condensed water is returned to the boiler by the pipe, F, by which the feed water is also supplied. The smoke pipe is shown in the rear. The grates of the shaking and dumping pattern, and can be easily removed without disarranging other portions of the heater. G is a deflector, the object of which is to prevent the heated gases taking a direct course to the smokepipe. It is made by setting one course of bricks close to the tubes.

The boiler is set in brickwork eight inches in thickness, the outer course being built up square, while the inner course is made circular to conform in shape to the firepot and boiler. A space is left between the bricks and the steam drum, which forms a flue to the stack. The apparatus shown at H is a fire regulator, so constructed and poised that, when the steam falls, the weighted arm of the lever is lowered and the ash pit door opened, thus admitting a draft under the grate. On the steam rising above the limit, the weight arm rises, opening the furnace door and so cooling the fire.

A section of one of the tubes enlarged, shown in Fig. 2, exhibits an inner tube, about which is coiled a spiral guide dividing the interior of the outer tube into a continuous spiral channel. When the fire is started, the water contained in the last mentioned portion, becoming heated, rises, and its place is taken by the cold water which descends in the inner tube. By this arrangement a constant circulation is maintained in both tubes, in the directions indicated by the arrows. Tubes thus constructed, we are informed, have been in successful operation for seven years. Each tube, in fact, is a separate boiler, and each being fastened by its upper end only, is free to expand and contract independently of all other portions of the boiler, so that any undue strains from this cause are avoided. They are secured to the water and steam drum, by taper screw threads, and when once made tight they will remain so. They may be readily removed, however, in a few moments when desired.

Patented through the Scientific American Patent Agency. Application for additional improvements is now pending. For further information address the inventors and manufacturers, Messrs. Kafer & De Lacy, Trenton, N. J.

METHOD OF SECURING FISH PLATES TO RAILWAY JOINTS.

In the annexed engraving we illustrate a new method of securing rails in the fish plates, which is so constructed that the injurious strains, occurring at the joints by the passage of trains over the rails, are obviated. The arrangement is also such that the bolts are prevented from turning or working loose, which is another important feature. In Fig. 1 the invention is shown in place, in Fig. 2 the various parts are separated.

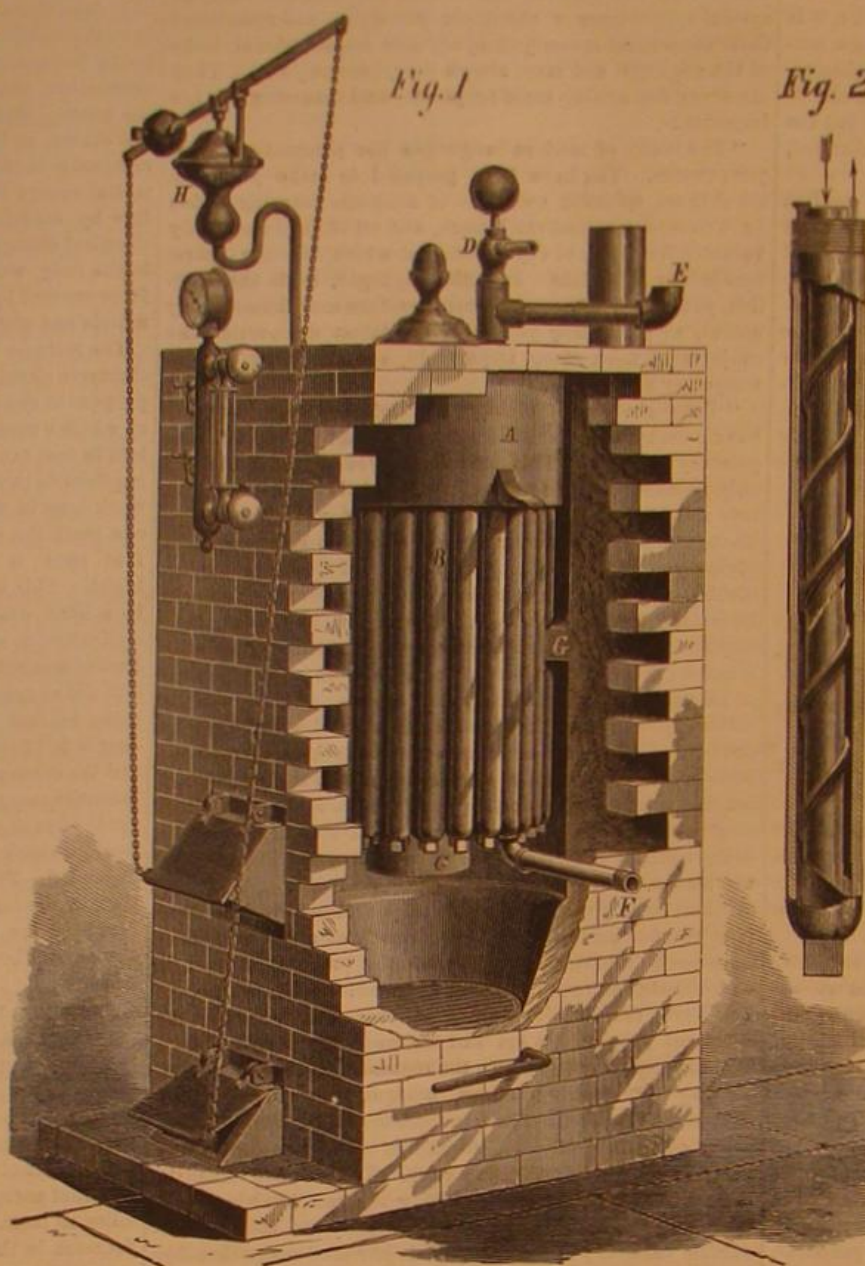
The fish plates are secured as represented, on each side of the joint. In one of the plates are formed a series of sockets, A, in which rubber rings, B, Fig. 2, are inserted. Through these rings pass the bolts, C, which are secured on the opposite side of the other fish plate by nuts. As the head of each bolt impinges upon the elastic rubber, it is claimed that, through this means, the strains on the fish plate bolt and nut are prevented.

To keep the bolt from turning, two small wings, D, Fig. 2, are formed on the shank near the head. These are deep enough to enter the oval recess, E, of the fish plate when the bolt is drawn into place tightly by the nut. This construction rigidly secures the bolts in position, so that there is

no danger of their turning. The various parts are firmly bound together, and the rubber further serves to take up the yield of the bolt under strain, and thus prevents the turning of the nut on the thread.

The invention tends to considerable economy in the construction of railroads, as it obviates, in some degree, the frequent replacing and repairing of worn connections; and at the same time it adds to the safety of the road, especially under high speeds of travel.

Invented by Mr. Caspar Dittman. Patent recently allowed.



KAFER & DE LACY'S STEAM HEATER FOR DWELLINGS.

For further information address the Star Nut Lock Company, Leacock P. O., Lancaster county, Pa.

The Tellier Refrigerating Machine.

We recently examined with much interest a Tellier refrigerating machine which has just been erected and is now in operation in a large brewery in 47th street in this city. The operation of the apparatus is based on the alternate expansion and compression of methylic spirit vapor, the former producing intense cold and the latter reducing the vapor to a liquid form, ready for new vaporization. The cold gas is carried through a series of large plates in a cooling chamber, over and under which plates a powerful air current is driven by a fan blower. This current, which showed by the thermometer a temperature of 32° Fah., is conducted directly to the cellar or other locality to be cooled. The principle ad-

practical scientific value; especially as this machine embodies the very latest improvement in the process of the artificial production of cold, adaptable to so many important manufactures and preserving processes.

New Smoke Condenser.

At the Queen Louisa coal mine, near Zabrze, in Upper Silesia, there are two pairs of Cornish boilers, each 21.5 feet long and 5 feet in diameter, placed in boiler rooms off the main drawing level, about 120 yards below the surface, for the purpose of driving a 44 inch Tangye pumping engine, and a double cylinder horizontal engine for drawing coals from the dip workings. The smoke from these boilers was at first conveyed to an upcast shaft through a drift only partially protected by a lining of masonry, until the deposit of finely divided soot, often in a state of ignition, was so constant as to give rise to a fear of the ignition of the coal. It was therefore decided to adopt a means of cooling the smoke before admitting it into the flue drift. The condenser consists of an upright cylinder of boiler plate, about 14 feet high and of 5 feet internal diameter, with twelve horizontal diaphragms placed at equal distances apart. Each of these diaphragms is made of a double thickness of sheet iron, perforated with a great number of round holes 0.2 inch in diameter. They are of the same size as the internal diameter of the tube, but from each a segment about 1 foot in breadth is cut off, the cut edge being placed alternately opposite to those of the adjoining plates above and below, so as to form a serpentine passage for the smoke, which is admitted at the bottom through two circular orifices of about 2 feet in diameter, one for each pair of boilers. Water from the top falls through the plate in a fine shower, and is discharged through an 8-inch pipe at the bottom. The upward current of smoke is maintained by a Schiele's exhaustor of 13 inches diameter, the distance traveled, owing to the obstructions caused by the diaphragms, being about 51 feet. The aperture for the discharge of the cooled smoke is about 12 inches in diameter. The supply of water for the condenser is taken directly from the discharge main of the pumping engine, and afterwards flows off by the silt. The apparatus works well, no soot now being deposited in the flue drift; but the resistance to the current is greater than was estimated, and the exhaustor and its 5 horse power engine, being insufficiently powerful to maintain the flow at a proper speed, are to be replaced by another of 15 horse power. The exhaust steam from the engines is discharged into the smoke drift, and contributes something towards increasing the draft. The experi-

ments up to the present time show that the efficiency of this class of condenser is dependent chiefly on the power of the exhaustor, on the distance traversed by the smoke, and the perfect division of the water, and not to any great extent on the quantity of water employed.

A New Elevated Railway.

A party of gentlemen, including several well known engineers, recently visited the works of Messrs. Clarke, Reeves, & Co., at Phoenixville, Pa., in order to witness trials of a new project for an elevated railroad, designed by General Roy Stone for rapid transit purposes in this city. About 800 feet of track, raised on posts, had been constructed, and this included a curve of 90 feet radius. The engine and car rests on a single rail, and are steadied by wheels bearing against two rails placed below, so that there are really three tracks.

The locomotive was driven by two rotary engines. The car had two tiers of seats, and accommodated 60 passengers. The operation over the short space was satisfactory.

The objections to the plan are obviously to be found in the difficulty of arranging the switches, and of causing one line to cross another at the same level. The advantages are its low cost, about \$100,000 per mile of single track, its safety—for it is impossible for the vehicles to run off the track—and the fact of its occupying a comparatively small portion of the street. These taken into consideration, the plan is perhaps one of the

best of those based on the elevated principle. The inventor, we learn, is endeavoring to obtain the consent of the authorities of this city to build an experimental section of some 500 feet in length along the street which crosses the City Hall Park on the north side of the post office.

THREE times the weight in pounds per fathom equals the working load in hundredweights of good hempen rope



DITTMAN'S METHOD OF SECURING FISH PLATES AND RAILWAY JOINTS.

vantage of the machine is its economy, there being practically no waste of the vapor, and it being possible to make from 6 to 8 tons of ice per day of 10 hours by the aid of pumps of from 5 to 7 horse power. Both the principle and the operation of the apparatus are very interesting, and as we expect shortly to publish a fine large engraving, together with a complete description of the entire apparatus, our readers may anticipate something of more than ordinary

BLACK COCKATOOS.

The gardens of the Zoological Society, London, have recently been enriched by the acquisition of the great black cockatoo of New Guinea and the adjacent islands. The structure and habits of this bird render it one of the most remarkable of its tribe. Its favorite food in its native state consists of the kernel of the canary nut, which grows on a lofty forest tree abundant in the islands where the birds are found. These nuts are so excessively hard that it requires a very heavy hammer to break them; but they are readily opened by the extraordinary mandibles of the bird, which, taking one in its bill and holding it against the notch in the narrow upper mandible by means of the singular, horny-tipped cylindrical tongue, cuts a notch in it by sawing the cutting front edge of the lower mandible from side to side. This done, it is enabled to break off a small piece of the hard shell by a strong bite, and then, with the long tip of the upper mandible, it picks out the kernel piecemeal. The tongue itself is very singular, being a bright red cylinder with a horny black tip, and having two roots diverging to each side of the lower jaw. The appearance of the bird is remarkable. The bill is of immense size and strength; the head very large, possessed of powerful muscles to wield the jaws, and covered with a feathered crest. Than this singular bird perhaps no living animal offers a more striking example of the exact relation that always exists between the structure of an animal and its habits. It is evident that the form of its extraordinary bill alone enables it to live upon a kernel that cannot be obtained by any other bird.

The coloring of the animal is almost as remarkable as its structure. The entire plumage is slaty black, powdered with the white excretion from the skin that is so abundant in cockatoos, pigeons, and some other birds. The bare, skinny cheeks are of a blood-red color, varying in intensity with the health and condition of the bird. The scientific name of the species is *microglossa aterrima*.

THE IGUANA FAMILY.

The lizard tribe furnishes one of the most universal and persistent types in all natural history. No country is entirely without them, and none but the very earliest geological formations fail to furnish specimens of this remarkable race. Of the iguanas, the characteristics are mainly the horny scales which cover the body, and the toes, which are distinct and free. The serrated crest along the ridge of the back is generally present; and the teeth are usually set in a common alveolus, but sometimes they are attached to the free edge of the jaw bone.

The specimen herewith represented is a native of Australia, where eleven species of the tribe have been found, all of which are described in Dr. Gray's catalogue. One observable feature is the long, conical tail, covered with overlapping scales. The head is flat and triangular, and the small scales covering the upper parts of the body are intermixed with a kind of thorny tubercles, seen also along the back of the body. The elevated crest along the backbone is not found in this instance, but the scales all over the body are elongated and sharp-pointed, so that the animal is furnished with ample exterior protection.

The color of the upper part of the head, the feet, and the lower part of the face is yellowish; the throat and the sides of the neck are of a deep black color, and the sides of a brownish hue; the back is grayish brown, and the belly and chest show yellowish spots surrounded with circles of brownish black, on a clear brown skin.

A Lesson for Brakemen.

A railroad brakeman, who had been celebrating his grandfather's birthday, was arraigned before a Detroit police court. "You run on the cars, eh?" asked the court. "Yes, sir." "And you belong to that class of men who open the door as the train stops at Pontiac, and yell out 'Upontyack!' at the passengers." The man was silent. "It makes my bones boil to think how I've been used on these railroads," continued His Honor. "The seats are locked, the water cooler empty, the windows won't stay up, and every few minutes you open the door and cry out 'Jawkun' for Jackson, or 'Kl-a-zoo' for Kalamazoo. I believe I'll mark you for six months." "Please, sir," protested the prisoner. "I must strike a blow at this great evil somewhere, and I might as well commence on you." "Please, sir, I was never here before, and it's my first drunk in four years." His Honor leaned back

and chewed the corner of a blotting pad while he reflected. Finally he said: "Well, I'll let you go, though I'll be blamed for it. Now, sir, after this you want to adopt a different style. When the train approaches a station, you want to go through the car like a cat, smile gently, and say in quiet tones: 'Ladies and gentlemen, this train is now in the outskirts of the beautiful city of Ypsilanti, and such of you as desire to step off will please make ready; and may health and prosperity ever attend you.' What an innovation that



THE GREAT BLACK COCKATOO OF NEW GUINEA.

would be, sir! How the traveling public would rush for your road! Will you do this, Mr. Wellington?" The prisoner promised, and was allowed to go.

Too Much of a Good Thing.

Messrs. Smith and Potts, inventors of the ingenious adding pencil which we illustrated and described a few weeks ago, send us a pathetic appeal to stop the avalanche of letters, orders, and inquiries which have poured in upon them since the notice of their invention appeared in our columns. They want the "wholesale waste of stamps" arrested, because they do not sell pencils, but only the rights to manufacture them. We hasten to comply with the request. Our readers, excepting those desiring to purchase rights as aforesaid, will

within ten miles of London, in one and a half hours. Should the present efforts to educate the birds prove successful, next summer will find an almost daily ocean mail in practical operation, as it is believed that the flight from continent to continent can easily be accomplished between sunrise in one hemisphere and sunset in the other.

Recent Arctic Explorations.

The Pandora, a small screw steamer which left England for the arctic regions in search of relics of the ill-fated Franklin expedition, recently returned to Portsmouth after a brief but eventful voyage of three months duration. Following Sir John Franklin's track, the vessel, after leaving Upernivik, steamed to the westward and penetrated further in that direction than any other ship has yet succeeded in doing. A yacht, abandoned by Sir James Ross, was found beached and in fair condition; and the storehouse built by the same explorer, together with the graves of some of Franklin's men, were visited. The Pandora brings back the news that the Alert and Discovery, of the British expedition, are now in Smith's Sound, and that there are indications that that body of water is comparatively free from ice.

The ease with which the Pandora, small as she is, accomplished so long a journey—one which Franklin, with his sailing ships, occupied two years in performing—in the brief period abovementioned, augurs well for the success of Captain Nares. The efficacy of steam is fully shown; and as the *Polaris* hardly merited the designation of a steamer, the Pandora is really the first to prove what even moderately powerful engines will do toward breaking through the ice floes. With the channel as open as is reported, and driven on by their strong machinery, it is not impossible to believe that the Alert and Discovery have already attained the borders of the open polar sea.

New Life-Preserving Mattress.

Interesting trials of the Gay safety mattress were lately made at the Maritime Exhibition, Paris. This mattress folds in two, longitudinally, forming a double belt, with attachments to fasten it to the person in such a way that it cannot possibly be displaced. It is formed of a double row of *boudins*, or "sausages," made of cork cuttings tightly compressed by machinery within a waterproof impermeable case, and the whole covered and incased in No. 7 canvas. The cork ribs are about 8 or 9 inches wide, and half that in thickness. The whole forms a mattress, one like which is intended to be placed in each sailor's hammock, cot, or berth, it makes a bed which, contrary to what might be expected, is elastic and easy to lie on. Its weight is about 6½ lbs., and it suffices to sustain in water the weight of four men, so as to save their lives, as was conclusively shown by the experiments on this occasion.

The celerity with which this valuable aid can be rendered available was shown by the fact that a man lying thereon in the hammock, on a given signal, drew out the safety mattress, arranged and put it on, fastening it perfectly, and jumped into the water, all within the space of three quarters of a minute. Thus every one on board a ship may have at immediate command, in case of accident, the means of enabling him or her to float without other aid in the water, even assisting others, and so to await the arrival of further aid, by ships or boats; thus materially multiplying the chances of safety, which, after all, is the utmost that can certainly be attained, be the life-saving ap-



AN AUSTRALIAN IGUANA.

paratus what it will. Another important point in this appliance is that, as was also shown, the motion of the limbs, as in swimming, are entirely free and unfettered by the mattress, when thus used as a cincture; moreover, in case of wreck and being cast ashore, this appliance is calculated to afford great protection to the body, and mitigate the shock if the wearer be thrown by the waves against a rock or beach; or should any one or more of the separate cork ribs be cut or damaged in any way by such collision, being independent, the cincture as a whole retains its buoyancy and life saving power unimpaired.

A Transatlantic Pigeon Post.

Experiments are now in progress in England, in training a variety of carrier pigeons indigenous to Iceland, the object being to establish, if possible, a pigeon transatlantic mail between the United States and England. The bird is of great docility, intelligence, and spirit, and is naturally ocean-homing. Its speed is over 150 miles per hour, and it is said to be able to return to its habitation from any part of the world. A pair of these pigeons recently carried despatches from Paris to a lonely spot in a wild and rocky part of Kent,

paratus what it will.

After filing a saw, place it on a level board and pass a whetstone over the side of the teeth until all the wire edge is off them. This will make the saw cut true and smooth, and it will remain sharp longer. The saw must be set true with a saw set.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Positions of Planets for November, 1875.

Mercury.

Mercury rises on the 1st of November at 6h. 8m. A. M., and sets at 4h. 37m. P. M. On the 30th, Mercury rises at 5h. 58m. A. M., and sets at 3h. 45m. P. M.

Mercury should be looked for about the middle of the month, in the early morning, south of east. It will rise some time before the sun, and may be known by its soft white light.

Venus.

On the 1st of November, Venus rises at 7h. 28m. A. M., and sets at 5h. 20m. P. M. On the 30th of November, Venus rises at 8h. 39m. A. M., and sets at 5h. 27m. P. M. It should be looked for after sunset, a little south of the place where the sun was last seen.

Mars.

On the 1st of November, Mars rises at 1h. 12m. P. M., and sets at 10h. 33m. P. M. On the 30th, Mars rises a little after noon, and sets at 10h. 27m. P. M.

Mars can be seen from night to night to change its place among the fixed stars. Its path has lain among the stars of *Sagittarius* and *Capricornus*, and in November it reaches the smaller stars of *Aquarius*. Mars and Saturn are in conjunction on the 21st.

Jupiter.

Jupiter is very unfavorably situated for observation. It rises at 6h. 48m. A. M., and sets at 5h. 2m. P. M. on November 1st. On November 30th, it rises at 5h. 26m. A. M., and sets at 3h. 25m. P. M.

Saturn.

Although low in altitude, Saturn is still well situated for recognition. On the 1st, it rises at 1h. 46m. P. M., and sets at 11h. 46m. P. M. On the 30th, Saturn rises at 11h. 55m. A. M., and sets at 9h. 57m. P. M.

On the 21st Mars and Saturn are in conjunction; Saturn is a few minutes of arc above Mars. They can be seen directly south at about half past five at an altitude (in this latitude) of $32\frac{1}{2}^{\circ}$.

Uranus.

On the 1st, Uranus rises at 11h. 47m. A. M., and sets at 1h. 41m. P. M. of the next day. On the 30th, Uranus rises at 9h. 45m. P. M., and sets at 11h. 48m. P. M. of the next day. It is among the small stars of *Leo*, which rise before the well known stars of the Sickle.

Neptune.

Neptune rises at 4h. 38m. P. M. on the 1st, and sets at 5h. 52m. A. M. On the 30th, Neptune rises at 2h. 43m. P. M., and sets at 3h. 56m. next morning. It is so remote that it cannot be seen without the aid of a good telescope.

Sun Spots.

The report is from September 29 to October 20, inclusive. The picture of September 29 shows a group of spots near the center. In the photographs of September 30, October 2, and October 4, the only change shown is that caused by the revolution of the sun on its axis. On October 5 this group was still visible with a glass, while another group and two small spots, near the center, which had not been seen the day before, were observed.

Photographing and observations of the sun were interrupted by clouds from October 4 to October 8; and from that date to October 19, no spots have been seen.

The picture of October 20 shows, near the eastern limb, two elongated spots, followed by two very small ones.

Cork-Leather—A New Fabric.

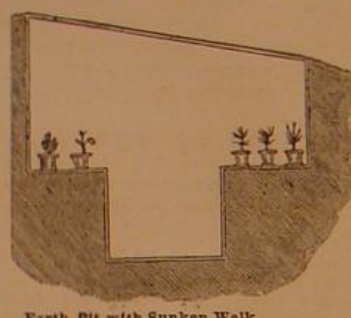
M. Horeau exhibits, at the French Maritime Exhibition, what may be regarded as a new fabric, under the name of *cuir-léger*, or cork-leather, which possesses a somewhat remarkable combination of qualities, adapting it for many and various special applications and uses, of which the most important relates to military equipments. *Cuir léger*, as its name implies, is prepared mainly from cork, and has all the characteristics of leather, for which primarily it is a substitute; its most singular peculiarity consists in the change operated in the cork by the treatment adopted. Thin sheets, or pieces of cork, are covered on each side by an extremely fine India rubber skin, with any ordinary textile fabric outside of all, the whole becoming one *quasi* homogeneous tissue; and whereas the cork sheets in their primal condition are porous and penetrable by water, friable and brittle, and endowed with very little strength and cohesion, having only the positive qualities of lightness and non-conduction of heat: yet when treated as above described, the resulting product, *cuir-léger*, is extremely supple, and, so to say, malleable, endowed with great strength to resist tensile strain, and, while retaining its comparative lightness and impenetrability to heat, it is rendered waterproof and impermeable to moisture. This new material may be crumpled up, rubbed and wrung like linen and calico in the wash, doubled up any number of times and hammered with a mallet, without injury; the interior web of cork, which is the basis of the fabric, neither cracks nor tears in any way, but preserves its unity and entirety. In regard to its waterproof character, the experimentum in corpore vilo is perfectly conclusive; boots, shoes, and other articles, formed out of *cuir-léger*, are seen swimming in water, without the wet penetrating, or at all deteriorating them; aquaria are formed of *cuir-léger*, either in one piece or in several pieces, sewn together,

and there is no penetration, no exudation, no trace of moisture on the external surface, nor leakage at the seams. In evidence of the strength of the material, a weight of nearly half a ton remains suspended indefinitely by a strap about 2 inches in width and $\frac{1}{4}$ inch in thickness, which has an external resemblance to leather, but is only *cuir-léger*. Externally, according to the textile material used in combination with the cork, the appearance varies, resembling leather, American cloth, macintosh, or other waterproof materials, but endowed with far superior qualities.

EARTH PITS.

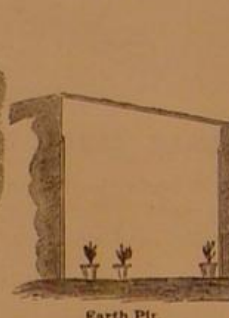
The object of a cold pit is to get heat from the earth below and to shut out the cold above. The degree of heat thus obtained will vary with the shape. A broad sash, for instance, which rests on the top of the ground, with the sides of the frame considerably exposed, and where the warmth of the earth comes up only from the bottom of the shallow space, will afford only partial protection, and may be employed to cover half hardy plants. In Fig. 2, while the glass is much less exposed to the sweep of winds by being nearer the earth's surface, and the sides of the frame are banked up and protected, there are three times the warmth derived from the earth at the two sides as well as on the bottom. To this style of pit, the drawings of which we take from the *Albany Cultivator*, may well be given the name of earth pit. By covering the glass sufficiently with mats, etc., in severe weather, such a pit as this will preserve plants from great cold. Fig. 1 represents a good pit, so arranged that the attendant may enter through a door at the end and

Fig. 2.



Earth Pit with Sunken Walk.

Fig. 1.



Earth Pit.

pass through the whole length. Such a pit may be from 10 to 12 feet wide, and of any desired length. One of the first requisites of a pit is perfect drainage.

FLOWER POTS.

As many of our readers, agriculturists and others, live far from the large cities, and have to depend on their own skill for many minor articles of household economy, a few simple directions for making flower pots will be useful to them. They are published by Mr. McIntyre, gardener in one of the London parks, in the *Journal of Horticulture*.

Fig. 1 is the model, which is made of tin, copper, or zinc, either of the two latter being cheaper in the long run. It is $2\frac{1}{2}$ inches in width at the top and $1\frac{1}{4}$ inches at the bottom, inside measure, and about $2\frac{1}{2}$ inches in depth. Fig. 2 is the pot when made. Fig. 3 is the bolt, which is about 5 inches in length of half inch round iron, to which is soldered a shield of stout tin an inch in diameter; this shield is an inch from the end of the bolt. Fig. 4 is the mold (inverted), which is made of wood; the size of the plug is $1\frac{1}{4}$ inches across the top, and 1 inch across the bottom, and $2\frac{1}{4}$ inches deep.



The composition of which the pots are molded may consist of various ingredients, provided they do not destroy its adhesive character. Strong loam, of the fat greasy kind, as we believe it is termed, is the best staple, and to this is added a little leaf mold and cow dung. Cocoa nut fiber (not the dust), wool threads, fragments of straw, hay and chopped turf, may also be mixed with the mass, which must be thoroughly incorporated, and worked up to the proper consistency with water. In making the pots a hole is made in the bench, through which the spindle of the bolt, Fig. 3, passes, having previously been put through the hole in the model, Fig. 1. Some of the composition is then placed in the model, pressing it around the edges, but always taking care to have a superfluity of the composition. The plug, Fig. 4, is then placed in the center of the model, a slight indentation in its bottom being made to fit over the end of the spindle of the bolt, Fig. 3. The plug is then pressed home, and turned gently to the right, while the model is turned to the left. The superfluous composition is then removed with a knife, and the pot removed by pushing up the bolt. If the composition is at all sticky, it will be found advisable to dip the plug in water before pressing it into the model, and the lat-

ter will also require an occasional dip. The pots as molded are placed in an oven, or in the hot sun, where they speedily dry, and if the composition has been well tempered they will stand a good deal of storing. The dimensions given are only approximate, and for small pots; other sizes can easily be estimated from them, and the thickness of the pots can be varied to suit the wants, or according to the judgment, of the maker. When well made and of proper materials, these pots will stand the winter and spring in frames, though the roots of the plants often work through them. Of course, when bedding out, the pot is put in the ground as well as the plant, and thus, while avoiding any check from shifting, the plants are provided by the rapid softening of the pot in the damp soil with food which they speedily appropriate. These pots are so easily made, and the implements cost so little, that we recommend a trial of them to all who practise the bedding-out system.

The Brotherhood of Locomotive Engineers.

The annual convention of the Grand International Division of the Brotherhood of Locomotive Engineers opened at Irving Hall, in this city, on the 20th of October. The attendance was large, including delegates from all parts of the United States and Canada. An address of welcome was delivered by Mr. Clarkson N. Potter, which was responded to by First Grand Engineer F. S. Ingraham, of Ohio. Grand Chief Engineer Arthur, of Cleveland, in his opening speech noted the growth of the brotherhood, and very justly commended the efforts which some railroad managements have directed toward lowering the wages of the engineers. He mentioned several cases of disagreement between railroad authorities and engineers which had been amicably settled through the arbitration of the Society.

Occupation of New Houses.

It is possible to avoid danger from dampness of new houses by passing air through them rapidly enough to prevent its becoming saturated with moisture. Air which contains no watery vapor is neither pleasant nor wholesome. It should be two thirds saturated; and if this proportion be not much exceeded no injury can arise from such vapor only, and there seems no reason why, if it be derived from a damp wall, it should be injurious if not in excess—that is, if the air be changed rapidly enough to prevent it becoming too damp.

DECISIONS OF THE COURTS.

United States Circuit Court.—Southern District of New York.

PATENT PLANKER MACHINE.—H. D. STOVER AND J. A. FAY & CO. VS. E. S.

HALSTED AND G. W. MERRITT.

[In equity.—Before Shipman, J.—Decided August, 1875.]

Shipman, J.:

This is a bill in equity praying for an injunction and an account, and is founded upon letters patent of the United States, for an improvement in Planing Machines, which patent was issued to Henry D. Stover, one of the complainants, on July 23, 1861. The other complainants, J. A. Fay & Co., are a corporation and the assignees and owners of an undivided half interest in so much of the patent and of the invention covered thereby as is embodied in the third claim of said patent. The assignment was executed September 14, 1868.

The third claim of the patent of H. D. Stover—improvement in planing machines, July 23, 1861—namely, "The arrangement of matching cutters to be adjusted both laterally with each other and vertically upon the bedpiece, essentially as described, in combination with the platen, so that the planing and matching of the piece may both proceed at the same time, or either the planing or matching may be done separately, whether the platen be made movable with the piece secured thereon or the platen be fixed and the piece be made to move thereon," held valid.

The claim, though not expressed with accuracy, should be construed *ut res magis valeat quam pereat*.

The inventor intended to claim a surfacing and matching machine, in which the matching cutters were adjusted laterally and vertically, in combination with the platen, and were so adjustable vertically that the matching mechanism could be mechanically dropped below the platen when surfacing alone was to be done.

The movable or fixed character of the platen is not a necessary part of the improvement to which the third claim relates, and might have been omitted therefrom.

The term "matching-cutters" in the claim signifies "matching mechanism," and the claim is infringed by the Merritt machine, in which the matching spindles alone are dropped below the bed, the heads with the cutting blades having been first removed.

The corporate character of a corporation complainant being averred under oath in the bill of complaint, and the same not being denied in the answer, but simply proof thereof being called for: Held, that the fact of incorporation was in effect admitted by the pleadings.

[S. J. A. Duncan and George Gifford, for complainants.

W. J. A. Fuller, for defendants.]

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From September 10 to September 30, 1875, inclusive.

AIR ENGINE.—A. K. Rider, Walden, N. Y.
BALE HOOP, RUCKLE, ETC.—J. M. Seymour, Newark, N. J.
BLASTING POWDER.—H. Courtelle, New York city.
BOILER FURNACE.—Z. S. Durfee, New York city.
BUTTON FASTENER.—Z. Young, Philadelphia, Pa.
CABINET, ETC.—H. Smith, Jamestown, N. Y.
COMPRESSING INGOTS, ETC.—G. W. Billings, Cleveland, Ohio.
COMPRESSING SCRAP METAL.—L. J. Atwood, Waterbury, Conn.
CORSET SPRING, ETC.—H. Kellogg, Milford, Conn.
GENERATING OZONE.—F. W. Bartlett, Buffalo, N. Y.
HARVESTER.—S. Johnston, Brockport, N. Y.
HEATER.—A. H. Merston, Philadelphia, Pa.
HYDROCARBON FURNACE.—R. B. Horland, New York city.
LOOM.—C. H. Chapman, Shirley, Mass.
LOWERING BOATS.—J. Ferguson, Chicago, Ill.
MAGNETO-ELECTRIC MACHINE.—J. B. Fuller, Brooklyn, N. Y., et al.
MAKING GAS.—W. H. Spencer, Brooklyn, N. Y.
PRISON ALARM, ETC.—J. B. Cook et al., Memphis, Tenn.
PUMP.—J. N. Rowe, Rockland, Me.
PURIFYING GAS.—F. Sweeney, New York city.
RAILWAY BEARING.—B. M. Livermore, New York city.
REFRIGERATOR.—I. Allegretti, New York city.
RETORT LID, ETC.—H. Collinson, Boston, Mass.
SEED DRILL.—W. A. McClintock, Pittsfield, Ill.
SEWING BOOTS, ETC.—C. Goodyear, Jr., New Rochelle, N. Y.
SEWING MACHINE.—C. S. Cushman et al., Philadelphia, Pa.
SOAP.—S. S. Lewis (of Brooklyn, Mass.), London, England, et al.
STITCHING BOOKS, ETC.—H. G. Thompson, Milford, Conn.
TACK-ROLLING MACHINE.—H. A. Williams, West Medway, Mass.
TYPE-SETTING MACHINE.—A. C. Richards, New York city.
VALVE.—W. B. Chisholm, Cleveland, Ohio.
VEHICLE SPRING.—G. Godley, Philadelphia, Pa.
WAGON, ETC.—G. P. Carr, Altoona, Pa.
WATCH, ETC.—A. H. Potter, Chicago, Ill.
WELDING CHAIN, ETC.—Pittsburgh Chain Company, Pa.
WHEEL.—G. Leverich, New York city.

Recent American and Foreign Patents.

NEW TEXTILE MACHINERY.

IMPROVED WEFT-STOP MECHANISM.

Thomas Isherwood, Westerly, R. I.—This is a novel weft-stop motion, whereby the tension of the weft against the feelers, when the shuttle flies from box to box, and during the time the latter is going back, will actuate said feelers. In the absence of the weft, this device causes the shipper to be thrown off half a revolution sooner than when the action is caused by the weft being carried against the feelers by the reed, thereby stopping the loom in the same pick in which the weft breaks. By this means both loss of time and waste of yarn will be saved, as all the picks made in fancy looms using two or more shuttles, after the break, have to be taken out by the weaver. It is also designed to be so contrived that it will not be in the way of the weaver in taking out and putting in the shuttles.

MACHINE FOR FORMING IMITATION BUTTON HOLES.

John Kenny, Dover Road, England.—This machine includes thirteen new devices, and is intended for employment by shoemakers and other workers in leather. Its object is to form a corded button-hole tag, and this is done by cutting a strip of leather into sections with slotted ends, applying a cord across the middle of each section, and so tightening the cord, and compressing the whole between dies.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COMBINED CULTIVATOR AND HARROW.

Isaac P. Pickering, Table Grove, Ill.—The standard of the plow stock has a head made in two parts, bolted together for the reception of the movable teeth. The latter are pointed at one end, and shovel shaped at the other, so that either end may be employed. To form a cultivator, one, two, or more heads may be used, and four, more or less, heads may be used to form a harrow.

IMPROVED REVERSIBLE PLOW.

Myron R. Hubbell, Wolcott, Vt.—This is an improved reversible plow which is so constructed that the point of draft attachment may be changed from one side of the beam to the other by the operation of turning the mold board. The novelty is found in the mode of connecting the draft rod and mold board, which is quite ingenious.

IMPROVED CHURN.

Elias Groat, Napa, Cal.—In this churn the dasher consists of two oscillating comb-shaped frames, the fingers of which swing between each other, so as to effect very great agitation of the cream in a simple way. There is a fluted or corrugated contrivance of the fingers or beaters, which greatly increases their efficiency, and also simple and novel devices for disconnecting the shafts readily, to allow of taking out the beaters and putting them in, as is requisite for cleaning out the churn.

IMPROVED MIDDINGS PURIFIER.

Alvin F. Ordway, Beaver Dam, Wis.—The middings are admitted to an inclined rack at the lower end of the air trunk. As they slide down this rack and so become spread out, a blast of air from beneath carries them up through a series of inclined racks in the trunk, which gives them a zigzag motion. On leaving the trunk the particles have a rotary movement, and come in contact with a vertical partition, around which the light materials pass to a fan blower, while the flour falls and escapes through a spout.

IMPROVED FEEDER FOR THRASHING MACHINES.

Alexander Washington Lookhart, Sacramento, Cal.—The feed arms rest upon the inclined feed table, and are notched at their upper edges and tapered to their lower ends. By means of eccentricities they are given a to-and-fro motion in opposite directions, so that as they move downward they will push the grain to the thrashing cylinder, but will not carry the grain with them when they move upward.

IMPROVED SEEDLINGS PULLER.

John S. Swaney, Marengo, Iowa.—To the shaft at one side of its center is attached a polygonal hub, having eight sides, to the faces of which are hinged an equal number of jaws, which are made in the form of sectors, and which together form a wheel. These jaws, as the machine is drawn along, grasp the plants and lift them up by the roots, holding the same by pressing against the rim of a wheel. Then a wedge enters between the jaws and wheel, and forces the former outward, causing them to drop the plants, which fall upon a receiver, where they are removed and bound in bunches.

IMPROVED WHEEL PLOW.

James Flow, Pilot Point, Tex.—The plow frame is arranged with one side longitudinally adjustable upon the axle, and the plow beam is slotted and so combined with guides that the plow may be gaged to take more or less land as desired.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED SLIDE REST FOR METAL-TURNING LATHES.

George F. Ballou, Pawtucket, R. I., assignor to Henry N. Fisher and John E. Whitcomb, Waltham, Mass.—The slot in the stationary part of the ordinary slide rest is usually cored out at one part sufficiently to insert the nut, which is then attached to the slide by screws after the same is in place. In the present invention the slot and also the nut chamber are extended to the end of the stationary part, so that the shank and nut can be slid into place at the same time that the slide is put on. The idea is to admit of the slide rest being easily taken off or placed in position without detaching the nut.

IMPROVED OSCILLATING JOINT FOR PITMAN CONNECTIONS.

Albert K. Smith, Nebraska, Ohio.—This is a new mechanical device of which it would be difficult to convey a clear idea without the aid of drawings. It is adapted to the connection of a pitman and the object to be moved, also to a crank pin. It is easily detachable, and made so that any slack occasioned by wear can easily be taken up.

IMPROVED PIPE TONGS.

Alexander McDonald, Halifax, Canada.—The fixed jaw, which is the larger, has a hooked end. The forward end of the movable jaw is V-shaped and corrugated. The jaw last mentioned is attached to the stationary jaw by pivoted bars, which are governed by a set screw, so that the space between the jaws may be arranged for different sizes of pipe. The construction generally is such as to secure a large gain in leverage.

IMPROVED SUCKER ROD SOCKET.

Plympton E. Jenks, Petrolia City, Pa.—This is a new instrument for extracting pieces of broken sucker rods from oil wells. It terminates in a socket which fits down over the piece; then a wedge is forced down which jams the piece between it and the socket walls, enabling the fragment to be easily lifted out.

IMPROVED PISTON ROD STUFFING-BOX.

Joseph M. Searle, Stanhope, N. J.—This is a self-adjusting packing box for piston rods, and the essential feature is a conically recessed cup which, impelled by a spiral spring, acts against the natural exit of the steam. The idea is to obviate the continual screwing up of the box to prevent leakage.

IMPROVED OILER FOR CRANK WHISTS.

Charles Kurth, Chattanooga, Tenn.—A pipe leads from an oil receptacle to a bore in the crank pin. Said bore has a branch at right angles, which extends to the surface of the pin. The oil runs from the vessel into the pin, and at the lower half of each revolution of the latter escapes so that a continuous supply is furnished to the crank without necessitating the stoppage of the engine.

IMPROVED TUNNEL.

Olney H. Dowd, New York city.—This inventor proposes to construct a tunnel of narrow sections of elliptical tube, the shape being selected on account of the facility which it offers of transporting the sections to be added, through other sections already in position. He provides means for carrying the sections on trucks through the tunnel, also a means of fastening the sections and packing them, and also a contrivance for holding the cage or case employed in advance of the wall for digging out the bore from being pressed back by the pressure on the head of the case.

IMPROVED AIR VALVE FOR PUMPS.

Simon Smith and Isaac S. Collins, Mauch Chunk, Pa.—The object here is to furnish air to the pump and relieve it of strain, and to save wear on the valves, etc., by preventing pounding. This is done by a valve, suitably arranged in the plug usually inserted in the pump chamber for drawing off the water. This valve is governed by a spring, and its play may be regulated. At each stroke of the piston it rises and admits a small quantity of air.

IMPROVED CAR COUPLING.

Lewis Sibley, Ramapo, N. Y.—On one drawhead is a vertical slotted plate. The other has an arrow headed rod provided with a weighted arm attached at right angles to its axis. When the arrow head is vertical, it easily enters the slot, the weighted lever arm being raised. Dropping the lever turns the arrow, which thus engages in the plate. The principal advantage is offered in the speedy manner in which cars can be uncoupled.

IMPROVED CAR STARTER.

Thomas Murgatroyd, St. Joseph, Mo., assignor to himself and Ferdinand Schoen, of same place.—There is a main lever provided with a hook which fits on the axle. To this lever another lever is pivoted, and this last has a forked end which bites into the flange of the car wheel, turning the same upward, and so starting the car.

NEW HOUSEHOLD ARTICLES.

IMPROVED SPRING ROCKING CHAIR.

Stephen Fallon, Brooklyn, N. Y.—This is a rocking chair minus rockers—the places of which are supplied by coiled springs which support the seat. The springs are attached to a round which crosses the pedestal, and are provided with simple devices whereby their tension may be quickly adjusted.

IMPROVED CLOTHES DRYER.

Harrison V. Osborne and Robert Hay, Trenton, Mo.—This aims at the abolition of that unwieldy article of kitchen furniture the clothes horse, and substitutes therefor a neat rack composed of bars separated by washers and pivoted upon a vertical pin, which, by a suitable bracket, is secured to the wall.

IMPROVED PILLOW.

Gardner T. Barker, Pittsfield, Mass.—This is simply a sack made in two compartments. In one, which forms the upper side of the pillow, feathers or similar materials are placed; the other and larger division is left empty, to be filled with dry leaves or sticks, the device being primarily intended as a convenience in the camp.

IMPROVED PORTABLE LUNCH HEATER.

Maria Bradley, New York city.—Mrs. Bradley offers to workmen who carry their dinners with them to the shop a simple means of keeping their meals hot, and hence rendering them much more palatable. The device is a pail divided into several compartments for various kinds of food, and containing a receptacle having a chimney for the reception of a lamp, by which the contents can be quickly warmed.

IMPROVED DOOR CHECK.

Edwin S. Grauel, Dayton, Ohio.—This is a sliding spring-acted plunger, with hinged head piece and rubber extension, that is thrown by a projecting pin into contact with the floor, and retained by the ends of the head piece locking into ratchet teeth of the casing, the rubber being drawn back into the casing on closing the door. The object is to hold the door open at any desired point, for which purpose the device seems well adapted.

IMPROVED SEWING MACHINE CASTER.

Benoni P. Pratt, Chicago, Ill.—This inventor has devised a caster combined with a simple shoe and frame, so that it can be easily clamped to the feet of sewing machines unprovided with casters. The same invention would probably answer well for chairs or any other article to which it could be applied.

IMPROVED BED BUG TRAP.

Edmund G. Watkins, Georgetown, Cal., assignor to James B. Watkins, same place.—This is a new idea for the extermination of bed bugs. Instead of poisoning them, this inventor makes a trap in which there are several cells or sections. In these dark holes the bugs are sure to congregate, and then all that remains is to remove the apparatus and treat the inmates to any form of death which revenge may dictate.

IMPROVED ASH PAN.

James M. McHelm, Carlisle, Ky.—This is an ash pan, an ash sifter, a poker, and a shelf for heating irons, all combined in one. The poker is worked by a handle from outside, which causes it to rise up between the bars. The shelf for the irons is attached to the frame which supports the ash sifter just above the ash pan, which last is in the form of the drawer.

IMPROVED CRADLE.

Joseph B. Nelbach, Utica, N. Y.—Springs keep the rockers in place upon the edges of a pedestal frame, and also hold the cradle from upsetting in case a child should attempt to climb in or out.

IMPROVED STOVE LEG.

Ira A. Lovejoy, Denver, Col. Ter.—In this device, the inventor provides a really needed improvement in the means of fastening stove legs in place, for at present, when a stove is lifted, the legs frequently fall out. In the present invention, recessed socket projections are made on the underside of the hearth plate, and into these a curved and braced tongue from the leg tightly fits.

IMPROVED SOFA BEDSTEAD.

John B. Kline, Cincinnati, Ohio.—This lounge is so constructed that it may be converted into a bedstead by pulling out the seat section, and then swinging up to the level of the latter a supplementary section which is stored away underneath. The whole takes up but little space.

IMPROVED KITCHEN CABINET.

George Holt, Minneapolis, Minn.—This is a cabinet containing receptacles for nearly everything used in the kitchen, all stowed away in the smallest space. There is an iron board, a dish cupboard, drawers for flour, etc., for spices and for cutlery—a bread board, a knife scourer, a grater, and a vegetable cutter. Besides all these, there are closets for storing large articles, and good sized drawers for table linen.

IMPROVED WASHING MACHINE.

Thomas B. Kirkwood, Dublin, Ind.—The body is hung on trunnions, to adapt it to oscillate, and thus press or squeeze the clothes between a vertical stationary dasher and fixed abutments of the box. Each side of the box works independently of the other side, and can be independently operated. The return stroke, usually lost on ordinary machines, is utilized in this by working the garments in the second compartment. There are several other useful points which tend to adapt the machine to its especial purpose, and to economize the power applied.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WHIFFLETREE.

Patrick McGlew, Des Moines, Iowa.—This invention obviates the necessity of giving the trace a sharp bend or twist in attaching it to, and detaching it from, the whiffletree. The trace is attached to hooks on the end of the tree, after passing through stout straps, secured to the forward side of the same.

IMPROVED PLANER CUTTER SHARPENER.

Garry Marvel, Rochester, N. Y.—In this device the cutter is fastened in jointed clamps so that it can be swayed forward and backward relatively to the stone, so as to vary its bevel. There is a weighted lever for pressing the cutter on the stone, and other useful attachments for adjusting, etc.

IMPROVED CARRIAGE SPRING.

John Fredenburgh, Greene, N. Y., assignor to himself and J. F. Smith, same place.—This is a simple torsional spring for vehicles composed of a steel rod socketed at both ends rigidly to lever arms swinging in opposite direction from each other. The effect is to create a torsional strain in the steel rod, through the separating of the lever arms.

IMPROVED MACHINE FOR JOINTING STAVES.

Benjamin Barker, Ellsworth, Me.—This machine, of which a good idea cannot be obtained without detailed drawings, is the first which has been invented for rapidly jointing machine staves with bevels and bilges perfectly proportioned to their different widths. It adds one more to the category of barrel-making machines which of late years have completely revolutionized the cooper's trade.

IMPROVED BUCK-SAW FRAME.

Porter B. Towle, Haverhill, Mass.—In this invention is given a new way of making substantial saw frames. Three nearly straight pieces of wood are joined by corner pieces of metal inserted in slots in the end, and nails are inserted through both wood and plates.

IMPROVED SLEIGH.

Robert B. Parks, of Princeton, Ill., assignor to himself and John R. Parks, same place.—We have here a sleigh made without tenons, mortises, or joints, and consequently, being free from these sources of weakness, it is without doubt a strong and substantial vehicle. The supporting frames with runners and braces are made of a single piece, either wood or metal, and are attached to the seat.

IMPROVED REIN HOLDER.

Hugh Gilmore and Joseph T. Spencer, St. Louis, Mo.—This hitching attachment is applied to the hind axle of a vehicle, and made to gear with cogs on the hub of the hind wheel, by the action of a pivoted foot lever at the front part or dash board, which causes a hitching line connected to the bridle bits to be wound up and tightened, so that the horses are brought to a stop by the automatic action of the wheels on the hitching mechanism. This does away with the ordinary hitching devices, and at the same time offers a handy means of controlling runaway horses.

IMPROVED CHILDREN'S CARRIAGE.

Leonard B. Harrington, Jr., Boston, Mass.—This inventor has devised a new way of constructing the body of children's carriages so that the same is self-supporting, without the aid of ribs, stays, or frame work in the inside. This is done by an outside rib on the edges. The appearance of the body is improved, and bent wood may be used in its manufacture.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED STENCIL PLATE.

William M. Kellie, Nashville, Tenn.—Instead of cutting of a stencil of several letters from a single plate, this inventor proposes to cut the letters on small separate plates, and then to join the latter to form words by means of overlapping grooves and spring clamps.

MACHINE FOR MIXING AND MOLDING AN IMPROVED COMPOSITION FOR ARTIFICIAL FUEL.

Emile F. Loiseau, Philadelphia, Pa.—The first invention relates to improvements in the apparatus for mixing and molding artificial fuel, for which letters patent have been granted to same inventor under date of February 17, 1874, and which was described and illustrated on page 319, vol. 23, of the SCIENTIFIC AMERICAN. The invention consists mainly in the construction of the molding or compressing cylinders with cavities connected with each other by small channels, and in arranging at the ends of the alternate rows of cavities, near the ends of the cylinders, small recesses for preventing the contact of larger portions of the metallic surface of the cylinders. The composition is fed in granulated state to the molding cylinders by a top hopper with revolving stirrer shafts.

The new composition for artificial fuel consists of coal waste, pulverized clay, and diluted rye and lime paste, thoroughly mingled in suitable proportions.

IMPROVED ARTIFICIAL LEG.

Cornelius Collins and James H. McCalla, East Melrose, Iowa.—The object of this invention is to allow the heel to turn conveniently upon the ankle joint. It consists of a cushion of rubber and hinged rods. The cushion is seated between the ankle and instep, in little recesses, preventing it from being displaced, and it is held up firmly to the ankle by one of the rods, which is permanently fastened. The foot is clamped against the cushion with the requisite pressure by the adjusting nut on the other rod. A spring of rubber together with the cushion and the pivot, forms a very easy and efficient joint.

IMPROVED GLASS TOOL.

Thomas Carr, Rochester, Pa.—At the present time paddles and forks are used for transferring glassware, when finished, into the annealing oven; but for want of proper means for discharging the ware, they are jerked and otherwise manipulated to get the ware off and lodge it in place. To avoid this difficulty, this inventor adopts the simple expedient of combining a pusher with the glass paddle, so as to discharge the ware when placing it into the oven.

IMPROVED MEANS FOR REEFING AND FURLING SAILS.

Edward Rawley, North Union, Me.—This invention includes a triangular topsail set immediately above the gaff of a fore and aft sail. The tack of the upper sail reeves through an eyebolt on the gaff, thence up through rings on the back of the sail to a block, and thence to the deck. The idea of thus arranging this rope is to give increased support to the jaws of the gaff, and at the same time to admit of the easy handling of the topsail.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

\$500 invested in a profitable invention will give large returns.—A. D., 333 Morris Avenue, Newark, N. J. Agents Wanted: Knife Cleaner, 62 Fulton St., N. Y.

Brass Plating on Zinc without battery. Instructions for sale by W. Key & Co., 183 Allen St., N. Y. City.

Shapley Engine, guaranteed full rated power, 60 lbs. steam pressure. Send for Circulars. R. W. Wilde, agent, 20 Cortland St., N. Y.

For Sale—New Woodworking Machinery: Excelsior Machine, \$275; Power Moulder and Jointer, \$250; Shingle Mills and Jointers, \$235; 30 in. heavy Rotary Bed Planer, \$650; 26 in. Rotary Bed Planer, \$235; and 24 in., \$190; Woodworth Planer and Matcher, No. 3, \$1,000; Woodworth Planer and Matcher, No. 2, \$750; Woodworth Planer and Matcher, No. 2½, \$840; Excelsior Planer and Matcher, \$410; Woodworth Surface, \$345; 3 side Monitor Moulder, \$325; 4 side Moulder, Ball's, \$360; 4 side Sash Moulder, \$308; 3 side Sash Moulder, \$140; Ball Rail Planer, \$308; 3 side Sash Moulder, \$140; Door Mortiser and Borer, \$175; No. 4 wood frame Tenoners, each, \$240; Blind Stile Tenoner, \$80; Hor. Rail Car Borer, \$80; 20 Hand Boring Machines, each, \$4; Wright Scroll Saw, \$115; Rollstone Scroll Saw, \$90; Iron Frame Band Saw, \$150; 20 in. Pattern Maker's Lathe, \$100; 21 in., 20 in., and 12 in. Wood Turning Lathes, \$96, \$87, and \$60; Butting Machine, Ball's, \$85; No. 3 Dowel or Rod Machine, \$24; Hor. Cornering Machine, \$45; Cylinder Stave Saw Machine, \$75; Iron Frame Railway Cut off Saw, \$92; Box Board Matchers, \$65; Lot Steel Saw Arbors, from \$12 to \$21, each; 5 Knife Grinding Machines, \$16 each; 2 Emery Grinding Machines, \$15 and \$30. For printed descriptions, address Forsyth & Co., Manchester, N. H.

2d Hand Mill and Woodworking Machinery for Sale: 3 Complete Circular Saw Mills, \$550, \$380, and \$310; 2 Patent Saw Mill Set Works, \$80 each; Up and Down Saw Mill, with 3-24 in. Whitney Wheels, \$360; Perry Shingle Mill and Jointer, \$135; Shingle Mill, \$55; Lath Sawing Machine, 3 saws, \$185; 26 in. double belted rotary bed Planer, \$240; 24 in. rotary bed Planer, \$170; 16 in. Planer, \$90; Daniels Planer, 28 ft. x 28 in., \$175; No. 2-3 side Rogers Moulder, \$325; No. 2-4 side Lee Moulder, \$320; Sash and Blind Sticker, 1 side, \$115; No. 2 Smith Power Mortiser, \$135; No. 2 Smith Tenoner, \$175; Smith Blind Stile Borer, \$63; 2 Small Boring Shafts and Bits, \$16 each; Box Board Matcher, \$40; Iron Frame Blanchard Spoke Lathe, \$225; Felloe Machine, \$50; Stretching Machine, \$75; Cut-off Saw Arbor and 2 in. Saw, \$16. Also lot Shuffling, Pulleys, and Ringers. For full printed lists, address Forsyth & Co., Manchester, N. H.

For Sale—2d Hand Engines, good order: 60 h.p. Sta. hor., \$1,100; 40 h.p. Sta. hor., \$740; 50 h.p. Chubbuck, \$1,200; 40 h.p. Upright, \$700; 2-35 h.p. Portables, \$1,500 and \$1,400; 30 h.p. Portable, \$1,270; 3-25 h.p. Portables, \$1,475, \$1,525, and \$1,500; 25 h.p. Sta. hor., \$625; 2-18 h.p. Portables, \$1,000 and \$950; 10 h.p. Upright Reolting, \$610; 8 h.p. Sta. hor. (with Boiler), \$525; 6 h.p. Portable, \$475; 3-5 h.p. Portables, \$445, \$275, and \$250; h.p. Caloric, \$250; 2½ h.p. Sta. (with Boiler), \$300; new 1½ h.p. Portable, \$185. For printed lists, address Forsyth & Co., Manchester, N. H.

Boilers, 2d H'd, in good repair and complete, for Sale: 50 h.p. horizontal, \$1,000; 2-60 h.p. hor., each \$425; 4-50 h.p. hor., each \$500; 1-45 h.p. hor., \$700; 1-12 h.p. upright, \$300; 1-10 h.p. upright, \$175. For full printed descriptions, address Forsyth & Co., Manchester, N. H.

Grist Mill Machinery, 2d Hand, for Sale: 1-36 in. "Platt" Portable Grist Mill, \$220; 1-30 in. "Platt" Portable Grist Mill, \$200; 1-24 in. "Olds" Portable Grist Mill, new stones, \$225; 1 Run Stones, 4 ft. diam., \$50, or same with curb, hopper, elevator, and pulleys, \$65; 1 Rim 4½ ft., French Burr. For printed list, address Forsyth & Co., Manchester, N. H.

Bolt Headers, both power and foot, and Power Hammers, a specialty. S. C. Forsyth & Co., Manchester, N. H.

Address wanted of Manufacturers of Small Tools and Lathes. J. L. Kennedy & Co., Macon, Ga.

Treatise on the Steam Engine Indicator, price \$1.50. Address E. Lyman, C. E., New Haven, Conn.

A useful set of Tables for Machinists. Price 25 cents. E. B. Knight, Manayunk, Philadelphia Co., Pa. Main Driving Belts—Pat'd Improvement. Address for circular, Alexander Bro's, 413 N. 3d, Philadelphia, Pa.

Geo. P. Rowell & Co., Advertising Agents, No. 41 Park Row, New York. As the proprietors of the first and most extensive of these agencies in New York, they are well qualified to furnish information. The details of the work transacted by the agency, and the way it is done, the perfection of the arrangements for facilitating the act of advertising by relieving the advertiser of trouble and expense, and bringing before him all the various mediums throughout the country, with the necessary knowledge pertaining to them, are given with a minuteness that leaves nothing to be desired. All the particulars respecting the character and position of a newspaper which an intending advertiser desires to know are placed before him in the most concise form.—[New York Times, June 7, 1874]

The London Manufacturing Company's Varnishes are better than any imported. Their varnishes for oil-cloth makers have never been equaled, and their other products rank equally high. The quality of the goods is unsurpassed.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Friable & Co., New Haven, Ct.

Wanted—The best Machine for pointing Horse Shoe Nails. William Morehouse, Buffalo, N. Y.

Saw Teeth Indicator—Showing improved form for filing teeth on saws for use in different kinds of wood, &c. Sent free for 50c. E. Roth, New Oxford, Pa.

For reduced prices of Surface Planers and Mitre Dovetailer's Machines, send to A. Davis, Lowell, Mass.

"Pantocot," or Universal Worker—Best combination of Lathe, Drill, Circular, and Scroll Saw. E. O. Chase, 7 Alling Street, Newark, N. J.

Scale in Boilers Removed—No pay till the work is done. Send for pamphlet. Geo. W. Lord, Phila., Pa.

To Manufacturers—Pure Lubricating Oil, Sample Package (34 gals.), \$7. Send to Geo. Allen, Franklin, Pa.

Educational Lantern Slides—Send for Catalogue to Prof. W. A. Anthony, Cornell University, Ithaca, N. Y.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Sale—Second Hand Wood Working Machinery. D. J. Latimore, 21st & Chestnut St., Phila., Pa.

Small Engines. N. Twiss, New Haven, Conn.

Soap Stone Packing, in large or small quantities. Greene, Tweed & Co., 18 Park Place, New York.

Boulton's Paneling, Moulding and Dovetailing Machine is a complete success. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

For best and cheapest Surface Planers and 1 Universal Wood Workers, address Bentel, Margader & Co., 11 Milton, Ohio.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

Rubber and Oak Tanned Leather Belting—Greene, Tweed & Co., 18 Park Place, New York.

Price only \$3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

Small Tools and Gear Wheels for Models. List rec. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Peck's Patent Drop Press. Still the best in use. Address Atlio Peck, New Haven, Conn.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

All Fruit-can Tools, Ferracute W'ks, Bridgeton, N. J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Temples and Oilcans. Draper, Hopedale, Mass.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Magic Lanterns and Stereopticons of all sizes and prices. Views illustrating every subject for Parlor Amusement and Public Exhibitions. Pays well on small investments. 72 Page Catalogue free. McAllister, 49 Nassau St., New York.

Water, Gas, and Steam Goods—New Catalogue packed with first order of goods, or mailed on receipt of eight stamps. Bailey, Farrell & Co., Pittsburgh, Pa.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$6, with good battery. F. C. Beach & Co., 246 Canal St., New York. Makers. Send for free illustrated Catalogue.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

The Baxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Brass Gear Wheels, for Models, &c., on hand and made to order, by D. Gilbert & Son, 212 Chester St., Philadelphia, Pa. (List free.) Light manufacturing solicited. American Metaline Co., 61 Warren St., N. Y. City.

Genuine Concord Axes—Brown, Fisherville, N. H.

Faught's Patent Round Braided Belting—The best thing out—Manufactured only by C. W. Army, 148 North 3d St., Philadelphia, Pa. Send for Circular.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

Notes & Queries

J. J. P. can harden strips of iron by the method described on p. 69, vol. 31.—H. E. Jr. will find a good recipe for mullage on p. 251, vol. 33.—W. A. B. will find directions for making a rust joint on p. 213, vol. 32.—S. T. C. will find rules for proportioning boats on p. 239, vol. 28.—D. M. will find a good recipe for blacking on p. 283, vol. 31.—Soap-making is described on p. 218 vol. 23.—J. C. McG. will find directions for polishing shirt bosoms on p. 203, vol. 31.—T. T. will find a rule for ascertaining the horse power of an engine by referring to p. 33, vol. 33.

(1) M. C. S. asks: We often have occasion to make a large quantity of an alloy composed of 80 parts of copper to 20 of tin. What is the best flux to prevent the slagging of the metals? The furnace is a large reverberatory one. A. Use a little potash, or a mixture of potash and soda, putting it on top when the metal is melted.

(2) W. B. says: 1. I am building a boat 80 feet long, and will use 13 foot side wheels. What sized hub should I use? A. Two feet in diameter. 2. How many spokes would be best? A. Twenty. 3. What should be the size of the paddles? A. About 18 or 20 inches long, and 8 or 10 wide.

(3) J. S. C. says: Owing to the situation of the earth's aphelion at the present time, the northern spring and summer is seven and a half days longer than the southern spring and summer. Now when the earth's aphelion comes to be situated at a point in the earth's orbit opposite to what it is at present, will the spring and summer for southern latitudes be seven and a half days longer than the northern? If not, what is the difference that will then exist? A. There will be no difference.

(4) N. S. T. asks: 1. How can I describe a circle whose circumference shall pass through one angle and touch two sides of a given square? A. This is the problem of passing a circle through any three points, not in the same straight line, which is given in nearly every work on geometry. We understand you to mean the vertex of the angle, in speaking of the angle. 2. How can I draw the geometrical representation of a circle of any given size and from any given point of vision? A. You will find it fully explained in the "Student's Draftsman's and Artisan's Manual," by Professor Warren.

(5) J. E. W. and others.—We do not know what is meant by an engine of 25 nominal horse power, as this term has no fixed signification.

(6) J. B. L. says: In your issue of January 1874, is an article on cheap telescopes, signed B., in which he mentions a meniscus lens of 1 inch in di-

ameter and 48 inches focus as a proper objective for a small telescope. I propose to get one 1½ inches diameter and 48 inches focus; and would like to know if it would not make a more powerful object glass than the one selected by your correspondent. A. A lens of 1½ inches diameter will not be more powerful than one of 1 inch, if the focal length is the same; but it will admit more light. The form of the larger lens must be very perfect, otherwise the images will not be as sharp. It is for this reason that diaphragms are used to cover up the imperfections of large inferior lenses. 2. Is it a rule that the focus should be any ratio to the diameter? A. There is no rule for focus and diameter; but 1½ inches is a rather small diameter for 4 feet focus, and only highly illuminated objects can be distinctly seen through such a telescope, of which the great defect is want of light. 3. Will a plano-convex 1½ inch in diameter and of 1 inch focus make a good eyepiece? A. A plano-convex will make only a tolerable eyepiece. 4. What would be right? A. Have two such lenses in the eyepiece, combined on the Huyghenian principle. 5. What would be the power of the instrument constructed of the glasses proposed? A. The power of a telescope is found by ascertaining how often the focal length of the eyepiece goes into that of the objective. Your eyepiece being 1 inch, its length is contained 48 times in the focal length of the objective; and the magnifying power will be 48. With a ¾ inch eyepiece it would be 64; with a ½ inch eyepiece, 96; and the same eyepiece, used with an objective of 48 feet focus, would give 1,152.

(7) E. G. A. asks: How can I obtain membership of the American Association for the Advancement of Science? A. You have to be proposed by a member at the next meeting, in Buffalo, N. Y., August, 1876, and then you pay \$5 initiation fee and \$3 annual dues.

(8) W. A. H. asks: 1. Is it possible that any opaque substance may be colorless? A. When opaque substances are colorless, they are white or black. Chalk is white, and coal is black; this means that coal absorbs the luminous rays, while chalk reflects them; if not all, at least equal quantities of each colored ray. 2. Does it follow that opacity of matter is consequent upon laws of color and light? A. Of course opacity of matter as well as transparency depends as much on the laws of light and color as in the material. 3. What constitutes opacity of matter, aside from the general definition of not being transparent? A. Opacity of matter depends on the internal structure of the substance; if it is adapted to transmit light with a certain degree of perfection, it is called transparent; if the light is transmitted only imperfectly, it is called translucent. 4. Why is not colored glass opaque? A. Colored glass may be opaque, and may be made so as well as transparent or translucent; it is used in the imitation of various colored gems, some of which are opaque and some transparent. For instance, the onyx is translucent, with opaque layers, in a variety of colors.

(9) J. M. S. says: I have a small spyglass which magnifies very well, but the view is slightly indistinct. Can anything be done to improve it? A. See if the lenses are clean and not scratched; see if they are put in right, and not reversed, as is sometimes done after cleaning them, which will spoil the best glass. Perhaps the objective needs a diaphragm, a black disk with a hole in the center, placed outside in front of the objective; this addition will often make very inferior glasses more distinct. Make several of these diaphragms, and find out which suits best. The smallest holes give the most distinct images, but admit the least light, and vice versa.

(10) W. B. says: I have a double lens microscope; the lenses are 1¼ inches in diameter and 0.2 inch thick in the center. I wish to make a field glass of it; how long a tube should I make? Must I use both lenses or only one? Must I have a smaller lens for the eyepiece, or should this be a plain glass? A. A microscopic lens cannot be used at all for an object glass in a telescope, and it makes a very bad eyepiece. Try an object glass of 17 inches focal length; and if it is of good glass, you may perhaps use the strongest power of your microscope, but you will see everything upside down. The object glass will cost you as much as a whole telescope or field glass. We advise you to leave the microscope as it is, and buy a field glass ready made; it will be the best and cheapest in the end.

(11) H. W. P. asks: 1. How can I construct a celestial eyepiece for a telescope with a 2 inch achromatic objective, of 30 inches focal length, that will magnify 100 diameters? A. Make the proper combination of two lenses, as we have already described, and give it a focus of 1 foot or 2½ inches, as the focal length of the objective divided by that of the eyepiece is equal to the magnifying power. 2. What is the composition of speculum metals, for reflector mirrors? A. Use 66 per cent copper and 34 of tin, or 7 parts copper, 3 zinc, and 4 tin, or 2 lbs. copper and 14 oz. tin. 3. Is there any work published giving information as to the grinding and polishing of lenses? A. You will find an article on this subject in Ure's "Dictionary of Arts and Manufactures," under the head of "Grinding Optical Glasses." Also read the article "Glass;" it probably contains all you want to know.

(12) J. G. says: We find that we cannot make cry cellars in Louisiana. Will it do to sink a watertight tank 25 or 30 feet into the earth? Would the air become foul at the bottom? A. Tanks, of not too great a diameter, with plank bottoms and with proper cribwork bracing, might be built and used for cellars as you suggest; but if they are to be employed for the storage of fruit, proper means of ventilation would have to be provided. A box tube extending to the bottom and provided at top with a hood, arranged with a vane to open always towards the windward, would utilize the force of the wind for this purpose.

After the air is fully changed, the tube could be closed with a valve, when the air confined below would gradually become of the temperature of the earth at that depth.

Our jail being of poor brickwork, prisoners often break out. Would this be a remedy: Build up at single brick wall within the present wall, leaving open space of 6 or 8 inches, and fill this space with dry sand up to the roof? Could any one pass out through the wall till all the sand from above had run out? A. Your plan is an ingenious one, and might answer if the walls were well anchored together. An entirely new wall, however, of stone work, consisting of large stones laid on good cement, would be far preferable if you could accomplish its erection.

(13) H. F. S. asks: 1. Would tungstate of soda do for saturating a rug, to prevent ignition by sparks from a wood fire? A. Yes. 2. How strong should the solution be? A. Dissolve as much as you can of tungstate of soda in hot water sufficient for the rug.

(14) S. W. asks: How do practical opticians give the final adjustment to microscope objectives which are composed of superposed lenses? With two lenses there is no difficulty, as there is only one distance to determine; but with three the trouble is greatly augmented, owing to the innumerable changes which may be made in the distances with that number of lenses. I have tried various formulas, some as published and others original, but I have not found one by use of which I could take an arbitrary distance for two of the lenses, and finding by trial the best position for the other. A. This is a subject on which it is utterly impossible to give satisfactory written explanations; it has been the great problem of such men as Lister, Hartnack, Tolle, Wenham, etc., and to which they devoted a great part of their lives. But you must consider that you can never take an arbitrary distance of two of the lenses and make it all right with the addition of a third; the distances are all determined by the curvature of each lens.

(15) F. G. says: Please describe the process of charging electro-magnets. A. Electro-magnets are charged by surrounding them with helices of copper wire and then passing a strong current from a battery through the helices. Artificial magnets of steel are charged by rubbing them with a powerful permanent or charged electro-magnet, commencing at the center and passing to the ends several times in succession. Care must be taken to use the same end of the charging magnet for one half of the new magnet, and the opposite end for the other half.

(16) J. L. T. asks: 1. What are the elements of a Hill battery? How are they put together, and what exciting liquid is used? A. Copper and zinc. The copper plate, to which is soldered an insulated copper wire, is placed at the bottom of a jar of water in which a little sulphate of zinc has been dissolved. A zinc casting is then suspended from the top of the jar so that it just dips below the surface of the water, after which a handful of sulphate of copper crystals is dropped in and the battery is ready for action. None of the copper crystals should be left in the zinc; care, also, must be taken to keep the blue line from quite reaching the latter. A wire from the zinc and the insulated wire from the copper plate form the terminals. 2. What is a Lockwood battery? A. Same as the Hill, with the exception that a long spiral copper wire is substituted for a copper plate in the latter. 3. How was House's battery made? A. We believe there is no such battery in use. House originally used the Grove battery to work his printing instrument. 4. I often see the diameter of wire given in decimals of an inch. How may this be reduced to the regular gage? A. The diameter of the different gage wires is arbitrary. What is called the Birmingham gage is used in England and, less extensively, in this country, but it varies with the different manufacturers, as no authorized standard has been made. More exact information is therefore conveyed by simply stating the diameter in inches. An American gage was introduced a few years ago, and is much used; with this gage the numbers run in a geometrical ratio. See p. 363, vol. 28. 5. Am I right in making a condenser as follows? I take a strip of silk, to which I stick tissue paper with varnish, and (with varnish) fasten tinfoil to both sides of the silk and paper, covering the sides to within an inch of the edges. I fold this with another piece of varnished silk to prevent metallic contact. After all is folded, must this tinfoil be made part of the primary current of a Ruhmkorff coil? A. Yes, but the alternate tinfoil strips must be connected together so that, in reality, there are two large tinfoil surfaces. These are connected to opposite sides of the break in the primary circuit, one to each.

(17) E. T. H. asks: How are the wires arranged in electrical annunciators so that the electricity generated in a few cups is sufficient for all the wires? If they are all joined together, I should think the electric fluid would find the shortest way back to the battery, and so not touch the wires, but pass through their connections. A. Where only a few annunciators are to be worked, they are commonly all supplied by one battery. In other cases, they are divided up and one battery made to work a given number. Every conductor offers some resistance to the passage of the current; and when several circuits are supplied from one battery, the current in each is inversely proportional to its resistance. The proper way, therefore, is to make resistance of all the circuits equal, when supplied from a common battery; the current will then be alike in all.

How are Pharaoh's serpents made? A. See p. 347, vol. 28.

(18) S. W. says: My local battery "boils over," leaving a white coating on the top of the inside and all over the outside of the jar. This is a gravity battery. The same thing occurred when

I used a Daniell battery, with the difference that the deposit on the jar was blue. One curious thing about this performance is that the battery always takes advantage of my absence for this performance. I think it prefers a cold dark night, at all events I can never catch it in the act. I have tried kerosene oil, but it still stops over. What is the matter with it? I have no doubt many other operators owe a dirty office or battery closet to the same cause, and would like to learn a remedy through your paper. A. The white deposit is sulphate of zinc. This always appears when a solution reaches its point of saturation; cold water will contain less of the salt than warm, which accounts for the greater amount that is noticeable when the weather is cold. The simplest remedy is to paint the inside of the jar at the top, or warm it and rub with paraffin from the water level to the edge. The solution should also be kept considerably below saturation, by drawing part of it off from time to time and supplying its place with fresh water.

(19) G. P. H. says: I wish to construct a magneto-electric machine for medical purposes, to be operated by a crank. I have seen one in which a small double cylinder was made to revolve with great rapidity. Of what is the double cylinder composed? A. The double cylinders form an electro-magnet. This is composed of two soft iron cores, around which helices, consisting of many convolutions of copper wire, are first wound; the cores are afterwards united by a flat bar of iron. Connection between the helices is so made that the direction of all the windings would be one way if the cores and joining bar were drawn out straight. This is done by connecting the two inner ends of the coils together, when the windings start at like ends of the cores and go in the same direction. One of the outer ends of the coils is then connected directly with the axis to which the magnet is attached and through this to one end of the box, while the opposite, outer end is connected to an insulated ring placed on the same axis. A small piece or segment is cut out of the ring, and a flat spring from the latter leads to the opposite end of the box. One or more permanent magnets placed in front of the electro-magnet charge the latter twice in opposite directions for each revolution, and the electro-magnet, acting inductively, then produces currents of electricity in the surrounding coils.

(20) R. asks: What is the use of the steam pipe from the top of a steam dome on a boiler to the water barrel of the water gauge? Is it to keep the water at a certain level? A. It is for the purpose of furnishing dry steam to the gauge.

(21) H. M. asks: 1. In using a portable engine with 5 inch cylinder to run an up and down saw, what length of stroke do I require? A. Let the stroke of saw be 6 or 8 inches. You can run the carriage also with a small saw and a high pressure of steam. 2. Does an up and down saw require more power than a circular to do the same work? A. No, less.

(22) A. D. asks: Is there a gain in power, in having the area of the sails of a windmill equal to the whole area of the circle, over the old style of four sails? A. No.

(23) J. E. M. says: I am troubled with a chimney which draws pretty well except when the wind is in a certain direction; what arrangement for the top of it will surely prevent the smoking? A. You do not give sufficient data to enable us to judge of the cause of the difficulty. It is usually found, however, that when a chimney smokes during the continuance of a wind in a certain direction, it is caused by its being in close proximity to a higher object, such as the ridge of a roof, or a higher building. The remedy in such case would be to extend the flue to a point sufficiently high to overtop the neighboring more elevated structure. There are other conditions, such as the place of the doors and windows of the apartment from which the flue proceeds, their being open or closed, etc., which should be taken into consideration, but of these we are not informed.

(24) J. B. asks: If a rope 300 feet long when coiled up weighs 100 lbs., will it weigh twice or more than twice as much if suspended from the scales? The argument originated about the ability of aeronauts to cause their balloons to descend by that means. A. It will weigh the same in both cases.

(25) E. A. A. asks: 1. How is Hooke's universal joint made? A. It is the common universal joint. 2. Will it transmit power at nearly right angles? A. You should use two joints to turn a right angle.

(26) J. S. E. asks: A water motor makes a great noise in our buildings, roaring and thumping through the pipes. What can be done so that this noise can be stopped? A. Probably an air vessel on the delivery and discharge pipe, arranged so as to cushion the water, will remedy the trouble.

(27) J. S. S. asks: 1. How wide should I make a 20 foot breast wheel under a 12 foot head, to run a circular saw 48 inches in diameter? A. You can calculate it for yourself, on the assumption that the power of the wheel will be from 68 to 70 per cent of that of the water in which it is used. 2. Will cogs with 6 inches face on the side of the wheel, making a circle of 20 feet, be strong enough to run a 48 inch circular saw? A. Yes.

(28) H. H. asks: 1. Given a lathe whose fly wheel is 18 inches in diameter, and crank $1\frac{1}{4}$ inches long, attached to a treadle worked by foot power, which would give the best result in power and speed (apart from friction), connecting the piston of a small engine direct to the crank to which the treadle is now attached, or to a belt from a 6 inch pulley on main shaft of the engine to a 6 inch pulley on main shaft of lathe, on which the fly wheel is? A. The direct connection would

be the best. 2. About what size of cylinder should be used, other parts being in ordinary proportion, for an engine to run a lathe which is easily operated by foot power? What size of boiler is needed? A. Cylinder $1\frac{1}{4}$ by $1\frac{1}{2}$ inches. Boiler, 12 inches in diameter by 18 inches high.

(29) J. A. says: I am making a pond and desire to prevent leakage. Your advice will be appreciated. A. See p. 249, vol. 29, for a full description of the best way of making puddle walls, which will apply in your case. The bottom of your pond may be laid in the same manner as the two first courses in the wall.

(30) Y. F. C. says: 1. I am about to make an induction coil 12 inches long, with heads 7 inches in diameter, and a tube or cylinder of pasteboard, perfectly dry and hard. Will it do? A. Pasteboard saturated with paraffin would answer very well, so also would thin sheets of gutta percha. If the latter are employed, several thicknesses should be used. In the construction of large coils, glass or thick gutta percha tubes are commonly employed for this purpose. 2. In insulating the secondary coils, would you use pure sheet rubber upon each layer? A. Pure sheet rubber is good, but would probably be expensive; thin paper saturated with paraffin will answer perfectly well. 3. Should the primary coil be very well insulated from the core, or will the pasteboard of $\frac{1}{4}$ thickness be sufficient? A. Yes, insulate carefully. A tube $\frac{1}{4}$ of an inch thick at the ends is sufficient to place between the primary and secondary of a coil 12 inches long; it may even be made less in the middle.

(31) J. H. asks: Can we bring a spring to the house a distance of 260 feet, the fall being about 22 feet, with a slight elbow, and a brook to cross that will make a bow down in the pipe of 2 feet? A. If we understand you, you have a total vertical fall of 22 feet to where the lowest part of the pipe will be, and then a rise of 2 feet to where the water is to be discharged. If this is correct, you have simply to close up the lower end of the pipe, attach a faucet a short distance from the end, and the water will run, notwithstanding the 2 feet rise, whenever you turn the faucet. The pipe should be laid under ground deep enough to avoid freezing. If the spring is higher than the point where you want the water supplied, the water will rise of itself to that point, without regard to the depth it may have to descend below it before reaching it.

(32) W. B. says: I intend building a fruit preserver, with an upper story to store the ice in, and a lower floor for fruits. Please give me the best plan of construction to prevent sweating and to regulate temperature. A. See p. 251, vol. 31, for description of an icehouse that will give you all the information you require, if you use the surrounding chamber instead of a lower room to store your fruit, etc. If, however, you prefer the room under the ice, elevate the ice chamber high enough for the purpose by providing a strong frame and heavily timbered floor to sustain the stock of ice, and then construct the surrounding chamber the same as described on the page referred to. A cube of ice of 12 feet will keep, better than one of less size, through an unfavorable season.

(33) M. K. asks: What was Dr. Bradley's method of winding helices with uncovered wire? A. The helices are wound by machinery specially constructed for the purpose, but the process has not been made public.

(34) C. R. asks: 1. How should one totally ignorant of electro-plating proceed to learn enough of the art to do a little amateur dabbling, working alone and where he can get no assistance? A. Better read some elementary work on the subject. Sprague's "Electricity, Its Theory, Sources, Sources, and Applications," contains much excellent information for amateurs. 2. Do the solutions deteriorate by being kept in a lead tank, and that for some time? A. As a general thing, no; the solution, however, determines that. 3. What is the proper mode of securing the gold and silver contained in the solutions in a tangible, marketable form? A. Two silver processes are commonly recommended: (1) Add sulphuric acid until all the metal is thrown down, and then melt the precipitate after drying; this is a dangerous one and must be effected in the open air, as poisonous gases are given off. The residue must also be fused by degrees, as the cyanide of silver does not fuse quietly. (2) Evaporate the solution to dryness and fuse till the silver is reduced, and wash off the cyanide of potassium. Gold may be precipitated in the same way. Mix the precipitate with an equal weight of litharge, and fuse. After washing the residue, place it in excess of nitric acid, which will dissolve out any other metals present, and leave the gold pure.

(35) G. H. M. asks: I am running a planer and matcher; it has yellow metal boxes, which trouble us by heating. Can you suggest a remedy? A. We have known of several instances in which boxes lined with Babbitt metal have been substituted, for the kind which you describe, with good results.

(36) J. B. W. says: 1. We have a 26 feet x 44 inches boiler. The brick stack is 49 feet high, and was built for burning wood, for which there is plenty of draft. In burning coal it takes 25 to 30 bushels to run 2 pairs burrs for 10 hours. Would it take less coal to keep the same amount of steam if our stack was built up to 65 feet? A. You do not send sufficient particulars. Possibly your grate, which was suitable for wood, is not well adapted for coal. 2. Would sheet iron do for the addition to the stack? A. Yes. You can ascertain the best height for your chimney by putting on a sheet metal top and fixing it at the best point for your draft.

(37) C. B. R. asks: What is used to whiten the fire pots of cast iron stoves? A. We believe they are generally kalsomined.

(38) R. L. F. says: A friend of mine, a locomotive engineer, says that a man, before taking charge of a locomotive, should first fire one for 3 years. I say this is not necessary in every case. I have a model engine of my own make, fitted with a link motion for reversing which works very well. I have read and studied steam and the steam engine. Would it be necessary for me to fire 3 years in order to take charge of a locomotive? A. Your friend's statement is generally correct, but there are exceptions to nearly every rule.

(39) H. L. C. asks: Is a steam engine of 1 inch bore large enough to run a small light lathe for turning file handles and chalk line spools of soft wood, supposing the steam to be at 30 lbs. to the inch, and engine to cut off at $\frac{3}{4}$ stroke? A. You do not send sufficient data, but your engine is rather too small.

(40) G. H. J. asks: Is not a breast wheel the best where the water supply is limited and the fall deep? A. We think it would be a question between this and one of the best turbines.

Is phenology a genuine science? A. We believe that it is based upon correct principles, but it is as yet not fully developed for lack of data. In these respects, it bears some comparison to the science of weather observation.

(41) R. E. A. asks: 1. Please give me directions for making a paper canoe. A. See p. 163, vol. 27. 2. Please give me a recipe for the paste for paper boats. A. Use a fused mixture of equal parts of pitch and gutta percha. 3. Should the paste on one layer be allowed to dry before putting on another? A. Yes. 4. What is the best waterproof paint for it? A. Solution of asphalt in turpentine. 5. Will thick brown wrapping paper do? A. Such paper will answer, but it is advisable to use thinner paper and a greater number of layers.

(42) T. H. says: Some three years ago a neighbor commenced wearing wire spring garters. After wearing them a few months, her limbs began to have strange feelings, such as occasional numbness and nervous flashings up and down the limbs below the garters; and as she did not like them very well she thought she would not wear them and gave them to her sister. After her sister had worn them a few months, she felt numbness, etc. Was the wire charged with electricity or not? A. We do not see how the garters could be charged with electricity to any greater degree than anything else attached to the person. We hardly think the cause of the trouble is electrical.

(43) F. P. M. and all others who wish to commence studying the steam engine should read Bourne's "Catechism," "Hand Book," and "Recent Improvements in the Steam Engine," and Forney's "Catechism of the Locomotive."

(44) R. H. H. says: I have two patents. The drawing in one is attached to the specification with a blue ribbon, and the other with a red ribbon. A neighbor (another patentee) tells me that the color of the ribbon, which is attached to the seal and connects the specification and drawing together, indicates the extent of novelty of the invention. Can you give an explanation? A. The only significance which we have ever heard attached to the color of ribbon used on patents was that it indicated the temperament of the clerk at the time he was preparing the documents to send out. When he is melancholy and out of sorts, it is said he uses blue; when cheerful and happy, red. We do not vouch for the truth of this, but it is the best reason for the difference of colors used which we have ever heard.

(45) S. S. says: In repairing the bell of 1775, do not drill, cut, or waste the precious metal. Mold it in some infusible material: heat the whole mass (bell and mold) to perfect fusion. When cool you will have the same metal that peeled forth notes of independence in 1775, except that lost by oxidation in the process of fusing.

(46) G. D. says: 1. In No. 14 you speak of iodine and olive oil as a remedy to prevent hair from falling off, but you neglect to state how to use it, namely, how often and how long. A. See answer to J. N., p. 138, present volume. 2. Nine men out of ten, over 30 years old, in Chicago are bald or rapidly becoming so. Is it caused by the climate? A. It is attributable as much to the mode of life of your citizens as to any climatic influence.

(47) M. R. says: I wish to make one quart aqua ammonia. How can I make it? A. Place in a capacious glass flask or retort a quantity of either the carbonate or chloride of ammonia; pour over this a strong solution of potassa in water, and apply heat. A copious evolution of ammonia gas will ensue, which should be conducted by means of properly arranged glass tubes, so as to enter beneath the surface of the water (distilled) which it is desired to saturate with the gas. The water should be kept as cool as possible during the operation, as cold water dissolves the ammonia in much larger quantity than hot water.

(48) I. X. L. asks: Has the temperature of a gas after being condensed any influence on its capacity for absorbing heat when allowed to expand, that is, if we condense a gas to a liquid, would it make any difference if we reduced the temperature of the liquid before allowing the expansion to take place? A. It would. This question has been answered several times before.

(49) E. H. says: You give a recipe for making paraffin varnish. I tried it on a sample of bright steel goods, and it would not dry. What was the cause? A. If the solvent used be pure, and the paraffin (not paraffin oil) good, we do not see how a failure could be possible. The recipe is by no means new.

(50) C. B. C. asks: What kind of acid shall we use to put names on iron? A. Coat the iron with paraffin, and write with a needle. Dip the iron in strong nitric acid (aqua fortis).

(51) J. P. O. asks: 1. Can air be forced through spirits of any kind? A. Yes. 2. Will said air retain any of the qualities of the spirits it is forced through? A. Yes. The quantity depends upon the dryness and temperature of the air as well as the alcohol. 3. Is there any way to separate that portion which retains the quality from that which does not? A. If we understand your question, no.

(52) J. N. N. says: 1. In your issue of October 9 you say "distilled over soap." Do you mean by that expression that the soap dissolved in the article to be distilled? A. No. 2. We make soap with potash lye, and harden it with salt, would that be considered soda soap? A. It is commonly so called.

(53) W. G. S. says: I have a tube 4 inches long by $1\frac{1}{4}$ inches in diameter, $\frac{1}{4}$ inch thick. I wish to introduce into the tube the blaze from a spirit lamp. What is the best position for the blaze inside the tube, in order to heat it, and not be interrupted by the in and outflow of air? The tube revolves, and I want to have one end closed, except a small hole in the center. A. Unless both ends of the tube be left open, so as to give free access of air to the flame and outlet for the products of combustion, the flame will soon expire. 2. What is the best metal to make the tube of, in order that the blaze will heat it? A. Copper.

(54) F. B. L. asks: How can I make a pliable waterproof paint for cloth? A. Make a solution of gum rubber in hot naphtha over a water bath. This is the so-called rubber varnish.

(55) N. P. B. asks: With what can I varnish printed paper? A. Use dammar varnish thinned with turpentine. Flow the varnish over the paper. Do not use a brush.

(56) A. C. S. asks: 1. Can water glass be mixed with white lead paint? A. It can be readily mixed with the white lead by grinding, etc. 2. Will the mixture be more durable for outside work? A. We do not think it would add anything to the appearance or durability of the paint.

(57) C. T. W. asks: 1. Is there anything I can put in a tooth to kill the nerve? A. If the nerve is exposed, wrap a small pledget of raw cotton around the point of a knitting or darning needle and dip it in creosote; then insert the point with the cotton directly into the hollow of the tooth. The cotton may be left in for a while, covered by a dry piece. Care is needed not to let the creosote drop or run upon the lips or gums, on which it will act as a caustic. 2. Is there any way of loosening the same other than by the use of force? A. We know of no method. Consult a dentist.

(58) R. J. L. asks: Is there a method of making ordinary glue harder rapidly? A. There is nothing that we know of that will give perfect satisfaction in this direction. The addition to glue, when melted, of a small quantity of zinc oxide, plaster of Paris, etc., will cause it to set or harden quickly, but it also greatly deteriorates the adhesive properties of the glue.

(59) O. S. asks: What is the object of filling in between the framework of fireproof safes with cement or concrete? A. The cement, etc., is a very poor conductor of heat. If the filling were metallic, and the safe was subjected to even a comparatively modern degree of heat, owing to the good conductivity of the metal the books and papers contained in the safe would soon be converted into charcoal.

(60) E. S. McC. asks: What black preparation must I use to mark on gold with a pen? A. Use black paint and a brush.

(61) F. J. T. asks: Please inform me of the most economical, practical, and effectual process of evaporation, to condense yeast now in liquid form. A. The process employed in the manufacture of condensed milk would probably be the most economical and effectual method. It consists in boiling the milk in large, airtight boilers from which the air has been exhausted by means of suitable apparatus. The low temperature at which the operation may be conducted under the circumstances prevents the burning and partial decomposition, liable to occur when it is subjected to the ordinary method of distillation.

(62) J. D. says: What makes a good preparation for blacking harness, one that will retain its blackness, and that will not be injurious to leather? A. Ivory black and molasses each 12 ozs., spermaceti oil 4 ozs., good vinegar 4 pints. Mix.

(63) A. D. says: I have a thermometer which has been lying flat for three or four days. I hung it up, when the fluid entirely filled the tube, and it has not yet descended. Please inform me of a remedy. A. It is probably due to the air not having been completely expelled when the instrument was manufactured, or the air may have entered the tube subsequently through some flaw or pinhole. In the former case you had better have the instrument refilled; in the latter, a new tube will be requisite.

(64) A. M. says: Please give me a recipe for coloring gold by acids. I want a rich color. A. Use strong nitric acid, pure. First experiment upon a small piece of gold, until you hit the proper strength of acid and time of exposure.

(65) E. W. C. says: I read that, if I take a small phial and place in it a lump of phosphorus and enough olive oil, previously boiled, to cover the lump, the phosphorus, when the air is admitted, will become luminous. Is this a fact? A. Yes. The bottle should be well shaken just before removing the cork. The faint light observed is due to the phenomena of phosphorescence. There is no perceptible increase of temperature.

(66) E. M. asks: Of what material are stove brick composed? A. Usually of a good variety of fire clay, well burnt. The clay consists principally of the silicates of alumina, lime, and magnesia.

(67) N. S. J. asks: How can I make a desirable cement for leather? A. The following waterproof cement has been highly recommended: Melt together in an iron pot equal parts of common pitch and gutta serena, and stir well. This may be kept liquid under water, or solid, to be re-melted when wanted. It is not attacked by water, and adheres very strongly to leather.

(68) J. L. W. asks: How are pictures properly transferred to vehicle panels? A. Cover the picture entirely (taking care not to go beyond the outlines) with a slight coat of fixing varnish, then put the picture on the object to be ornamented, being careful to place it properly at once, to avoid spoiling it by moving. The varnish newly applied being too liquid, the picture should be allowed to dry for about ten minutes, and placed on the object to be ornamented, when just damp enough to be adherent; this done, cover the back of the picture with a piece of cloth steeped in water, then, by means of a knife or penholder, rub it all over, so as to fix every part of it; then remove the piece of cloth and rinse the paper with a paint brush steeped in water; at the end of a few minutes the paper will come off, leaving the painting transferred. Care must be taken that the piece of cloth, without being too wet, is sufficiently so for the paper to be entirely saturated. The picture must now be washed with a wet brush, and dried very lightly with some blotting paper. Keep the ornamented article in a warm, dry place, until dry. The polishing varnish should not be applied until the next day, keeping the pictures meanwhile out of the dust. The latter varnish should be applied as lightly as possible. If dark colored objects are to be ornamented, the picture should first be covered with a mixture of white lead and turpentine, following the outlines of the design, and covering it entirely. When this coat is perfectly dry, proceed as above.

(69) T. K. G. asks: Will a mixture of two parts chlorate potassa and one part sulphur answer as a compound for explosive bullets? A. Use chlorate of potash 6 parts, sulphur 1 part.

(70) J. B. W. says: I have industriously sought for a long time to find the genuine article of camphene. I am informed that it is nothing but spirits of turpentine doubly refined, but no one can tell me the exact process of making. I want such an article as used to be made for burning purposes. A. The so-called camphene is ordinary refined spirits of turpentine. In some cases a little alcohol was added to render the flame less smoky.

(71) J. P. N. says: I have noticed two blue flagstones which appeared to have been outside layers in the quarry, each having on them grooves, the hollows of which were about one fourth inch deep, leaving the ridges some two inches apart; but the grooves, instead of being straight, were regularly zigzagged. I can readily see how straight grooves and scratches are made by the action of glaciers; but how can these zigzag grooves be produced? A. It is not certain that the lines are due to the action of the glaciers; they may have been formed in the rock itself.

(72) A. R., Marienbad, Bohemia, says: Let me correct your answer to W. H. W., on p. 133, vol. 33. The addition of a small quantity of cyanide of potassium to a solution of copper will completely discolor it, even in the presence of an excess of ammonia.

(73) F. McC. and others ask such questions as the following: Are the chances favorable for a young man aged 23, with good English education, a strong love for mathematics and the profession of civil engineering, and some knowledge of algebra and geometry, to become a good civil engineer, by spending his evenings in the study of mathematics? If so, what knowledge of mathematics would be necessary before beginning the practice of the profession? A. Our advice to such a young man is to get a position, if possible, with a civil engineer engaged in active work, such as surveying, prospecting, or constructing. No matter how humble the position at first, if the young man has it in him he is pretty sure to rise; and his own experience will tell him what studies he had best pursue.

(74) H. L. C. says: In answer to R. L. S.'s query as to stone arrow heads, you say "that they were used before the discovery of America." I will add that they are used at the present day by the Indians of the Far West, where they use them for shooting game; but the arrowheads are small compared with some of those found in this State. The size of those now in use is from $\frac{1}{2}$ to $\frac{3}{4}$ inches to $\frac{1}{2}$ x $\frac{1}{4}$ inches; while I have found several in this State as large as $\frac{1}{2}$ x $\frac{1}{4}$ inches.

(75) O. C. L. says, in reply to R. H., who asks if it is not unusual for flies to be magnetic; I would say that I have often observed it in our own flies, but especially in a small punch, which was capable of supporting the weight of a tack. In the case of the punch, it was probably caused by the hammering.

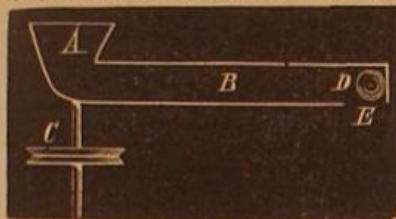
(76) W. E. S. says, in answer to J. H. R. who asks how to make an electro-magnet that will work very slowly: There is really nothing easier than to regulate the ultimate quickness of electro-magnetic action, with a given electromotive force. Everything depends upon the length of the iron core, its thickness, and the adjustment of the armature. For instance, the core of an electro-magnet, which includes not only that portion of the metal which is encased in the helices, but the back connecting piece, may, with a single cell of battery, attract its armature, adjusted to a certain tension, at the rate of 1,000 times per minute; while if we double the length of the core, the armature will be attracted to a bearing, under the same tension and with the same battery, but 500 times per minute. I have a very long electro-magnet which will exert its maximum force but 25 times per minute, while I have another, the

core of which is less than 2 inches long, which will attract its armature between 4,000 and 6,000 times per minute. A great deal depends upon the thickness of the iron core; much upon the resistance of the helix; but most upon the length of the core. If I. H. R. will construct an electro-magnet of $\frac{1}{2}$ inch round iron, each limb of which shall be 12 inches long, with a resistance of say 200 ohms of No. 24 wire, I fancy he will have a sufficiently slowly acting apparatus, provided his battery has not too great electro-motive force, and his armature adjustment be proper. Such a magnet could be regulated to exert its maximum force as slowly as 60 times per minute.

(77) E. D. R. says, in reply to a correspondent who asked: "What is bird pepper?" I enclose a specimen with a small limb of the plant. It grows wild all over Southwestern Texas, and is called by Mexicans and Spaniards *chili colorado* which, translated, means red hot. If you taste the enclosed specimen, you will find the name is a good one. It grows up from the root every year. Where it is abundant, the turkeys and prairie chickens feeding upon it become so saturated that it is impossible to eat them. A. The specimen sent is very similar to the cherry pepper of West Africa, which is eaten by small birds, and is used by the natives to spice their favorite dish, palaver sauce, with.

(78) A. S. says, in reply to E. N., and others, who asked how to remove superfluous hair: *Aurum pigmentum* (sulphuret of arsenic) mixed with slaked lime to the consistence of paste, is used in Europe to remove the beard from the face, without soap or razor.

H. A. P. asks: Where is the deepest mine in the world?—G. W. P. asks: Is there anything that will render wood proof against the action of nitrate of silver, which has been used in sensitizing collodion? I want a solution which will not dissolve in either alcohol or ether. I have used asphalt and beeswax; but as they have to be applied hot, they are not very convenient.—R. F. H. asks: If a ball, D, is dropped in hopper, A, while the square



tube, B, is revolved horizontally at a high rate of speed, by means of shaft and pulley, C, it will be thrown by centrifugal force against the end of the tube. Will it be held there, or will it drop through the opening, E?—H. C. asks: How are the edges of the leaves of a book arranged to show a gold edge when closed, and a red edge when open?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Large and Small Wagon Wheels. By M. G. P. On Stealing Brains. By E. C. On Some Curious Properties of the Figure 5. By G. R. B. On American Grape Vines. By S. F. Also inquiries and answers from the following: B. K.—J. C. W.—E. G. S.—E. T. H.—F. J.—H. D.—W. S.—C. E. S.—N. D. T.—G. M.—C. C.—G. A. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells pyrometers? What is the price of a good aneroid barometer? Who deals in mica? Who sells theodolites? What does a binocular microscope cost?" All such personal inquiries are printed, as will be observed in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week ending

October 5, 1875.

AND EACH BEARING THAT DATE.

(Those marked (r) are renewed patents.)

Alarm, burglar, A. Gregory..... 168,391
Alarm circuit closer, L. Finch..... 168,470
Annealing box, C. H. Onions..... 168,408
Annunciator, electric, S. B. Beckwith..... 168,364
Artist's shading stump, L. F. Bruce..... 168,316
Auger, earth, W. E. Coman..... 168,454
Axle clip tie and loop, Clapp and Van Patten..... 168,320
Axle clip tie for carriages, Clapp and Van Patten..... 168,321
Bag and chair, traveling, C. Laumonier..... 168,402
Bale tie, Y. H. Murphy..... 168,518
Balloons, car or boat for, J. Hartness..... 168,496
Barrels, skid for oil, D. M. Haight..... 168,393
Bedstead, Osborn and Kendrick..... 168,342
Bedstead, invalid, A. Kaufman..... 168,509

Beef shaver, smoked, C. H. Turner..... 168,483
Bell ringing, G. H. Collins..... 168,452
Bending metal bars, A. H. Campbell..... 168,450
Blind stiles, boring, J. M. Seymour..... 168,532
Boiler feed apparatus, W. H. Jenkins..... 168,398
Bolt and lath machine, Galtner and Hill..... 168,474
Books, binding, G. K. Snow..... 168,535
Boot heel, T. C. Musgrove..... 168,341
Boot heels and soles, screw for, J. Uster..... 168,557
Boot soles and uppers, uniting, G. V. Sheffield..... 168,420
Boots, notching counters for, N. Harwood..... 168,329
Bottling apparatus, L. B. Wilson..... 168,547
Brake air valve, G. Westinghouse, Jr..... 168,539
Brush, hair, C. E. Teets..... 168,428
Brush, paint, C. R. Baker..... 168,363
Buildings, bird guard for, H. T. Blodgett..... 168,466
Buildings, wooden gutters for, A. K. Buffum (r)..... 6,675
Burner, candle, G. Hollister..... 168,393
Burners, sheet metal gas, M. Dyott..... 168,463
Butter worker, J. Rooney..... 168,418
Buttons, attaching, D. Heaton..... 168,331
Canning meats, etc., W. Leland..... 168,508
Car coupling, J. H. Johnson..... 168,399
Car coupling, E. L. Sanford..... 168,345
Car coupling, O. C. Smith..... 168,423
Cars, warming and ventilating, J. Story..... 168,426
Cars, side bearing for railroad, G. Galloway..... 168,476
Carpet linings, G. W. Chipman..... 168,373
Carriage, C. Thomas..... 168,450
Carriage, child's, A. Crandall..... 168,458
Carriage, child's, L. B. Harrington, Jr..... 168,394
Carriage, child's, S. Oppenheimer..... 168,523
Carriage jack, A. W. Richards..... 168,530
Carriages, die for loop blanks for, Clapp et al..... 168,322
Carriage top prop, Clapp and Van Patten..... 168,319
Cart, dead, T. F. White..... 168,438
Caskets and coffins, J. M. Hutto..... 168,499
Catamenial sack, G. Meacom..... 168,515
Cement tanks, T. New (r)..... 6,683
Chair, opera, W. A. Slaymaker..... 168,351
Chair, tilting, H. S. Hale..... 168,482
Chairs, base for revolving, W. T. Doremus..... 168,383
Cheese protector, D. A. Wells..... 168,437
Chimney stack, T. C. Nativel..... 168,520
Chisel, mortising, A. R. Watterson..... 168,358
Chuck for turning whip stocks, C. S. Hartwell..... 168,487
Churn, A. D. Grose..... 168,392
Churn, I. E. Smith..... 168,533
Churn, rotary, W. R. Lampton..... 168,506
Cistern cut-off, automatic, H. L. Wells..... 168,361
Clothes pin, H. C. Hill..... 168,332
Confectionery, E. Hawker..... 168,488
Copying press, Hoffman and Hoyt..... 168,494
Corpse lifter, J. J. Flannery..... 168,471
Cotton opener, J. E. Crane..... 168,324
Cracker machine, J. W. Reger..... 168,531
Crane, Caswell and Worth..... 168,372
Crane, F. A. Pratt..... 168,412
Crimping pin, hair, M. Gardner..... 168,388
Croquet apparatus, J. A. Crandall..... 168,323
Crozing staves, J. Pennie, Jr..... 168,410
Cultivator, sulky, J. Spain..... 168,537
Curtain fixture, G. W. Corey..... 168,456
Dental engine, W. W. Evans (r)..... 6,677
Desk, office, F. H. Cutler..... 168,479
Distilling oils, Van Devort and Van Fleet..... 168,542
Drag, D. Miller..... 168,516
Dredgers, diking attachment for, G. W. Parsons..... 168,409
Drill, seed, B. Regan (r)..... 6,672
Dumping attachment, offal, T. Webber..... 168,545
Egg beater, M. Lozo..... 168,510
Electroplated figure, etc., Worthen et al..... 168,442
Engine governor, electrical marine, C. C. Wolcott..... 168,548
Equalizer, draft, J. M. Buckner..... 168,379
Ethylene, package for, J. P. Moore..... 168,340
Fence, iron, J. B. Wickersham (r)..... 6,685
Fire arm, breech-loading, W. W. Greener..... 168,328
Fire arms, sight for, D. M. Martinez..... 168,404
Fish spear, M. Jinks..... 168,323
Floorway for warehouses, J. H. Morrell..... 168,317
Flour sack packer, Fuller and Parkerson..... 168,387
Furnace, annealing, W. S. McKenna..... 168,513
Furnace for smelting lead, J. V. Woodhouse..... 168,440
Furnace, steam boiler, E. Kaselowsky..... 168,502
Furniture, castor, W. Gould..... 168,479
Gas apparatus, H. J. Surmon..... 168,539
Gas as a motor, carbonic acid, J. Westcott..... 168,456
Gas machine, A. Glachet..... 168,380
Gas regulator, J. H. Bean..... 168,444
Gate, automatic, N. H. Long..... 168,309
Glass tool, T. Carr..... 168,371
Globe, terrestrial, M. McVicar..... 168,514
Grate, J. E. Crea..... 168,325
Grinding pearl veneers, etc., J. & G. Hoffman..... 168,493
Hammer, steam, S. D. Wilson..... 168,439
Harness pad press, W. Dippert..... 168,381
Harvester, C. Denton..... 168,526
Harvester rake, M. Ray..... 168,526
Harvester pitman connection, A. Rea..... 168,415
Hay, unloading, W. H. Haynes..... 168,330
Bay tedder, E. M. Steckel..... 168,424
Head light, signal, W. M. and J. J. Walton..... 168,434
Heel trimming machine, I. Van Noyhuys..... 168,540
Hinge, L. E. Bolton..... 168,368
Horse power, A. B. Farquhar..... 168,469
Horseshoe, E. L. Brown..... 168,369
Horseshoe machine, W. W. Lewis..... 168,326
Hub, L. N. Bewley..... 168,445
Hydrant, C. F. Rapp..... 168,413
Hydrant, anti-freezing, R. Heston..... 168,422
Ice-breaking vessel, E. J. Weedermann..... 168,456
Ice machine, A. Jas..... 168,500
Ice machines, condenser for, A. Jas..... 168,501
Indexes, cutting and printing, H. H. Edwards..... 168,468
Indicator, W. L. Gallaudet..... 168,475
Induction coil, J. R. Chislett..... 168,451
Key hole guard for locks, H. Cochems..... 168,375
Kitchen cabinet, G. Holt..... 168,397
Ladder, extension, W. T. Core..... 168,378
Lap robe, F. L. Blakely..... 168,315
Lath and lock, knob, J. F. Cooper..... 168,377
Latch, gate, J. Peterman..... 168,325
Leather, machine for rounding, J. Lewis..... 168,403
Leather, graining and pebbling, H. Rowson..... 168,497
Leather, artificial, J. Harrington..... 168,485
Life-preserving stool, H. H. Nash..... 168,519
Machinery, preventing backlash of, J. A. Hafner..... 168,481
Mail bags, manufacture of, H. Stephens..... 168,425
Marking implement, J. O'Kane..... 168,407
Marking wheel, S. E. Worrell..... 168,362
Mechanical movement, J. McCloskey..... 168,387
Metal bars, bending, A. H. Campbell..... 168,450
Mill, rolling, King and Scott..... 168,504
Millstone staff, J. See..... 168,419
Motion, converting, W. F. Barnes (r)..... 6,674
Motion, transmitting, J. Sigwalt, Jr..... 168,350
Multiplier, pattern, O. W. Richardson..... 168,343
Night soil apparatus, C. E. Frazier..... 168,473
Night soil apparatus, R. S. Gillespie..... 168,477
Nut lock, F. C. Hamilton..... 168,489

DESIGNS PATENTED.

8,673.—LAMP CHIMNEY, ETC.—T. B. Atterbury, Pittsburgh, Pa.
8,671.—OIL CLOTHS.—J. Barrett, New York city.
8,675 and 8,676.—CASSIMERE.—F. Bosworth, Providence, R. I.
8,677 to 8,679.—CARPETS.—O. Heinigke, New Utrecht, N. Y.
8,680 to 8,684.—CARPETS.—H. Horan, East Orange, N. J.
8,685.—COOK STOVES.—W. J. Keep, Troy, N. Y.
8,686.—TRIMMING.—S. McLaughlin, Philadelphia, Pa.
8,687.—CARPETS.—E. J. Ney, Dracut, Mass.
8,688.—BUST.—W. Page, New York city.
8,689.—OIL CLOTH.—F. H. Randall, Camden, N. J.
8,690.—COFFIN SCREWS.—C. B. Rogers, West Meriden, Conn.
8,691.—CARPETS.—T. J. Stearns, Boston, Mass.
8,692.—CASSIMERE.—W. A. Walton, Providence, R. I.
8,693.—CARD BORDER.—M. Bolton, Jr., Philadelphia, Pa.
8,694 and 8,695.—BRACKET.—C. Herter, New York city.
8,696 to 8,698.—GABRIELIERS.—C. Herter, New York city.
8,699.—CHANDLIER.—C. Herter, New York city.
8,700.—LIGHT.—C. Herter, New York city.
8,701.—LAMP.—C. Herter, New York city.
8,702.—WALL POCKETS.—J. C. Lamm, Hopedale, Ill.
8,703.—DESK.—J. S. Morgan, Brooklyn, N. Y.
8,704.—PROVISION RAPE.—F. Northrup, Detroit, Mich.
8,705.—EMBROIDERY.—E. Crisand, New Haven, Conn.

SCHEDULE OF PATENT FEES.

On each caveat..... \$10
On each Trade mark..... \$25
On filing each application for a Patent (17 years)..... \$15
On issuing each original Patent..... \$20
On appeal to Examiners-in-Chief..... \$10
On appeal to Commissioner of Patents..... \$20
On application for Reissue..... \$30
On filing a Disclaimer..... \$10
On an application for Design (3 1/2 years)..... \$10
On application for Design (7 years)..... \$15
On application for Design (14 years)..... \$30

MAGNETS—Permanent Steel Magnets of any form or size, made to order by F. C. BEACON & CO., 248 Canal St., New York. Makers of the celebrated "Beacon" Tapes, and Miniature Telegraph Insulators.

Advertisements.

Back Page - - - - - \$1.00 a line.
Inside Page - - - - - 75 cents a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

Engine, Spindle, & Cylinder Oil. E. H. KELLOGG,
17 Cedar St., N. Y., manufactures the best. Established '58.



GALLOWAY'S PATENT Gas Fitter's Lamp.

Use it with one hand. Three tools in one, by mail, \$2.35. Send for Circular of Book and Lamp.
J. D. GALLOWAY,
345 North 10th St., Philadelphia, Pa.

GENUINE WALTHAM WATCHES

SENT BY EXPRESS,

to any place, no matter how remote, with bill to

C O D
Collect On Delivery,

with privilege to examine before paying.

Satisfaction Guaranteed, or

The Money will be Refunded.

Descriptive Price-Lists, with full particulars, free by mail to all who write for it.

HOWARD & CO.,

No. 222 Fifth Avenue, New York.

Mention Scientific American when you write.

Engines & Boilers, new & 2d h'd, perfect condition. Very cheap. Address BINGHAM & RICH, Oil City, Pa.

Todd & Rafferty Machine Co.

MANUFACTURERS OF

The celebrated Greene Variable Cut-Off Engine; Lowe's Patent Tubular and Fine Boilers; Plain Slide Valve Stationary, Hoisting, and Portable Engines. Boilers of all kinds. Steam Pumps, Mill Gearing, Shafting, &c., Silk, Tow Oaken, Bagging, Rope, Flax, and Hemp Machinery. Agents for the New Haven Manufacturing Co.'s Machinery; Tools; for Judson's Governors and Stop-Valves; Sturtevant Blowers; and Differential Pulley-Blocks. WAREHOUSES, 10 BARCLAY STREET, NEW YORK. WORKS PATERSON, NEW JERSEY.

PATENT

Planing and Matching

and Molding Machines, Gray and Wood's Planers, Self-oiling Saw Arbors, and other wood-working machinery. S. A. WOOD'S MACHINE CO., 151 Liberty St., N. Y. Send for Circulars, etc. 161 Sudbury St., Boston.

NOYE'S

Mill Furnishing Works

are the largest in the United States. They make Burr Millstones, Portable Mills, Small Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

THE CHRISTIAN UNION.

REV. HENRY WARD BEECHER, Editor.

Elliswood's authorized verb tim reports each week of Mr. Beecher's

Sermons in Plymouth Church.

All his literary productions, including the characteristic "STAR PAPERS," will be given. Serial Stories by

REV. EDWARD EVERETT HALE, D.D.,

(Author of a "Man without a Country," &c.)

HON. ALBION W. TOURGEE,

Judge of the Superior Court of North Carolina, (Author of "Tolalette," &c.)

MRS. HARRIET BEECHER STOWE,

(Author of "Uncle Tom's Cabin," &c.)

A Comprehensive Family Religious Newspaper. Terms \$3.50 per year, postage prepaid.

New and Unusual Terms to Agents.

Cash Commissions and Competitive Premiums in Cash.

\$2,000 Given Away!

Send for particulars.

HENRY M. CLEVELAND, Publisher.

HORATIO C. KING, Asst. Publisher.

37 Park Place, New York.



DECALCOMANIE.

or TRANSFER PICTURES, with book of 24 pp., giving full instructions in this new and beautiful art, sent post-paid for 14 cts. 100 are to be printed, 50 cts. They are made, Landscape, Animals, Birds, Insects, Flowers, Astronomical, Comic Figures, &c. They can be easily transferred to any article as to include the most beautiful scenery. Also, a beautiful GEM CHROMOS for 15 cts. 100 for 50 cts. Agents wanted.
Address J. L. FATTEN & CO., 301 William Street, New York.

THE BASTET MAGNETIC ENGINE.

FOR SEWING, SEWING MACHINES, PUMPS, DISTILLERS' AND JEWELLERS' LATHES, PRINTING PRESSES, MOVING PICTURE AND CHURCH ORGANS, OR WORKING ANY MACHINERY THAT CAN BE MOVED BY HAND OR FOOT.

Simple, Durable, and Economical.

SEND FOR CIRCULAR.

State Agents wanted.

L. BASTET,

607 Broadway, N. Y.



The TANITE EMERY WHEEL

Is a rotary file which runs a mile in a minute, and whose cutting points never grow dull. THE TANITE COMPANY publish monthly a first-class Mechanical Journal, called *The Emery Grinder*, which is printed in English, German, and French, and which is the best advertising medium known, both for this country and Europe. THE TANITE COMPANY publish an illustrated pamphlet of 120 pages.

THE TANITE COMPANY manufacture the most uniform and reliable Emery Wheels ever made, and are constantly getting up novelties in Emery Grinding Machinery. For Emery Wheels, Emery Grinders, Diamond Tools, Newman's Emery Planers, Suction Fans, Davis' Speed Indicators, &c.

Address **THE TANITE CO.,**
STROUDSBURG, MONROE CO., PA.

PURE EMERY,

arranted equal to any in the market, at prices lower than any other first class Emery.

GLASS OIL CUPS

of all kinds. Brass Fittings for Steam, Water and Gas.

Brass Castings. Send for Catalogue.

HILLARD & HOLLAND 82 Gold St., New York.

\$25 a day guaranteed using our Well

Augers & Drills. \$100 a month

paid to good Agents. Auger book

free. J. H. Auger Co., St. Louis, Mo.

Engines and Boilers, New and Second-Hand

Portable and Stationary. For description, address

GOODWIN & WHITE, Oil City, Pa.

Diamond Solid Emery Wheels.

PRICES—6x4, \$1.25; 8x1, \$2.25; 12x1 1/2, \$3.50; 16x2, \$12.50;

18x2, \$16.00; 20x2, 19.50; 24x3, \$42. All other sizes at pro-

portionate prices. Fast cutting, free from glazing, they

are the best Solid Emery Wheels. Give diam. of holes

in your order for wheels. Emery Grinders unequalled by

any in the world. Address AMERICAN TWIST DRILL

CO., Woonsocket, R. I.

Shaping Machines

Have novel device for changing

length of stroke while in motion,

also, automatic down feed, and

quick return. Four sizes.

Patented 1868, 1871, 1874.

Wood & Light Machine Co.

Worcester, Mass.

Manufacturers of all kinds of

Iron Working Machinery

Shafting, Pulleys, &c.

BOGARDUS' PATENT UNIVERSAL BOCCEN-

TRIC MILLS—For grinding Bones, Ores, Sand, Old

Crucibles, Fire Clay, Guano, Oil Cake, Feed, Corn,

Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices,

Coffee, Coconut, Flaxseed, Almonds, Mica, etc., and

whatever cannot be ground by other mills. Also for Paints,

Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON,

successor to JAMES BOGARDUS, corner of White and

Elm Sts., New York.

HARTFORD

STEAM BOILER

Inspection & Insurance

COMPANY.

W. E. FRANKLIN, V. P. J. M. ALLEN, Pres.

J. E. FRANKLIN, Sec.

HARTFORD, CONN.

PORTLAND CEMENT

For Walks, Cisterns, Foundations, Stables, Cellars,

Bridges, Reservoirs, Breweries, etc.

Remit 6 cents postage for Practical Treatise on Cements.

S. L. MERCHANT & CO., 75 South St., New York.

"Lowest Price and BEST."

Excelsior Do Your Own Printing

Portable \$3 Press for cards, labels, envelopes, etc.

Larger sizes for larger work.

Business Men do their printing and

advertising, save money and increase

trade. Amateur Printing, delight-

ful pastime for spare hours. BOYS

have great fun and make money fast

at printing. Send two stamps for full

catalogue presents type etc. to the Mfr

KELSKY & CO., Meriden, Conn.

THE NATIONAL

Steel Tube Cleaner.

Adopted and in use by U. S. Navy. For sale by dealers.

Send for Circular. THE CHALMERS SPENCE CO.

foot E. 9th St., N. Y., Agents for the U. S.

NON-COMBUSTIBLE STEAM BOILER & PIPE

COVERING

WITH AIR SPACE IMPROVEMENT.

Saves 10 to 25 per cent. CHALMERS SPENCE CO.,

foot E. 9th St., N. Y.; 1201 N. 2nd St., St. Louis, Mo.

8,000 in Use!

Blake's

STEAM PUMPS

for every possible duty. Send

for Illustrated Catalogue.

GEO. F. BLAKE MFG CO.

36 & 38 Liberty Street,

New York.

Cor. Causeway and Friend

Sts., Boston, Mass.

50 and 52 South Canal

St., Chicago, Ill.

For showing heat of

Pyrometers, Ovens, Hot blast pipes,

Boiler tubes, Super-Heated Steam, Oil Stills, &c.

HENRY W. BULELEY,

36 Liberty St., New York.

PATENT

COLD ROLLED

SHAFTING.

The fact that this shafting has 75 per cent greater

strength, a finer finish, and is truer to gauge, than any

other in use renders it undoubtedly the most economical.

We are also the sole manufacturers of the CHALMERS

DITCHING and EXCAVATION.

RANDOLPH'S DITCHER and EXCAVATOR: Simple,

strong, and adapted to all soils reasonably free from

stumps or large stones. Will do the labor of 100 men,

steadily, at the cost of ten. Machines of all sizes, cut-

ting from three inches wide, three feet deep, to 36 inches

wide, four feet deep. Extra sizes made to order. Circulars,

&c., sent on application to

RANDOLPH BROS., 111 Broadway, New York.

IRON AND STEEL

DROP FORGING.

Of Every Description, at Reasonable Prices.

The Hull & Belden Company, Danbury, Ct.

THE HEALD & SISCO

Patent Centrifugal Pumps.

VERTICAL & HORIZONTAL.

First Premiums at New Orleans, Cincinnati, and New

York. "Medal of Special Award,"

American Institute, 1874.

Perfect satisfaction guaranteed. The cheapest, simplest,

strongest, most efficient and popular Pump in use, for

emptying dry-docks, Coffers, etc., and for use in

Paper Mills, Tanneries, and Factories. STEAM PUMPS

very low, for Wrecking, Dredging, Irrigating, etc. Illus-

trated pamphlet, free. Nearly 1,000 references to actual

customers. 31 pages first class testimony. Address

HEALD & SISCO & CO. Baldwinsville, N. Y.

HASKELL'S THREE CYLINDER PUMP.

Hand or Power. Cheaper than a Steam Pump.

Will outwear a Rotary Pump—do more work, with less

power, than any other pump. Not liable to get out of

order. Any blacksmith can repair it. Adapted to any

kind of hard work. Send for Circular.

CHASE MACHINE COMPANY, Boston, Mass.

THE BEST INJECTOR

For Locomotive and Stationary Boilers.

FRIEDMANN'S PATENT.

Over 15,000 Now in Use Here and in Europe

Throws more and hotter water, with less steam, than

any others. It has two Waterways, fixed Nozzles, and no

movable parts to get out of order.

NATHAN & DREYFUS, Sole Manufacturers.

108 Liberty St., New York.

Send for Catalogue.

ROGERS' TANNATE OF SODA BOILER

SCALE PREVENTIVE. JOS. G. ROGERS & CO.,

Madison, Ind. Send for book on Boiler Incrus-

tation.

Portland Cement.

From the best London Manufacturers. For sale by

JAMES BRAND, 35 CHURCH ST., N. Y.

A Practical Treatise on Cement furnished for 25 cents.

IMPORTANT FOR ALL CORPORATIONS AND

MAN'G CONCERNS.—Buerk's Watchman's

Time Detector, capable of accurately controlling the

motion of a watchman or patrolman at the different sta-

tions of his beat. Send for circular.

J. E. BUEBK, P. O. Box 979, Boston, Mass.

N. B.—The suit against Imbucuser & Co., of New York,

has been decided in my favor June 10, 1874. Proceedings

have been commenced against Imbucuser & Co. for sell-

ing, contrary to the order of the Court, and especially the

clock with a series of springs in the cover, and marked

Pat'd Oct. 20, '74. Persons using these, or any other

clocks infringing on my Patent, will be dealt with ac-

cording to law.

RICHARDSON, MERIAM & CO.,

Manufacturers of the latest improved Patent Daniels'

and Woodworth Planing Machines, Matching, Sash and

Molding, Tenoning, Moulding, Boring, Shaping, Verti-

cal and Circular Sawing Machines, Saw Mills, Saw

Arbors, Scroll Saws, Halfway, Cut-Off, and Rip-saw

Machines, Spoke and Wood Turning Lathes, and various

other kinds of Wood-working Machinery. Catalogues

and price lists sent on application. Manufacturing, Wor-

cester, Mass. Warehouse, 107 Liberty Street, New York.

DAMPER

BEST

AND LEVER

REGULATORS

GAGE COCKS.

M

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIII.—No. 20.
(NEW SERIES.)

NEW YORK, NOVEMBER 13, 1875.

\$3.20 per Annum.
(POSTAGE PREPAID.)

IMPROVED SAWING AND GROOVING MACHINE.

One of the principal difficulties which the inventor has sought to overcome, in constructing the new sawing and grooving machine represented in the annexed engraving, is to hinge permanently the oscillating table, while avoiding the necessity of a wide opening in the latter for the saw to work through, or of repeated adjustments of the table to the saw. The means adopted are simple and effective, and consist in causing the table, when it is placed at any required angle, to be at the same time moved laterally, so that the aperture, which is no larger than the opening in the ordinary stationary saw table, is thus automatically adjusted to proper position with reference to the saw.

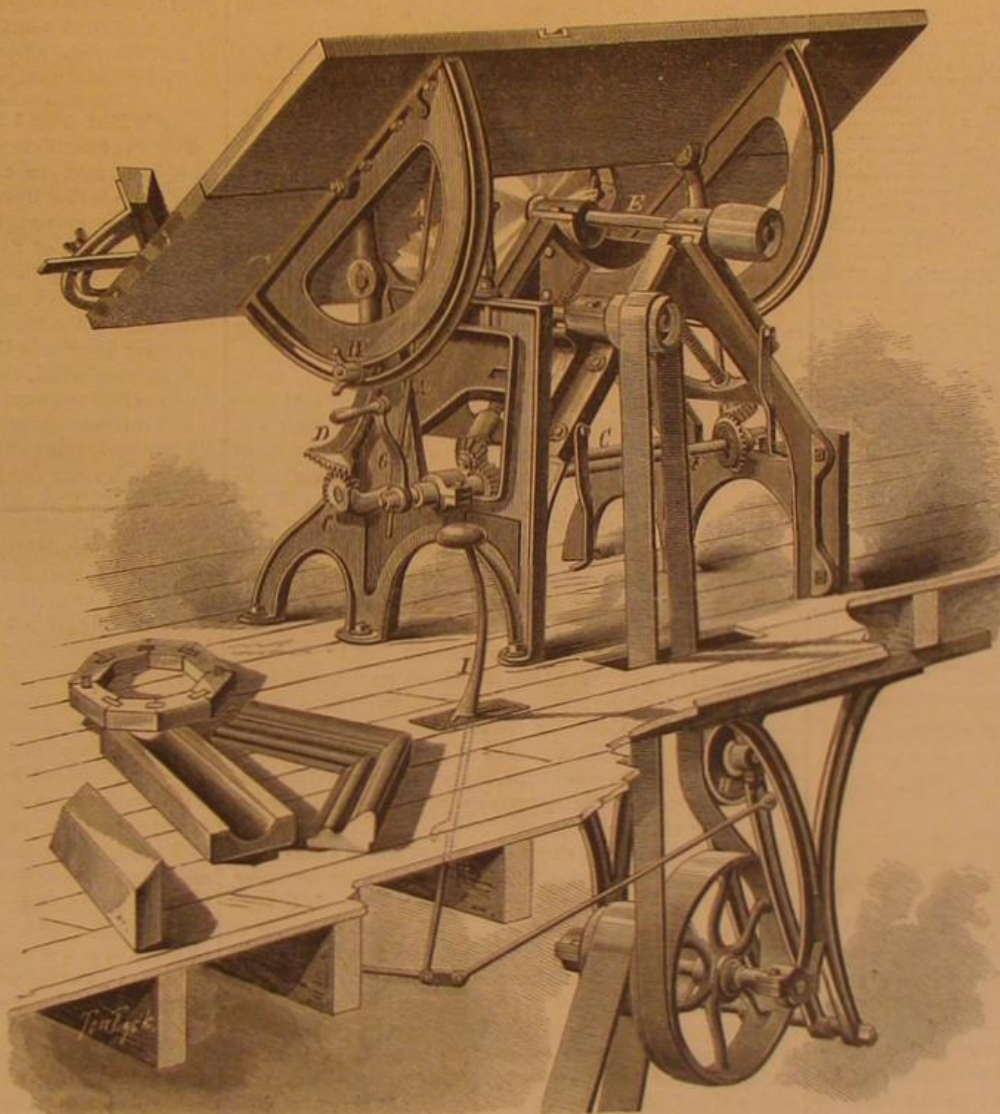
As will be seen from the engraving, the table is made in two parts, the rear of which is bolted to the oscillating table bearers, and the front leaf attached to dovetail slides which move over corresponding surfaces on said bearers. The object of the moving part is to allow of enlarging the saw opening in order to use the grooving saw for plowing, rebating, etc., or cutter heads for cutting wide gains, chamfering, raising base-casing panels, plinth blocks, shanking cogs, cutting small tenons, etc. The table has also an independent lateral adjustment, so that the fixed leaf can be set to tange the saw at whatever size it may be placed to operate, and thus rebates can be cut where there is but little wood left to pass between the saw and the gage, without danger of the work being caused to drop through by the downward pressure of the blade. This adjustment is also of advantage when cutter heads are used, as it permits the table to be moved back so as to clear the head when the same is screwed against the fixed collar on the mandrel. It is accomplished very quickly by loosening the set screw in the outer end of a crank pinion wrist, and sliding the latter up or down on the rod, A, which connects it to the table bearer. The screw is tightened, as is also the clamp, B, which prevents the table from turning. The front is then adjusted to tange the saw or cutter head on the outside.

The shaft, C, extending from end to end of the machine, carries the pinions which engage with the teeth of the vibrating arms, one of which is shown at D. By these arms the table is evenly moved and kept parallel to the direction of the saw. By means of the pinion and set screw on each end of the shaft, the table can be nicely adjusted to suit the draft of the saws, to prevent wedging or back cutting.

Beneath the table are two frames inclined at equal angles and meeting at their tops. These serve as slides and supports for the carriages which carry the two saw mandrels, E. Said mandrels are of steel, and run in self-oiling Babbitt metal boxes. To them are attached nuts through which pass long screws, which are secured in the inclined frames. By means of bevel gearing, these screws connect with the shaft, F. At one outer end of the latter is a crank, G, which by suitable means may be so placed as to turn either one or both of the screws, so raising either or both of the carriages, and consequently the saws. The latter can thus be set to cut to any required depth. The guide may be adjusted for use on either side of the saw or to any angle with the table; it is provided with adjustable holders for strips or molding. The grooving saw is adapted for plowing and rebating, and is made adjustable for any sized plow, varying in thickness from that of the saw plate to one and a half inches or the limits of the collars; the latter may be adjusted by set screws without unscrewing the mandrel nut.

The general advantages claimed for the machine, in addition to those mentioned, may be summed up as follows: It may be easily arranged to perform either square or angular sawing; the material lies flat on the table and close to the guide; the grooving saw will cut gains of any required size across the grain, either square or at any angle, and will do the work more effectually than heads and cutters, while needing much less time in adjusting and sharpening; the cross

cut guide is adjustable for squaring, mitering, and for all kinds of angle work, the table and the guide giving both vertical and horizontal angles in one cut. The table turns toward the operator, the saw remaining at the same height, so that the work is in full view and is convenient to hold; the saws overhang the frame so that they may be taken off or adjusted without removing any part of the top. The machine is readily adapted to faceplate turning; by placing the table at an angle, the front leaf serves for a rest. The rip saw is provided with a guard to prevent it from throwing sticks, which is arranged to move up and down with the saw, leaving the table clear for the use of the other blade.



BAGGS'S SAWING AND GROOVING MACHINE.

In the engraving there is also represented the countershaft and pulleys, exhibiting the mode in which the tightening pulley, H, is operated. The lifting rod, I, has two hooks, which engage with an iron plate screwed to the floor. When the rod is drawn up, and the lower hook is caught, the binder stands clear of the belt, the latter being of sufficient length to allow the saw mandrel to remain at rest. When the hook is disengaged, the binder is, by the action of the weight on the rod, brought forward against the belt. The object of the upper hook is to prevent the binder from dropping in contact with the running pulley. But one mandrel is used at a time, the belt being lifted from one to the other as desired. The inventor informs us that he has devised another arrangement for the countershafting, which admits of the belt being brought to the machine from above instead of from below. Either device is furnished with the machine.

For small shops, using small circular saws, the machine is capable of extended utility, while for large establishments the fact of its being suited for a variety of operations, enabling it to be kept constantly employed, renders the invention equally well adapted.

Patent for improvements now pending through the Scientific American Patent Agency. For further information address the inventor, J. T. Baggs, Bridgeport, Ohio.

THE horse power of waterfalls is found by multiplying the number of pounds of water which fall per minute by the length of the fall in feet, and dividing the product by 33,000.

Aniline Black by Electricity.

"If we take a strong solution of sulphate of aniline and submit it to the action of two Bunsen elements, employing platinum electrodes, we soon see the positive pole become coated with a violet blue covering, greenish in places, a fact remarked by Letheby. If the experiment is prolonged for 12 or 24 hours, we find fixed to the positive pole a black mass, easily detached. On treating this substance with ether and alcohol, and drying it, there remains an amorphous black body with some greenish reflections, insoluble in most solvents. If this body is treated with sulphuric acid, and spread out upon a porcelain saucer, it takes a greenish color-

ation, but on treatment with alkalis it resumes its jet black color. It is not affected by nascent hydrogen. To ascertain that the production of this black was due to nascent oxygen, and not to the platinum employed as electrode, I made use of electrodes of gas coke, and obtained in 12 to 24 hours identical results; a black adhesive mass was fixed to the carbon of the positive pole. Nitrate of aniline gave also a black deposit, which, on treatment with alkalis, took a velvet-like appearance; but in presence of sulphuric acid a decomposition took place, and I obtained a brown maroon coloration. The composition of this black is, therefore, different from that obtained with aniline sulphate. Muriate of aniline gave, around the positive pole, a black coagulum, but it is probable that, in this case, the action is complex, and that there may be at the positive pole, besides nascent oxygen, nascent chlorine, which complicates the results.

With the organic salts I have obtained differences which require mention. Aniline acetate gave, at the positive pole, a black glutinous substance, partly soluble in the surrounding salt. Aniline tartrate gave no result, not even the least coloration of the positive pole. Hence it appears that aniline blacks may be obtained without the intervention of any metal, and that the salts of aniline behave in different manners with the nascent oxygen."—J. J. Coquillon, in *Comptes Rendus*.

Baryta Green.

Make a mixture of two parts of caustic soda and one part chlorate of potash, and add very gradually two parts of manganese in very fine powder. Raise the temperature gradually to very dull redness. On reaching that point allow the mixture to cool, and after having powdered it filter the liquid thus obtained, and add to it when cold a solution of nitrate of baryta. There is formed a violet-colored precipitate of baryta, which is washed with care. It is then dried and treated with one half to one part of caustic baryta, hydrated, and gradually heated up to the commencement of redness, with consequent stirring. When this operation is at an end, the mass, on cooling, appears of a fine green. It is powdered and finally washed in order to remove any excess of baryta.—M. Boettger, in *Dingler's Journal*.

The Blasting of Diamond Reef.

Diamond Reef, an ugly ledge of rocks lying between Governor's Island and the Battery, in New York harbor, is rapidly disappearing before General Newton's dredging and blasting scow. Five blasts were exploded in the mass of rock during the month of October, which completely shattered what remained of the worst part of it, leaving, however, an immense heap of debris to be removed. The reef used to be 400 feet long, and at its highest point was 19 feet below low water. After the fragments are removed, there will be a minimum depth of 26 feet over an area of 6,000 feet of what was originally the highest part of the reef. Should the work proceed without interruption, the whole ledge will have been removed within seven months.

Among the best bearings for water wheels are those composed of good oak, rock maple, or lignum vitae.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. DEACH.

TERMS.

One copy, one year, postage included.....\$3 20
One copy, six months, postage included..... 1 60

Club Rates.

Ten copies, one year, each \$2 75, postage included.....\$27 00
Over ten copies, same rate each, postage included..... 2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXIII, No. 30. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, NOVEMBER 13, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

Æolian harp, to make an (10).....	315
Aniline black by electricity.....	315
Answers to correspondents.....	315
Baryta green.....	315
Beer in New York city, brewing.....	315
Bleaching cotton yarn.....	315
Boiler deposit (41).....	315
Boilers, pressure in tin (1).....	315
Brakes, air (18).....	315
Breath, human, analysis of.....	315
Bridge, progress of the East River.....	315
Business and personal.....	315
Calculus.....	315
Calcium, obtaining (31).....	315
Carbonic acid and fire.....	315
Cement for hair and metal (22).....	315
Cleaning feathers (7).....	315
Coal, the components of.....	315
Coloring of plants, artificial.....	315
Crape.....	315
Curtain fixture, improved.....	315
Diamond reef, blasting.....	315
Diamonds again, veneered.....	315
Drifts.....	315
Electric amalgam (28).....	315
Engineering structures (15).....	315
Engineers' examinations (16).....	315
Filth as a source of disease.....	315
Finishing color, the.....	315
Fleas, exterminating (14).....	315
Gages, testing (14).....	315
Galvanized water pipes (25).....	315
Galvanizing iron (15).....	315
Gas from cork.....	315
Gas furnaces, natural.....	315
Gold pens, tipping (23).....	315
Grapes, preserving.....	315
Gumming postage stamps (6).....	315
Hay, weight of (17).....	315
Ice cream carrier.....	315
Inks, colored (25).....	315
Ink, white, by acid (34).....	315
Inventions patented in England.....	315
Inventor, a juvenile.....	315
Keys, reverse.....	315
Lime for oxyhydrogen light (27).....	315
Link motion, the (13).....	315
Locomotives of 1825 and 1825.....	315
Mechanical engineers' education.....	315
Melon cucumbers.....	315
New books and publications.....	315
Oil, dryers, and colors.....	315
Oil tree, the Chinese.....	315
Paint cracking, cause of.....	315
Paint, how to dry.....	315
Painting, practical.....	315
Patents, mixing the.....	315
Patents, the printing.....	315
Patents, American and foreign.....	315
Patents, foreign.....	315
Patents, list of Canadian.....	315
Patents, official list of.....	315
Pond, L. W.....	315
Practical mechanism—No. 35.....	315
Press, improved drawing.....	315
Potty, the best.....	315
Rails, iron and steel.....	315
Re-varnishing.....	315
Revolving firearms (12).....	315
Roofs, arched.....	315
Rubber, hard, under pressure (11).....	315
Sawing and grooving machine.....	315
Sawing various woods.....	315
Sawmill gearing (3).....	315
Skimmias, the.....	315
Skins of uniform thickness (8).....	315
Solar engine, a.....	315
Space, interstellar, what fills.....	315
Steam pipes, covering (29).....	315
Swimming apparatus, new.....	315
Time clock, watchman's.....	315
Trees and bushes, trimming (30).....	315
Tunnel, St. Gothard.....	315
Varnishing.....	315
Wagon brake, improved.....	315
Washing vehicles.....	315
Waterfalls, power of.....	315
Water in pipes, conveying (2).....	315
Water, passage of (21).....	315
Waterwheel bearings.....	315
Waterwheel for sawmill (29).....	315
Wheel question, the (19).....	315
Whistling, nationality in.....	315
Wrinkles and recipes.....	315

FILTH AS THE SOURCE OF PREVENTIBLE DISEASE.

In his charming little poem, preaching resignation to the stroke of the "Reaper whose name is Death," Longfellow says:

"Let us be patient: These severe afflictions
Not from the ground arise;
For oftentimes celestial benedictions
Assume this dark disguise."

This has ever been the sentiment of piety: beautiful in the abstract, comforting in times of personal bereavement, but a deadly delusion when applied in mass. Not patience but impatience, not resignation but resistance, is the proper attitude in the presence of disease and death, more especially in those cases—and they are in the majority—in which the causes of "these severe afflictions" are preventable or removable: causes which, poetry and piety to the contrary notwithstanding, do from the ground arise.

This is a question of fact, not one of sentiment. The Mussulman says: "It is the will of God," and impassively shuts his eyes to the palpable causes of plague, pestilence, and famine, which shorten the lives of millions. The Christian, quite as criminally, dreams of possible "celestial benedictions" in conditions which contribute to make the average death rate double what it ought to be, while he holds up his hands in holy horror at the apathy of the Turk.

It is appointed of all men once to die: so far we have to submit to natural law, and there may be virtue in accepting the event with resignation—provided it does not come untimely: but there can be no virtue in being resigned to a condition of things by which not ten persons in a hundred, in the healthiest countries in the world, are permitted to reach the standard old age of seventy-five years: by which the death rate of the first year of infancy is swollen from one in twelve, as it is in some districts, to one in three, as it is in others. And the excess of deaths is but an imperfect measure of the aggregate influence which preventable diseases exert against the efficiency and happiness of a people. There remains an incalculable amount of physical suffering and disablement, of sorrow and anxiety, of thwarted effort and straitened means, not to speak of destitution and pauperism and their terrible effects upon the physical virtue and moral stamina of the rising generations: all to be traced directly or indirectly to easily preventable causes.

Foremost among the causes which affect the public health injuriously—causes not of local, but of general, almost universal, operation—the Medical Officer of the Privy Council finds most conspicuous these two "gigantic evils," which

claim the "earliest attention in the sanitary government of England," and equally, we may add, of every other civilized government, namely:

First, the omission (whether through neglect or want of skill) to make due removal of refuse matters, solid and liquid, from inhabited places; and secondly, the license which is permitted to cases of dangerous infectious diseases to scatter abroad the seeds of their infection.

Very frequently these two causes cooperate, doing immense injury to the public health, through the special facility which certain forms of local uncleanness provide for the spreading of certain specific infections: so that, on summing up the results of the extensive and very able investigations of sanitary conditions, made under his direction, Dr. Simon does not hesitate to say that, in total power, uncleanness must be reckoned as the deadliest of our present removable causes of disease. This, even when the term is restricted to such degrees of uncleanness as fall or ought to fall within the designation of filth, implying nastiness such as any average man or woman should be disgusted at. If the term were made to include all that it legitimately implies, as for example the foulness of air due to the non-removal of the volatile refuse of the human body, such as obtains in overcrowded and ill ventilated dwellings, a much stronger expression of its fatal influence would be justified.

That filth makes disease, meaning by filth putrescent refuse matter causing nuisance by its effluvia and soakage, must have been one of the earliest of social discoveries, for it is recognized in the oldest records which exist of legislation meant for masses of mankind: yet the more subtle and destructive effects of filth remained unsuspected almost until quite a recent period.

Filth kills in two ways. First, and most obviously, by a direct poisoning action, as when one succumbs to the concentrated fumes of organic decomposition from an old unventilated cesspool, or a long blocked sewer, or when the vigor of life is depressed by continuous breathing of a foul atmosphere in which the fetid gases have been largely diluted; second, with far greater and more subtle destructiveness, by means of the morbid ferments or contagia which it breeds or harbors. The chemical poisons of filth hurt by instant action, and in direct proportion to the palpable and ponderable dose: with contagia, on the other hand, indefinitely large ulterior effects are produced by, or by means of, doses which are indefinitely small.

The last named agents of disease and death consist, so far as known, in minute living organisms, indefinitely self-multiplying in their several spheres of operation. At least one sort, the ordinary septic ferments, seem always to be present where putrefactive changes are in progress; others, though not essential to putridity, are in different degrees apt, and some of them little less than certain, to be incidents of ordinary refuse. It is by these various agencies, essential and incidental, that filth produces the diseases classed by sanitarians as zymotic, and not by means of the usually accompanying stench. Hence, as Dr. Simon tersely observes, the question: What infecting powers are prevalent in given atmospheres? should never be regarded as a mere question of stink; and it is of the utmost practical importance to recognize, in regard to filth, that agents which destroy its odor may yet leave all its main powers of disease production undiminished. On the other hand, there may be prevalent fetid gases of the most sickening potency with an entire absence of septic ferment in the air.

Indeed filth ferments show no power of active diffusion in dry air. They may be passively wafted for short distances, but probably do not carry their vitality far if the air be freely open. Moisture is their normal medium. Currents of humid air, as from sewers and drains, lift them in full effectiveness; and if into houses or confined exterior spaces, the chances are that their morbid powers will be less preserved. Ill ventilated and low-lying localities, where refuse is allowed to lie, may especially be expected to have these ferments present in their common atmosphere, as well as teeming in their soil and ground water.

In the latter, too, as in the air, stench and palpable foulness afford no adequate test of zymotic malignity. Chemical demonstration of unstable nitrogenous compounds in water is a warning (and the disgust of healthy taste and smell equally so) which should never be disregarded: "but till chemistry shall have learnt to identify the morbid ferments themselves, its competency to declare them absent in any given case must evidently be judged incomplete, and waters which chemical analysis would probably not condemn may certainly be carrying in them very fatal seeds of infection."

Of the diseases distinctively due to filth, the most characteristic are those which, in respect to their leading symptoms, are called diarrhoeal. These are of two general types—common diarrhoeas, ascribed to the common septic ferments generated in all refuse, and specific diarrhoeal diseases, such as cholera and typhoid fever due to specific infection. It is in regard to the latter that the labors of the British Medical Board have been especially searching and successful.

In every one of the cases investigated, the relations of water supply and excremental deposits were horribly close in very many instances, as for example at Annesley, of which the inspector, Dr. Buchanan, reports, "arrangements for excrement disposal and water supply such that people must drink their own excrement!" Truly the chief medical officer may well say that it is difficult to conceive, in regard to any causation of disease in a civilized community, any physical picture more loathsome than the way in which enteric fever spreads its infection. Though sometimes making its way by covert processes, yet far oftener in the most glaring way, it apparently has its source in that which is of filth the filthiest.

est: "apparently its infection runs its course, as with successive inoculations from man to man, by instrumentality of molecules of excrement which man's filthiness lets mingle in his air and food and drink."

The distribution of an immense quantity of other diseases is traced to the same disgusting process. The argument which applies to the bowel discharges of enteric fever apply equally to cholera, and seems to extend, by extremely strong analogy, to every disease, whether nominally common or specific, in which the human intestinal canal is the seat of infected change.

But this does not limit the deadly influence of filth. The researches of Dr. Burden Sanderson and others have clearly shown that in the common septic ferment, so called, or in some ferment or ferments not hitherto to be separated from it, there reside powers of disease production as positive as those which reside in variolous or syphilitic contagia. By successive inoculations, it not only develops itself as one of the most tremendous of zymotic poisons, but becomes communicable from the sick to the healthy, producing diseases exactly corresponding to the fatal infections chiefly known under the names of erysipelas, pyæmia, septicæmia, and puerperal fever: infections sometimes arising in unquestionable dependence on filth, yet becoming, when arisen, the most communicable of diseases. And further, it seems most probable that the ferment which destroys life so quickly by septicæmia in its stronger actions can in slight actions start, in the infected body, chronic processes which will eventuate in general tubercular diseases. In this way the mischief done by filth in generating diseases like erysipelas or puerperal fever on the one hand, or tubercular diseases on the other, may be of a sort entailing possibilities of extension, by accidental contagion or by hereditary transmission, indefinitely beyond the original filthy neighborhood.

WHAT FILLS THE INTERSTELLAR SPACE?

That the interplanetary and interstellar space cannot be a perfect vacuum, or consist of absolutely nothing, is clear from the fact that light and heat are propagated through it; and whether we accept the old theory of Newton, that light is an emanation of fine particles, or the now generally accepted undulatory theory of Huyghens, that it is propagated by waves through an existing medium, we are driven in either case to the conclusion that there must be a something pervading the whole Universe (outside of the luminous and dark spheres which are suspended in it at various distances apart) to its furthest recesses. It has usually been agreed to call this something the celestial ether, and even different kinds of such ether have been supposed to exist: one to propagate light, one for heat, one for electricity, one for magnetic effects, and some philosophers have even suggested one to produce the phenomena of gravitation; and they have been respectively called the luminiferous ether, imponderable caloric fluid, electrical ether, magnetic fluid, etc., and even some of our foremost savants still indulge in the use of such hypothetical expressions.

It may be that this something which fills space is composed of a number of elements, in the same way as our atmosphere consists of nitrogen, oxygen, carbonic acid, and watery vapor; but it is also possible that it consists of a single substance, capable of transmitting various kinds of motions, as our atmosphere, without reference to its chemical constituents; it transmits waves of sound of various pitch and character, various pressures, currents of different velocities, etc. It is sufficiently well established that light, heat, and electricity are only modes of motion differing in character, being for instance progressive, circular, elliptical, to and fro, rotary, longitudinal waves, transverse waves, etc.; therefore it is possible that the same interstellar medium may transmit light, heat, attraction of gravitation, electricity, magnetism, and possibly other forces as yet unknown to man.

In the meantime, it forms an interesting subject of inquiry if this medium is absolutely without weight, and therefore of a nature different from what we call matter, of which weight is the first and fundamental property, or if it may be considered as very rarefied matter, so highly expanded that it is to our hydrogen as hydrogen is to platinum. The latter is, at the common atmospheric pressure, 250,000 times heavier than hydrogen, and we can easily reduce its density (by means of an air pump) to a one hundredth part, as is done in the Geissler tubes, which, when illuminated with an electric current, show the characteristic spectroscopic lines of hydrogen; and notwithstanding this still ponderable material has a density of only the twenty-five millionth part of that of platinum, it will, when condensed again, show all the characteristics of its nature, enter into chemical combinations, exert pressure, etc.

It is well known that our ancestors, a few centuries ago, had no conception of the gravity of gases in general, still less did they attribute weight to rarefied hydrogen, and even now, for the savage mind, such a thing has no existence; and it is a question whether even we, the enlightened and supposed to be well informed savants of the nineteenth century, do not stand in the same ignorance in regard to the gravity and other properties of the interstellar medium.

The modern theories of the conservation of forces and the transformation of heat into power, and *vice versa*, considered in connection with the velocity of the transmission of the solar rays and with the amount of heat poured out by the sun, which has been correctly measured (and which is the primary source of all motion and life on our planet, except the motion of the ocean tides), may give some light on this subject. As the heat of the sun is sufficient to melt half an inch of ice per hour, or 72 cubic inches for every square foot of surface, which is equivalent to $\frac{1}{2}$ of a cubic foot, or nearly 2½ lbs., and as the melting of 1 lb. of ice con-

sumes 142 units of heat, the solar rays exert a heating influence of $24 \times 142 = 355$ units of heat per hour on each square foot. But as 1 unit of heat is equivalent to 772 foot pounds, we have for the solar action a force of 274,040 foot pounds per square foot per hour, or 80 foot pounds per second. It has been demonstrated that light moves with a velocity of 192,000 miles, or very nearly 1,000,000,000 feet, per second; and calling the weight or mass of the molecules (which, according to the Newtonian theory, are emitted from the sun) x , we must, to ascertain the mechanical momentum of the effect of this transmission, multiply the mass with the square of the velocity; and as this momentum is found equal to 80 foot pounds per square foot, we have the equation: $1,000,000,000^2 \times x = 80$, from which it follows that $x = 80 \div 1,000,000,000^2 = 0.000000000000000008$ for the mass of a column of the interstellar medium 192,000 miles, or 1,000,000,000 feet, long and of 1 square foot section. Dividing this value of x by 1,000,000,000, to find the weight of 1 cubic foot, we see that it will amount to 0.00000008 lb. As the weight of 1 cubic foot of hydrogen is, at the ordinary atmospheric pressure, 0.002 lb., we see that, if these calculations are worth any consideration, the weight of the interstellar medium is about a million times less than hydrogen; therefore it is utterly inappreciable by our most delicate balances, but still very appreciable by calculation and observation. If we accept the Huyghenian theory of light transmission by waves, the mechanical effect of the luminous waves, striking with the demonstrated velocity of light (notwithstanding that its calculation involves more complex and difficult questions), will give results not very different from the above estimates; and these make it highly probable that the specific gravity of this interstellar medium is not absolutely zero, but stands in about the same relation to rarefied hydrogen as rarefied hydrogen does to platinum.

FOREIGN PATENTS—SPLENDID OPPORTUNITIES FOR AMERICANS.

We would direct the attention of inventors to the large reductions which have been made in the expenses pertaining to the securing of patents in foreign countries, as fully set forth in the advertisement of Messrs. Munn & Co., published on another page. It is not realized as thoroughly as it should be that the world, and not any one political division of it, is the inventor's legitimate field; that an original and useful device is likely to be as valuable and as profitable in one civilized country as in another; and therefore for the possessor of the same to attempt to glean its full advantages, from its working only in the United States, is as shortsighted as would be the course of a wholesale merchant who should reject all trade except within the limits of the town or city in which he resides. Add to this that American inventions have acquired an enviable reputation abroad, and are eagerly sought after, and an opportunity is offered for making money infinitely superior to that presented in the territory from which a dealer in other men's wares must literally discover and extract the means of establishing a business.

But apart from all these considerations, it is certain that at no period since patents have been in existence has the acquirement of foreign protection for his device been more vitally important to the American inventor than at the present time and during the coming year. All the world knows that in a few months such a display of new and ingenious inventions as has never before been witnessed will be exhibited at Philadelphia. Every means of making this Exposition known has been adopted. The foreign newspapers are filled with preliminary accounts of the buildings, and with anticipations of the grandeur of their contents. Our home journals are constantly on the alert to give to the public the latest intelligence of the progress of the enterprise. Nearly all the great governments of the world are getting ready exhibits of the finest productions of their several countries, and, finally, thousands of people, including probably all most prominently interested in invention and in industrial progress, will personally make the journey to the Centennial. The machine builders of England and France, the iron producers of all the European countries, capitalists from abroad ready to invest in and promote the advancement of new and useful ideas, all will scrutinize with the utmost interest our national display, and seek to profit by it. Skilled foreign engineers will examine every detail of the mechanism, ingenious foreign inventors will contrast their devices with ours, and note the improvements, and, in brief, we may venture safely to say, of each and every American invention of merit in the Exposition, there will be many scores of people who will have its every feature impressed on their memories, if not accurately portrayed in their note books. What then is to prevent these people from returning to their own countries and, with all the data before them, reproducing every American device, and reaping a rich harvest in return? Nothing but the protection of the foreign patent, of which the American inventor may now avail himself; and if that patent is not secured, he must be content to stand aside and see his ideas appropriated.

The advantage of the foreign patent does not, by any means, end with the prevention of piracy at the Centennial, important as such effect may be. It renders every particle of the enormous amount of advertising done for the Centennial as valuable to the inventor as if it had been done for his individual benefit. It changes every foreign visitor, coming from the country where he has protection, from a possible pirate into a probable customer. It brings him a new clientele, limited only by the population of the nation; and if his patents are obtained in four great countries—England, Canada, France, and Belgium—a hundred million people are tributary to his monopoly. His interest will then be to display the new and original advantages of his productions, not to

keep them back; to distribute descriptions and drawings broadcast, instead of nervously watching every stranger who dallies with pen and notebook; to court inquiry relating to his invention, rather than to avoid the same.

We think that there are few American inventors who will not appreciate the importance of this matter. It is a simple duty, easily attended to, and, as will be seen from Messrs. Munn & Co.'s announcement, the facilities of the largest patent agency in the world are now placed at every inventor's disposal, at an expense less than ever before, and certainly inconsiderable in view of the advantages to be gained.

"WRINKLES AND RECIPES."

We have never actually counted the number of questions which the SCIENTIFIC AMERICAN is called upon to answer through its "Notes and Queries" column; but it is no exaggeration to estimate these at several hundreds weekly. It is of course impossible for the editors to reply to all in full: first on account of the space at their disposal not being unlimited, and second because large numbers of the queries have been previously answered in its columns. Many readers, however, from various causes, either do not possess or have not access to the back files of the SCIENTIFIC AMERICAN; and it is to benefit these, as well as to place in the hands of mechanics generally a plain, precise, and practical handbook, in which the queries which form the very large majority of those constantly received at this office will be found fully and completely answered, that *Wrinkles and Recipes* has been projected.

The volume is divided into five departments, namely, Mechanics, Engineering, Practical Technology, the Farm, and the Household; and while embracing under these general headings a large amount of the most valuable and practical information which has appeared in the SCIENTIFIC AMERICAN, rewritten and condensed with care, it also contains a goodly proportion of entirely new material, prepared expressly for its pages. For example, under the division of Mechanics, will be found fine engravings of a set of master tools, forged at the request of the editor by Mr. Joshua Rose, and experimented upon by him until their form was such as to give the fullest possible duty. The perfected tools were placed before the artist and reproduced with the closest accuracy in point of size, etc., so that, with the complete instructions given in the letter press, any mechanic can make them for himself. These tools are adapted for metal turning, boring, etc. In the same department is also the cream of the series of papers on Practical Mechanism, which during the last two years have appeared in the SCIENTIFIC AMERICAN, also selected and rewritten by their author, Mr. Rose. In the Engineering department is a new paper on testing metals, expressly written by Professor Thurston, and also a series of illustrated articles, with practical rules on steam engineering topics, prepared by Mr. R. H. Buel. It is believed that the brief treatises on the slide valve, the indicator, on testing engines, and on the governor, are the simplest as well as the most practical expositions of these subjects extant. The department of Practical Technology, compiled under the supervision of Professor P. H. Vander Weyde, embraces recipes of all descriptions, for metal working, for cements, alloys, and glues, for electrical batteries, and on hundreds of other practical subjects. Under the head of the Farm are given suggestions of all kinds useful to farmers; and in the following department of the Household, the housekeeper is provided with an invaluable repository of useful hints. Especial attention has been devoted to "trade wrinkles and secrets" of which a large number are presented in the Mechanical department.

Altogether the work is one of the most useful guides for the classes to which it is addressed that has come under our notice; and it is sold at a price (\$1.50) which places it within almost everybody's reach. It comprises 250 pages, neatly bound in flexible grease proof covers for the pocket. Copies may be obtained, post paid, by mailing the price to H. N. Munn, publisher, P. O. Box 772, New York city. See advertisement on back page.

VENEERED DIAMONDS AGAIN.

Sydney Smith once observed that it required a surgical operation to get a joke into a Scotchman's head. We do not know whether the anonymous individual who has just sent us a letter signed "A Friend" hails from the land o' cakes; but we fear such must be the case, in view of the merciless hauling over the coals which he inflicts upon us for our recent innocent remarks on a cheap jewelry swindle. We might endure the letter in silence and lock the suffering it causes in our lacerated breasts, but now the veneered diamond man himself twists our paragraph into a commendatory testimonial, and publishes it as such in his brazen advertisements.

Seriously, however, for the sake possibly of others who may also have misunderstood our meaning, and in order to furnish the diamond(!) merchant with a new paragraph for future advertisements, we may plainly state that the wonderful discovery is a miserable deception. Science has never been able to produce the diamond artificially, though countless attempts have been made. Professor Silliman, by the aid of an intense heat, has made little globules from plumbago, which were transparent, and which resembled the genuine stone; so also globules have been obtained from apparently fused charcoal, but close examination showed them to contain iron and carbon, which proved that the charcoal had never been perfectly fused. Dr. Hare, of Philadelphia, by means of a deflagrator, succeeded in obtaining a metallic luster from intensely heated charcoal. Cagniard de Latour pretended to have discovered the ingredients of the gem;

but the small crystals shown by him turned out to be peculiar silicates, which polarized light differently from the diamond. M. Despretz has conducted experiments which are probably the furthest advanced of any. By voltaic action he prepared a pure carbon from sugar candy, which was deposited in the shape of microscopic crystals in black octahedrons, or colorless translucent plates, the whole of which had the hardness of the powder of the diamond, and which disappeared on combustion without leaving any perceptible residue. Being, however, only in powder, it was impossible to isolate and weigh these crystals, or to determine their index of refraction or angles of polarization, the two tests which infallibly distinguish the true diamond. It is reported, also, but we know of no confirmatory evidence, that a mixture of chloride of carbon and alcohol, when acted upon by galvanic currents for six months, is decomposed with a result similar to the above.

As regards the ridiculous theory of the humbug we have referred to, certainly no refutation of it is necessary. We have a better opinion of the scientific knowledge of the readers of the SCIENTIFIC AMERICAN, and of our journal itself as an educator, than to credit the idea that others, beside those few intensely matter of fact persons who have written, wondering that we could be so humbugged, will be deceived by so palpable a fraud.

SCIENTIFIC AND PRACTICAL INFORMATION.

ILLUMINATING GAS FROM CORK.

To the list of substances capable of furnishing illuminating gas of good quality, cork is now to be added. Recent experiments, made in Bordeaux, France, have given results both economical and satisfactory, and it has been definitely decided to use the material in the lighting of the city. Works for burning cork are now in process of construction. The fragments of cork, principally waste left after cutting bottle stoppers, are distilled in a close retort. The flame obtained is stated to be whiter and more brilliant than that of coal gas, while the blue zone is much smaller, and the density considerably greater.

A SOLAR ENGINE.

M. Mouchot has recently exhibited to the French Academy of Sciences a simple form of solar engine. It consists of a cone of polished tin, reversed and arranged so that its interior can be adjusted toward the sun. In the axis of the vessel is suspended a large flask of white glass, inside of which is a metal boiler covered with lampblack. The rays, concentrated by the mirror-like surface of the cone, traverse the glass easily, and are accumulated on the boiler, in which they speedily produce an ebullition of the water, and steam sufficient to drive a miniature engine. By increasing the dimensions of the apparatus, M. Mouchot has obtained a utilizable force, and produced, after three quarters of an hour exposure to the sun, a boiler pressure of 60 lbs. of steam.

NATURAL GAS FURNACES.

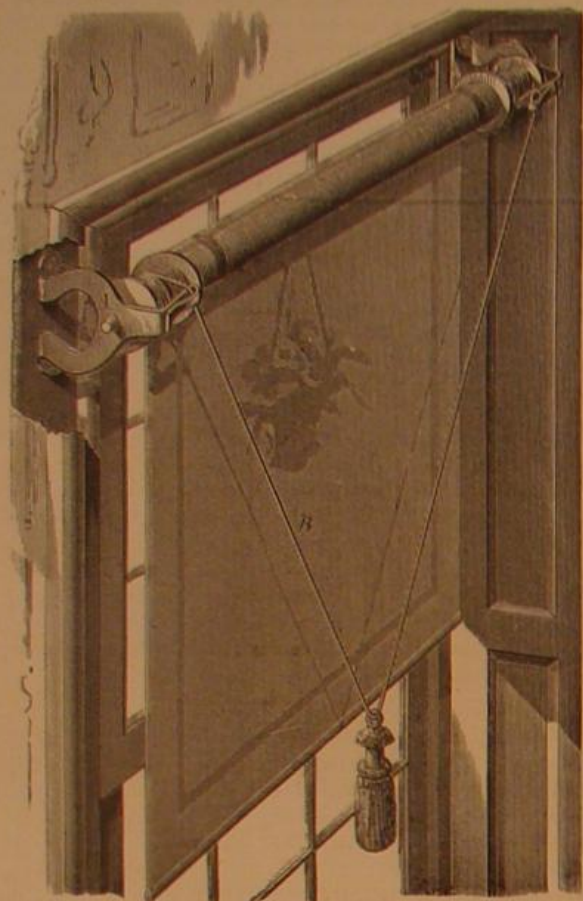
The constantly increasing utilization of natural gas for industrial purposes, throughout the oil region of Pennsylvania and its neighborhood, is attracting much favorable comment. The success of the puddling and heating furnaces at Erie, Leechburgh, and elsewhere in Pennsylvania, where the experiment has been thoroughly tried, seems to have attracted a widespread interest to the subject, and we now learn of schemes on foot to utilize the gas upon the large scale. Near Beaver Falls, the gas issuing from a well 1,100 feet deep is employed in a file factory at that place. It is also reported that the product of the great gas well in Butler county, Pa., will be brought to certain iron works in Pittsburgh. The work of laying a pipe, six inches in diameter and seventeen miles long, is said to be contracted for, to be finished within a month. It is further reported that a project is being mooted to purchase all the gas wells in Butler county, and bring their product to the Pittsburgh manufacturing. This last scheme, if successfully realized, would work quite an industrial revolution. But, whether feasible or not, the agitation of the subject is an indication that the question, of utilizing the enormous volumes of valuable heating gas which have, until the present, been allowed to go to waste, is at length receiving the attention it deserves.—*American Exchange and Review*.

AN AUTOMATIC SWIMMING APPARATUS.

Under the auspices of the London Swimming Club, and at the City of London Swimming Baths, Golden Lane, London, an invention for facilitating the acquisition of the art of swimming was recently exhibited. The invention, which was practically tested in the case of persons who could not swim, first consist in stretching across the bath, in any direction, a wire somewhat similar to a single telegraph wire, placed at some height above the water and parallel to it. Upon this wire a grooved pulley is mounted, from the axis of which an elastic cord depends, terminating in an adjustable supporting belt for the body to rest on. The weight of the body when in the water is capable of receiving more or less support according to the degree of proficiency the learner has attained. The suspended weight from the axis of the pulley, being under the line of support, keep the pulley in a true vertical position, so that during the time the swimmer is striking out the supporting pulley travels along the wire at a rate proportionate to the speed of the swimmer. To suspend the body in water by a string is not a new idea; but this contrivance is self-acting. The members of the club, who are laudably offering to teach swimming gratuitously to all who lack the art, consider this invention the best that has yet appeared for helping the novice to attain proficiency in swimming.

POIPISIL'S CURTAIN, FIXTURE.

We illustrate in the annexed engraving an improved curtain fixture, by means of which the curtain is retained at any height at which it may be adjusted, and is raised or lowered by means of a single cord. The ends of the roller are held in spring brackets, A, and near such extremities are formed pulleys, about which a cord, B, is wound in opposite directions. The bight of the cord hangs down in rear of the shade and carries a heavy tassel by passing through an eye on the same, said tassel thus serving as a counterpoise for the weight of the curtain. It will be clear from the engraving that, when the cord on one side is pulled, the roller will be rotated in one direction, and that the same will be turned in the opposite



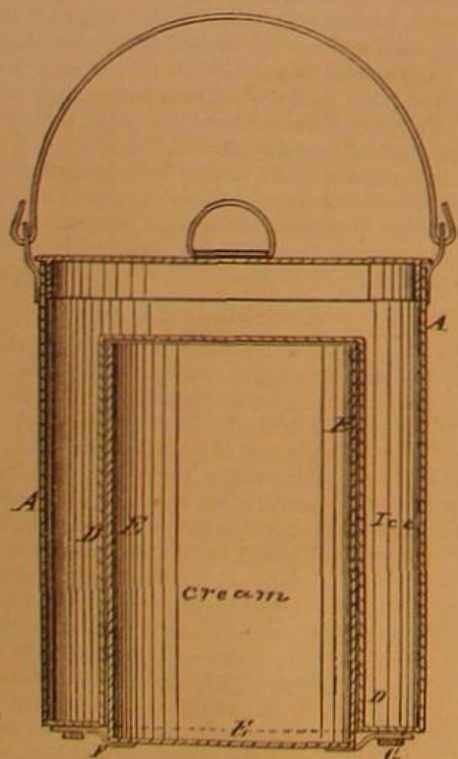
way when the cord on the other side of the tassel is drawn down. The shade is thus easily rolled or unrolled.

3. The fastenings, A, of the roller are provided with loops, which serve as guides for the cord. The device is simple and easily operated, and doubtless will be found an efficient substitute for the old-fashioned endless cord and single pul-

Patent allowed through the Scientific American Patent Agency. For further particulars, relative to sale of exclusive right for the United States or for State rights, address the inventor, Mr. Rudolph J. Pospisil, 757 Allport street, Chicago, Ill.

A JUVENILE INVENTOR.

A bright eyed manly looking youngster made his appearance in our office, not long since, with a tin model under his arm, and announced to us the fact that he was an inventor and wanted a patent. We inquired with interest as to the nature of his production. He promptly replied that it was an ice cream carrier, intended to transport that delicacy from the



Wyman's Ice Cream Carrier.

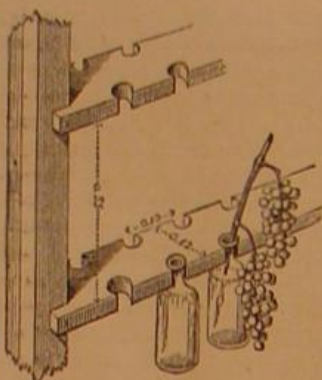
place of sale to wherever it was to be eaten, without danger of melting. After examining his model, we were curious to know how so young a lad came to invent such an article, and this elicited his story. He was a district telegraph messenger, he said, one of those blue and red uniformed boys whom any one who has an instrument in his house can summon at

any hour, night or day, to go on errands. It appears that a gentleman, desiring to indulge in ice cream on a hot evening, called our young friend and despatched him for a supply. The weather was warm, and doubtless the hands of the boy likewise, and so, despite the paper which enveloped the cream, by the time it reached its owner it was in a sadly demoralized condition. The gentleman, who had been luxuriating in anticipation of the frigid repast, forgetting the hot weather, was very exasperated, and vented his wrath on the messenger by a tremendous scolding. The unfortunate youngster felt the sting of the upbraiding, which he thought was unjust, for he said the fault was not his; and he set to work to invent something which would, on another and similar occasion, prevent his incurring another "blowing-up." The result was the ice cream carrier, for which a patent has now been granted. The device consists of an annular pail, having a cover and bail. The inner wall is not so high as the outer one, and is covered over. In this receptacle the ice and salt are placed. The ice cream vessel is a simple cylinder which is inside the annular pail, and which is held therein by clips on the bottom, as shown in the engraving.

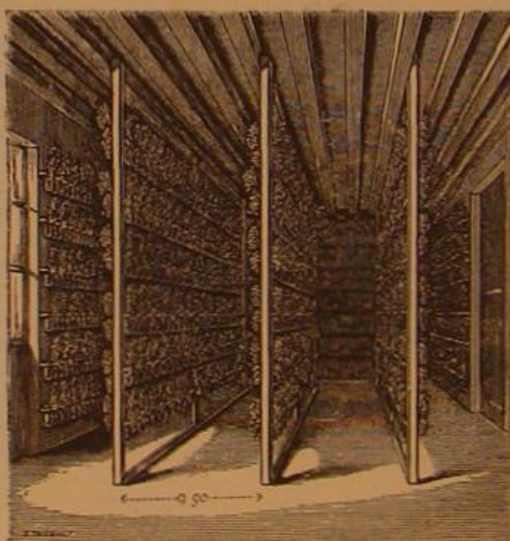
The device is practical, and we have no doubt will answer its purpose very nicely. The inventor is Master Henry W. Wyman, of this city.

PRESERVING GRAPES.

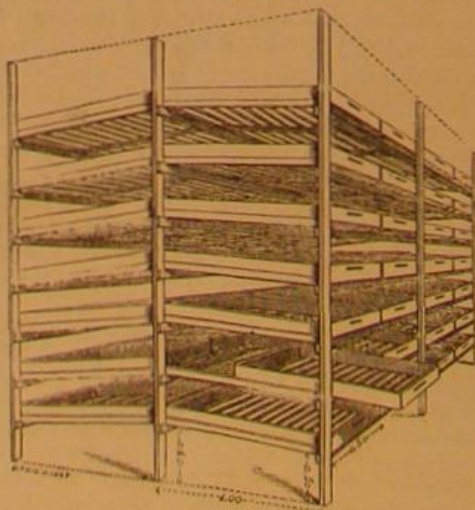
The preservation of grapes for winter and spring use is easily done; and by a lit-



are cut with a portion of the branch attached, and the branch is put into a small bottle filled with water (see Fig. 1). These



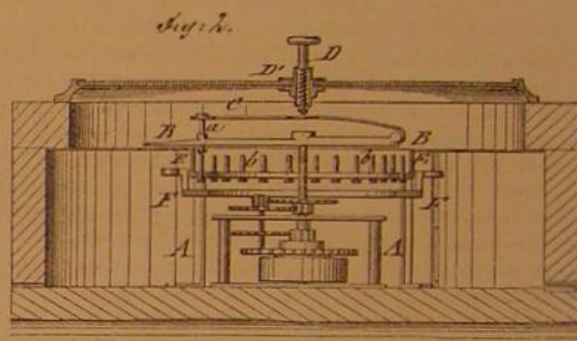
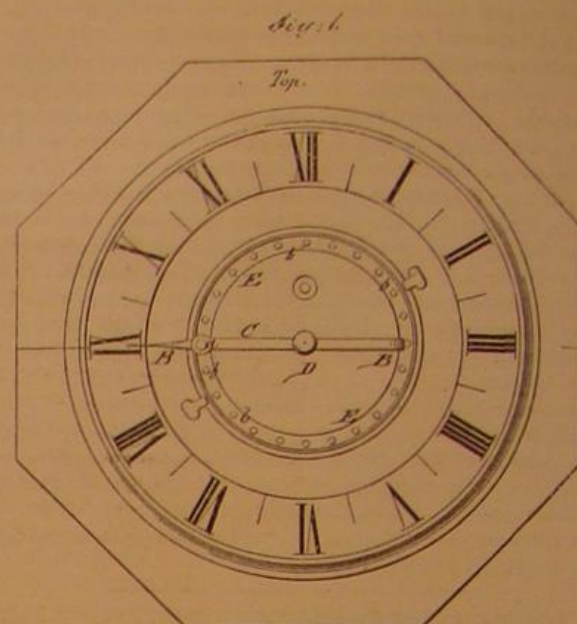
bottles are then arranged in racks, being placed just so far apart that the clusters do not touch. They should be looked at occasionally, and the bottles filled with water. Some growers recommend putting a little powdered charcoal into each bottle of water. The racks are arranged in a dark room (see Fig. 2), properly ventilated.



Large quantities of grapes are preserved in France on the dry stalks (*à rafle sèche*). The bunches are put away on trays made of slips of wood (see Fig. 3), placed a little asunder for the circulation of air. Fern leaves or barley straw is laid in the trays, and the bunches are laid away when the first frosts arrive. They require very careful watching, and every single berry that shows symptoms of decay, from whatever cause, must be carefully removed with a pair of scissors.

IMPROVED WATCHMAN'S TIME CHECK.

Messrs. T. D. Osborne and W. W. Le Grande, of Louisville, Ky., have patented (September 21, 1875), through the Scientific American Patent Agency, a new and simple form of detector, for attachment to an office or other clock, by which it may readily be discovered whether a watchman does or does not faithfully perform his duties. We give an illustration of the device herewith, Fig. 1 being a view of the front of the clock, and Fig. 2 a section. The glass front of the time piece has a central sleeve for a sliding spring pin and button, D. This pin acts upon a spring, C, Fig. 2, that



is applied to one end of one of the clock hands, the other end carrying a pin, *a*, which passes through the eye of the hand to be brought successively in contact with a series of sliding pins, *b*, on a guide ring, *E*, attached to the clock frame. The position and number of the pins correspond to the periods of time at which the watchman is compelled to register, the spring pin of the hand allowing the pressing back of the pins only when the hand indicates the proper time. Any one of the pins not depressed shows at a glance the neglect of the watchman. A sliding base ring, *F*, serves to restore the pins to their normal position.

The Components of Coal.

Dr. Hofmann, of the University of Berlin, furnishes, in *Percy's Metallurgy*, the following list of the compounds generated by the destructive distillation of coal, the new atomic weights being used

Hydrogen.....	H	Ethine (acetylene).....	C_2H_2
Water.....	H_2O	Benzol.....	C_6H_6
Carbonic oxide.....	CO	Toluol.....	C_7H_8
Carbonic acid.....	CO_2	Xylol.....	C_8H_{10}
Sulphurous acid.....	SO_2	Cumol.....	C_9H_{12}
Hydro-sulphuric acid (sulphuretted hydrogen).....	H_2S	Cymol.....	$C_{10}H_{14}$
Bisulphide of carbon.....	CS_2	Naphthalin.....	$C_{10}H_8$
Hydrocyanic acid ..	HCN	Anthracene.....	$C_{14}H_{10}$
Hydrosulphocyanic acid.....	HCNS	Phenanthrene.....	$C_{14}H_{10}$
Acetic acid.....	$C_2H_4O_2$	Fluorene.....	$C_{15}H_{12}$
Carbolic acid (phenol). C_6H_5O		Pyrene.....	$C_{16}H_{10}$
Cresylic acid (cresol). C_7H_8O		Crysene.....	$C_{18}H_{12}$
Phloric acid (phlorol). $C_8H_{10}O$		BASIC NITROGEN COMPOUNDS.	
Rosolic acid.....	$C_{10}H_{12}O_2(?)$	Ammonia.....	H_2N
HYDROCARBONS.		Aniline.....	C_6H_7N
Methane (marsh gas). CH_4		Pyridine.....	C_5H_5N
Sextane (propyl).....	C_6H_{14}	Picoline.....	C_7H_7N
Octane (butyl).....	C_8H_{18}	Lutidine.....	C_7H_9N
Dodecane (amyl).....	$C_{12}H_{26}$	Collidine.....	$C_8H_{11}N$
Decane (capryl).....	$C_{10}H_{22}$	Parvoline.....	$C_9H_{13}N$
Paraffin.....	$C_{15}H_{32}$	Corindine.....	$C_{10}H_{15}N$
Ethene (olefant gas). C_2H_4		Rubidine.....	$C_{11}H_{17}N$
Tertene (propylene). C_3H_6		Viridine.....	$C_{12}H_{19}N$
Sextene (caproylene). C_6H_{12}		Chinoline.....	C_8H_7N
Septene (anantyleno). C_7H_{14}		Leuceline.....	
		Lepidine.....	$C_{10}H_{15}N$
		Cryptidine.....	$C_{11}H_{17}N$
		Pyrral.....	C_8H_9N

SOFT and pliable woods, such as pine, willow, alder, etc., require the use of large saw teeth with acute points and considerable pitch; whereas hard woods or those of a tougher and denser consistence, such as oak, mahogany, rosewood, etc., necessitate the adoption of teeth of perpendicular pitch and diminished space. Yellow deal, pitch pine, larch, etc., are of so gummy and resinous a character that the teeth not only require more set, but the blades themselves have to be smeared with grease to keep them cool, and to decrease the friction arising from the adherence of resin during motion. Similar results are experienced in working soft woods; the teeth become choked by the damp consolidated sawdust, and obstinately refuse to perform their duty without extra force.

THE LOCOMOTIVES OF 1825 AND OF 1875.

There are few great inventions of modern times regarding the original conception of which there is not considerable difference of opinion. The sewing machine and the screw propeller have been credited to various inventors according as the weight of evidence, in favor of one man or the other, has impressed different chroniclers, and the same is the case with the steamboat and the locomotive. Regarding the last especially, there are sharply marked differences of opinion, amounting in many instances to conviction, strengthened perhaps by the dispute partaking something of an international character. In this country it is customary to ascribe the origin of the steam carriage to Oliver Evans, who, in 1787, obtained from the Maryland legislature a patent for steam carriages, which he designed as a means of transport

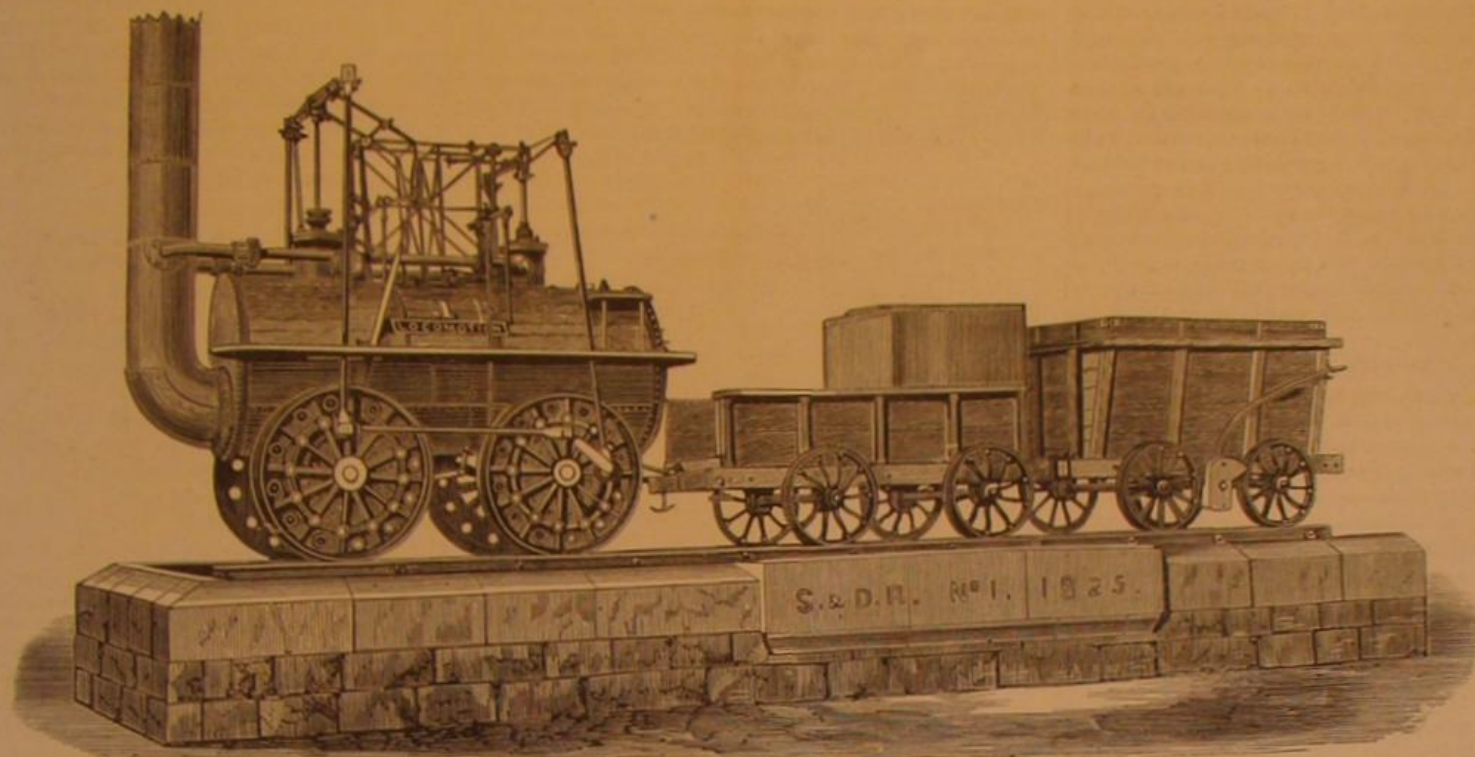
was done with the locomotive other than to apply it as a traction engine for coal and ore. Sometimes it was used on rails; again, it lumbered over the king's highway, to the unalloyed astonishment of the travelers thereon. It was reserved for Stephenson to conceive of its application to the drawing of stage coaches on a road provided with metal rails, and practically to test his theories on that September day, the fiftieth anniversary of which has just been so enthusiastically celebrated in England. Rails were placed between Stockton and Darlington, and the Locomotion ran over them at the astounding speed of eight miles per hour. The reader, in our first engraving, has before him a representation of this first passenger locomotive, as it now appears, placed as a monument upon a massive pedestal. The plain straight boiler, ten feet in length by four feet in diameter,

such are the contrasts the lapse of half a century brings together.

We add a second engraving, for the sake of the comparison, of one of the most powerful locomotives ever used on a narrow-gauge railway. It was built in England in November, 1874. Its boiler is 10 feet long by 4 feet in diameter, and contains 210 tubes of Low Moor iron, 1½ inches in diameter. The cylinders are 17 inches in diameter by 30 inches stroke. The boiler carries 140 pounds per square inch pressure; and with a train of fourteen cars, the locomotive has accomplished a speed of sixty miles per hour.

Practical Painting.

Everybody knows that the painting of first class passenger railway cars is a work of skill and experience. Good direc-



THE LOCOMOTION, THE FIRST PASSENGER LOCOMOTIVE.

of flour to and from mills. Evans found, however, that his engine, which by the way was the first ever built on the high pressure principle, worked better in mills than in carriages, so the initial vehicle upon which he was engaged at the time of this discovery, it appears, was not finished. In 1794, Evans sent his plans to England, and there, it is reported, Vivian and Trevithick gained access to them and pirated some of the ideas, a statement vouched for in the new edition of Appleton's *Cyclopedia*; but which the reader, conversant with the lives of these eminent inventors, will hardly credit. Unfortunately for Evans' claims, his invention had been anticipated and practically carried out in France eighteen years previously; and the ancient locomotive built by Cugnot in 1769, noticeable for its crude though ingenious mechanism, antedating the introduction of the crank, and necessitating the odd ratchet-like device for moving its wheels, still exists, standing in the same hall with the looms of Jacquard and Vaucanson in the Conservatoire des Arts et Métiers, in Paris. Besides, in 1784, Watt and his assistant Murdoch

has a single flue and sixty square feet of heating surface. The safety valve lifted at twenty-five pounds pressure. Above the generator are two cylinders, ten inches in length by twenty-one inches stroke, their pistons working cross beams which were coupled to the connecting rods, which in turn rotated the wheels. A loose eccentric sheave and bell cranks operated the flat slide valves; and from a crosshead on the piston rod, the pump was worked. Add a wooden framework, no brakes, a little tender capable of holding 240 gallons of water, and the picture of the machine which annihilated the pet theories of the majority of the skilled engineers of its day is complete.

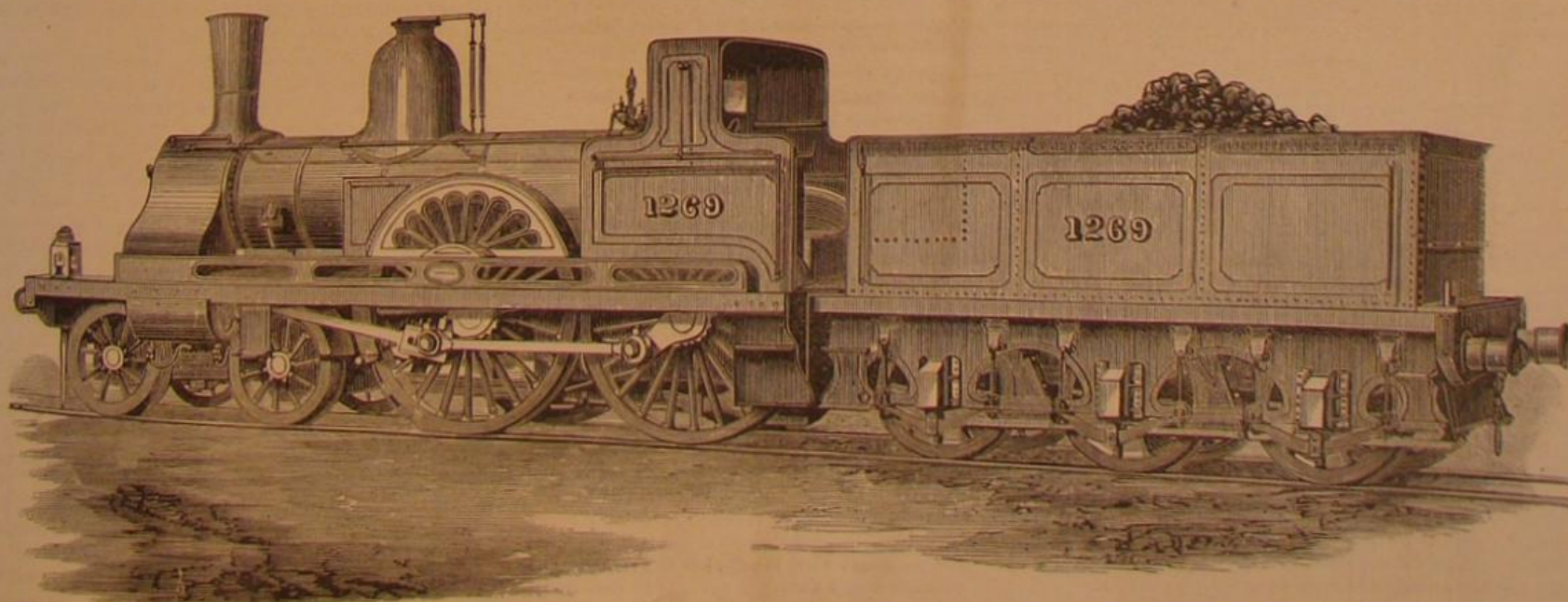
Fifty years have gone by since this machine was built; years that have seen a greater progress in civilization and in the arts than decades before. The few miles of track between the out of the way little English towns have grown and ramified until their iron network, already pushing its way into the wildernesses of Siberia and the burning sands of the African deserts, will soon have encompassed the world.

tions for painting of this kind ought to be found useful wherever the brush is employed for first class work, and we therefore give the following:

The sixth annual convention of the Master Car Painters' Association was held at the Grand Central Hotel in this city, on the 8th and 9th of September. Mr. R. McKeon, the Secretary and Treasurer, delivered the following address on the "Process of Car Painting," which we find in the *National Car Builder*.

"I make no great profession of my ability, but I certainly should have acquired some knowledge, and that of a practical nature, some twenty-five years having been exclusively devoted to the business. My long experience and constant practice, bringing me in contact with others of the profession, have given me that knowledge of the art which can only be secured by close attention and some study.

A first class railway coach, on any of our main roads, costs, when complete, about \$6,000. To protect this work, the painter expends from \$300 to \$600. The latter figure will



A MODERN LOCOMOTIVE.

both patented locomotive carriages in England, so that, much as it has possibly gratified some authors to prove the locomotive an American invention, their views do not stand the test of recorded fact.

At the risk of being considered as having diverged from our subject, we prefix the above brief scrap of history as of interest in connection with the two engravings given herewith, the quaint old machine in one of which marks the beginning of the development of the now vast railroad system. From the period above referred to, up to the year 1825, nothing

For the old stage coach bodies, deprived of their wheels and mounted on trucks, which constituted the first railway cars, there have been substituted elegant saloons where one may eat and sleep in luxury over journeys from ocean to ocean; instead of the slow, wheezing machine, typical of childhood in its fragility and incapacity, now exists the magnificent engine, equally typical of the strength and might of manhood. Six tons of rude machinery crawling along at eight miles per hour; sixty-five tons of the highest efforts of the artisan's skill rushing over an iron road at a mile a minute;

make a first class job. The car has been completed in the wood shop, and is turned over to the painter, who is responsible for the finish. He is expected to smooth over all rough places or defects in the wood, which requires both patience and skill to make the work look well. Twelve weeks should be the time allowed to paint a car, and it cannot be done in any less time, to make a good job that will be a credit to the painter and all other parties interested in the construction and finish of the car. Too much painting is done in a hurry; proper time is not given the work to dry or become

thoroughly hardened before it is run out of the shop, and consequently it does not always give the satisfaction it should; nor can it be expected that hurried work will be so lasting or durable as that which has the necessary time given to finish it.

THE PRIMING PAINT.

The priming coat of paint on a car is of as much importance as any succeeding one, and perhaps more. I have seen good work ruined in the priming by little or no attention being given by the painter to the mixing and applying of the first coat. The foundation is the support, and on that rests your success or failure. The priming should be made of the proper material, mixed with care from good lead and good oil, and not picked up from old paints, which have been standing mixed and must necessarily be fat and gummy, for such are unfit for use on a good job, and will have a decided tendency to spoil the whole work. Special care should be exercised, both in mixing and applying the priming, and it should be put on very light, so that it may penetrate well into the wood. Too much oil is worse than not enough. Good ground lead is by far the best material for the under coats on a car; and although I have tried other materials for priming, yet I have failed to find anything equal to the lead. Two coats should be given to the car before it is puttied, as it is best to fill well with paint the nail holes and plugs, as well as defects in the wood, so that moisture may not secure a lodgment, which otherwise will cause putty to swell, although sometimes unseasoned lumber will swell the putty; and as it shrinks, the nail remains stationary, and of course the putty must give way.

THE BEST PUTTY.

In mixing putty, which may be a small matter with some, take care to so prepare it that it will dry perfectly hard in eighteen hours. Use ground lead and japan, stiffening up with dry lead, and whatever coloring you may require in it to match your priming coats.

The next coats, after the work is well puttied, should be made to dry flat and hard. Two coats should be applied, and, for all ordinary jobs or cheap work, sandpapering is all that is necessary for each coat; but when a good surface is required, I would recommend one coat to be put on heavy enough to fill the grain; and before being set, scrape with a steel scraper. The plain surface is all that requires coating and scraping with the heavy mixture; for this coat, which we call filling, I use one half ground lead and any good mineral which experience has shown can be relied on. This scraping of the panel work will fill the wood equal to two coats of roughstuff, and it saves a great amount of labor over the old process, when so much rubbing with lump pumice stone was done. Sandpaper when the filling is thoroughly hard, and apply another coat of paint of ordinary thickness, when, after another light sandpapering, you have a good surface for your color.

Rough coating on cars has gone almost out of use, and I believe that but few shops are now using it to any extent. My experience is that paint has less tendency to crack where roughstuff is left off. I do not claim that the filling was the principal cause of the cracking, if it was properly mixed; but I believe the water used in rubbing down a car with the lump pumice stone injures the paint, as it will penetrate in some places, more particularly around the moldings and plugs.

THE FINISHING COLOR.

The car being ready for the finishing color, this should be mixed with the same proportion of dryer as the previous coat, or just sufficient to have it dry in about the same time. A very great error with many car painters is using a large portion of oil in the under coats, and then but little, if any, in the finishing coats; this has a decided tendency to crack, the under coats being more elastic. I always aim to have color dry in about the same time, after I have done my priming; by this plan, I secure what all painters should labor to accomplish—namely, little liability to crack. Work will of course crack sometimes, after being out a few months, or when it has repeated coatings of varnish; and using a quick rubbing varnish on work will cause it to give way in fine checks quicker than anything else. Many of the varnishes we use are the cause of the paint cracking, and no painter has been wholly exempt from this trouble.

CAUSE OF CRACKING.

The most common cause of cracking is poor japan, which is the worst enemy that the car painter has to contend with; the greater part of the japan that we get is too elastic, and will dry with a tack, and the japan gold size we have has generally the same fault, although the English gold size is generally of good quality, but its high price is an objection to its use. A little more care in the manufacture of japans would give us a better dryer, and few would object to the additional cost. Japan that I have frequently had, I found to curdle in the paint; it would not mix with it, but would gather in small gummy particles on the top. Work painted with such material cannot do otherwise than crack and scale, and the remedy lies only in getting a good pure article of turpentine japan.

In regard to using ground lead, car painters differ, as some prefer to grind their own in the shop. I use the manufactured lead, and my reasons for doing so are that it is generally finer than any shop can grind it with present facilities, and it has age after grinding, which improves its quality. You can also get a purer lead and one with more body than you can by grinding in the shop, which is a fact that I think most painters must admit; I have tested it very fully, and am convinced on this point.

MIXING THE PAINTS.

Permit me to make a few suggestions here in regard to

the mixing of paint, which may not fully agree with others' views. There is just as much paint that cracks by putting it on too flat as by using too much oil. I have seen some painters mix their finishing color so that it was impossible to get over a panel of ordinary size before it was set under the brush, and consequently the color would rough up. Color should be mixed up so that it will not flat down for some time after leaving it, and then you have got some substance that will not absorb the varnish as fast as it is applied to the surface. This quick drying of color is not always caused by want of oil in it, but because there is too much japan, and a less quantity of the latter will do better work, and make a smoother finish. Give your color forty-eight hours to dry between coats; I always give that time, unless it is a hurried job, and we have very few such jobs in our shop, as experience has fully demonstrated that it is poor economy to hurry work out of the shop before it is properly finished.

OILS, DRYERS, AND COLORS.

In car painting, both raw and boiled oils are used, and good work may be done with either, but I would recommend oil that is but slightly boiled in preference to either the raw or the boiled. After it is boiled, if it is done in the shop, let it stand twenty-four hours to settle, then strain off carefully; this takes out all the impurities and fatty matter from the oil, and it will dry much better, nor will it have that tack after drying that you find with common boiled oil. Use the proper quantity of dryer in mixing your paint, and a good, reliable job will be the result. In car painting, I would never recommend the use of prepared colors which are ground in oil, as nine tenths of such colors are ground in a very inferior oil, and they may have been put up for a great length of time, in which case they become fatty, and will invariably crack. These canned colors do not improve with age, as lead and varnish do. Finishing colors should all be ground in the shop, unless special arrangements can be made with manufacturers to prepare them; and the color should be fresh, not over six or eight days old after being mixed and open to the air. Enough may be prepared at a time to complete the coating on a job; but when color stands over a week, it is not fit to use on first class work, as it becomes lifeless, and has lost that free working which we find in fresh mixed colors; such color may, however, be used upon a cheap class of work, or on trucks, steps, etc., so that nothing need be wasted in the shop.

VARNISHING.

Three coats of varnish over the color are necessary on a first class coach. The first coat should be a hard drying varnish put on the flat color; the quick rubbing that some use I would not recommend, but one that will dry in five days (in good drying weather) sufficiently hard to rub is the best for durability. After stripping and ornamenting the car, and when thoroughly washed, give a coat of medium drying varnish; let this stand eight days; then rub lightly with curled hair or fine pumicestone, and apply the finishing coat, which is "wearing body"; this will dry hard in about ten days, after which the car may be run out of the shop. It should then be washed with cold water and a soft brush, and it is then ready for the road. In varnishing, many will apply the varnish as heavy as they can possibly make it lie, when, as a consequence, it flows over and runs or sags down in ridges, and of course does not harden properly; this also leaves a substance for the weather to act on. It is better to get just enough on at a coat to make a good even coating which will flow out smooth, and this will dry hard, and will certainly wear better than the coat that is piled on heavily.

Varnishing, we claim, can be overdone, some painters' opinions to the contrary. We have heard of those who put two and a half gallons on the body of a fifty foot car at one application, and we have also listened to the declaration, made by a member of the craft, that he put two gallons on the body of a locomotive tank. Such things are perhaps possible, and may have been done; but if so, we know that the work never stood as well as it would if done with one half the quantity to a coat. In varnishing a car, care should be taken to have the surface clean; water never injures paint where it is used for washing; and a proper attention to cleanliness in this respect, and in the care of brushes used for varnishing, will insure you a good-looking job.

Perhaps your shop facilities for doing work are none of the best, but do the best you can with what you have; select, if possible, a still, dry day for varnishing, especially for the finishing coat. Keep your shop at an even temperature; avoid cold drafts on the car from doors and windows; wet the floor only just sufficient to lay the dust, for, if too wet, the dampness arising will have a tendency to destroy the luster of your varnish. Of course we cannot always do varnishing to our perfect satisfaction, especially where there are twenty-five or thirty men at work in an open shop, and six or eight cars are being painted, when more or less dirt and dust are sure to get on the work.

A suggestion might here be made to railroad managers, which is that no paint shop is complete where the entire process of painting and finishing a car is to be done in one open shop. A paint shop should be made to shut off in sections by sliding doors, one part of the shop being used exclusively for stripping and varnishing. I know from experience that nine tenths of the railroad paintshops are deficient in this particular, and still we are expected to turn out a clean job, no matter what difficulties we are compelled to labor under. Many further hints might be given in regard to this matter of shop facilities and conveniences; but as it is not here my object to argue the point, I leave it with this brief mention.

IMPORTANCE OF WASHING VEHICLES.

In regard to the care of a car after it has left the shop, I

think more attention should be given to this than is done on many roads. The car should not be allowed to run until it is past remedy, and the dirt and smoke become imbedded in the varnish, actually forming a part of the coating, so that when you undertake to clean the car you must use soda or soap strong enough to cut the varnish before you succeed in removing the dirt. Cars should be washed well with a brush and water at the end of every trip; this only will obviate the difficulty, and these repeated washings will harden the varnish as well as increase its luster. We know that, in washing a car, where soap is required to remove the dirt and smoke, it is almost impossible to get the soap washed off clean; and if it is not quite impossible, the hot sun and rain will act on the varnish and very soon destroy it.

RE-VARNISHING.

Cars should be taken in and re-varnished at least once in twelve months; and if done once in eight months, this is better for them, and they will require only one coat; but where they run a year, they will generally need two coats. Those varnished during the hot months will not stand as well as if done at any other time. Painting done in extreme cold weather, or in a cold shop, is more liable to crack than if done in warm weather.

HOW TO DRY PAINT.

Paint dried in the shop, where there is a draft of dry air passing through, will stand better than that dried by artificial heat; and you will find, by giving it your attention, that work which has failed to stand, and which cracked or scaled, was invariably painted in the winter season or in damp, wet weather. I have paid some attention to this matter, and know the result."

Brewing Beer in New York City.

New York is now, paradoxical as it may seem, one of the largest German cities in the world. Our one hundred and fifty-one thousand Teutonic citizens outnumber those of Frankfurt and of Bremen, and approach very nearly the number of the population of Dresden or of Munich. It is to this circumstance, perhaps more than to any other, that the constant increase of the number of breweries in the city, and the frequent improvements in the manufacture of that popular beverage "lager beer," are due. As to the quality of the "beer," connoisseurs say that that made in this State is the best. The *Buffalo Express* asserts in the following positive terms that beer made in Buffalo is unapproachable. We will not question the editor's experience, as our own is scanty; but still for the credit of the metropolis, we venture the remark that New York breweries are larger and include more refinements in beer-making than others elsewhere in the country. The *Express* writer talks over his beer thus: "Cincinnati beer is good, Milwaukee beer is better, but Buffalo beer is alone and unapproachable. It is the *ne plus ultra* of lager. You may wander east and wander west, and you will find none like it. Rochester beer is execrable. A glass of it is a stronger argument for temperance than any which has yet been invented. A careful temperance advocate has accurately estimated that every barrel of ordinary beer contains half a suicide, three fourths of a murder, and a half dozen free fights. Rochester beer contains all these evils in a "schuper," besides other miseries too numerous to mention. Hence it is that when peaceable Rochester folks want a glass of beer, they come to Buffalo after it, or have it sent in bottles to them. The essence of comfort is a summer night at Schenkelberger's, with a glass of Herr Ziegler's lager to moisten the music of the Union Cornet Band. Then it is that one begins to appreciate life."

Against this, we set off the following description, from the *Evening Post*, of a big malthouse which has just been erected in the upper portion of New York city.

The malthouse consists of three buildings. The main building is 130 feet x 92 feet 8 inches in ground dimensions, and ten stories in height, with a deep basement. The first and second stories are respectively 13 and 12 feet in height in clear, while the remaining stories are but 6 feet in height. The lower stories will be used for storing grain, and have a capacity of a quarter of a million bushels. The walls of the basement are of stone, three feet in thickness, and the superstructure is of brick and of the most substantial character. The lower floors are of yellow pine, while the malting stories are floored with a pavement of concrete, with the exception of one story, on which is laid a flooring of Solenhofer stones, resembling those used by lithographers, imported from Germany. On these floors the grain is allowed to grow after its removal from the steeping vats in the cellar. At the top of the building is a tank holding five thousand gallons of water, which supplies the entire building. At the west end of the building, separated from the main part by a three feet partition wall, are two large storage rooms and the kilns. These are fireproof, eighteen feet deep extending across the width of the building, and are constructed on a plan invented in Germany, by which the grain is more rapidly treated than formerly. By an ingenious contrivance it is turned mechanically at frequent intervals, so as to allow the hot air from the furnaces to reach it uniformly, with a saving of time and an economy of grain.

The building containing the offices, engine, and boiler rooms, and storage bins for forty thousand bushels of grain, is triangular in shape. It is of brick, 57x37x36 feet, and five stories in height.

The malting season begins about the 1st of October and lasts for from thirty to thirty-two weeks. It is estimated that in that time this malthouse will produce at least three hundred and fifty thousand bushels of malt.

The cost of the building, with fixtures, machinery, and appliances, will be between \$100,000 and \$150,000.

PRACTICAL MECHANISM.

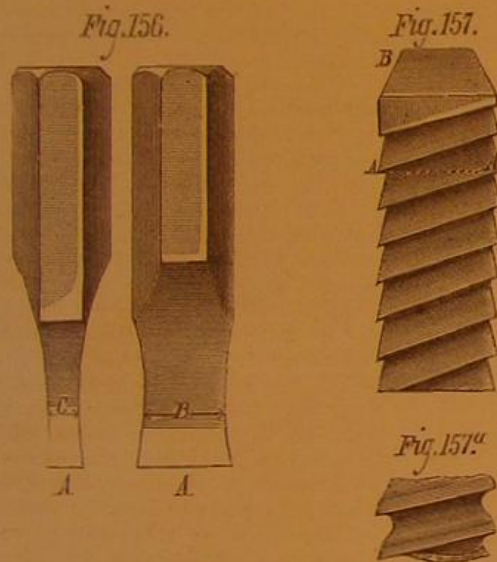
BY JOSHUA ROSE.

NUMBER XXXV.

DRIFTS.

Of drifts there are two kinds, one being a smooth round conical pin, employed by boiler makers to make the punched holes in boiler plates come fair, so that the rivets may enter, which may be aptly termed a stretching drift, and the other the toothed or cutting drift. Of the first, it may truly be said that it is utterly destructive of the safety of any work to which it is applied, because the punching of a plate considerably weakens its strength at the narrowest section of metal, namely, between the hole and the edge of the plate, where the latter, being the weakest, gives way to the pressure of the punch. If one closely observes the surface of a piece of iron which is being punched, he will find that the scale on the surface of the iron round the hole, and especially between the hole and the edge of the plate, will be sensibly disturbed, showing a partial disintegration of the grain of the metal beneath, even if the punch is very sharp; but if the punch is dull, or the edge is in the least rounded by wear, the scale will fly off the surface of the metal in small particles, evidencing a considerable disturbance of the metal beneath and an equivalent weakening of the substance between the edge of the hole and the edge of the plate. If then, after punching, the holes do not come fair, and the plain drift is employed to still further stretch the metal, not only is the weakening process greatly augmented, but the holes are stretched oval, so that the rivets do not completely fill them, however well the riveting may be performed. The use of the plain drift is therefore totally incompatible with first class workmanship; hence a description of this tool will be altogether omitted.

Of cutting drifts, there are two kinds, the first being that shown in Fig. 156. A is the cutting edge, the width and



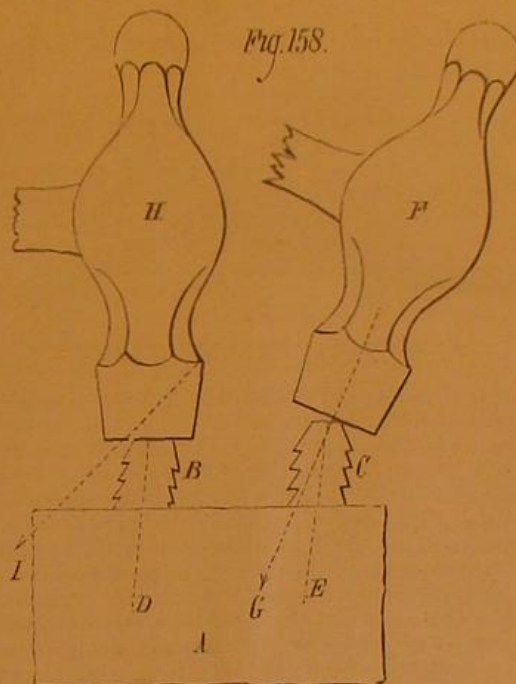
thickness at C and B being reduced so that the sides of the drift may clear the sides of the hole. The tools are filed at A A, to suit the required hole, and tempered to a brown bordering upon a purple. The hole or keyway is then cut out roughly, to nearly the required size, and the drift is then driven through with a hand hammer, cutting a clean and true hole. Care must, however, be taken to have the work rest evenly upon a solid block of iron or (for delicate work) lead, and to strike the punch fair and evenly, otherwise a foul blow may break the drift across the section at C. This class of drift is adapted to small and short holes only, such as cotter ways in the ends of keys or bolts, for which purposes it is a very serviceable and strong tool. It must be freely supplied with oil when used upon wrought iron or steel.

For deeper holes, or those requiring to be very straight, true, and smooth, the drift represented by Fig. 157 is used. The breadth and thickness of the section at A is made to suit the shape of the keyway or slot required. The whole body of the drift is first filed up, parallel and smooth, to the required size and shape; the serrations forming the teeth are then filed in on all four sides, the object of cutting them diagonally being to preserve the strength of the cross section at A A. The teeth may be made finer, that is, closer together, for very fine work, their depth, however, being preserved so as to give room to the cuttings. To attain this object in drifts of large size, the teeth should be made as shown in Fig. 157a, which will give room for the cuttings, and still leave the teeth sufficiently strong that they do not break. The head, B, of the drift is tapered off so that, when it swells from being struck by the hammer, it will still pass through the hole, since this drift is intended to pass clear through the work.

The method of using this tool is as follows: The hole should be roughed out to very nearly the required size, leaving but a very little to be taken out by the drift, whose duty is, not to remove a mass of metal, but to cut a true and straight hole. To assist in roughing out the hole true, the drift may be driven lightly in once or twice, and then withdrawn, which will serve to mark where metal requires to be removed. When the hole is sufficiently near the size to admit of being drifted, the work should be bedded evenly upon a block of iron or lead, and oil supplied to both the hole and the drift; the latter is then driven in, care being exercised that the drift is kept upright in the hole. If, however, the hole is a long one, and the cuttings clog in the

teeth, or the cut becomes too great, which may be detected by the drift making but little progress, or by the blow on the drift sounding solid, the drift may be driven out again, the cuttings removed, the surplus metal (if any there be in the hole) cut away, the hole and drift again freely oiled, and the drift inserted and driven in as before, the operation being continued until the drift passes entirely through the hole; for the drift will be sure to break if too much duty is placed upon it. After the drift has passed once through the hole, it should be turned a quarter revolution, and again driven through, and then twice more, so that each side of the drift will have contacted with each side of the hole (supposing it to be a square one), which is done to correct any variation in the size of the drift, and thus to cut the hole true.

The great desideratum in using these drifts is to drive them true, and to strike fair blows, otherwise they will break. While the drift is first used, it should be examined for straightness at almost every blow; and if it requires drawing to one side, it should be done by altering the direction in which the hammer travels, and not by tilting the hammer face (see Fig. 158).

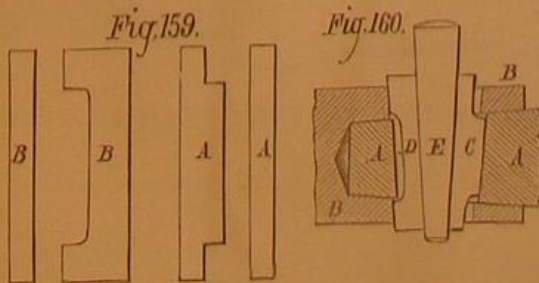


Suppose A to be a piece of work and B and C to be drifts which have entered the keyways out of plumb, as shown by the dotted lines, D and E. If, to right the drift, C, it was struck by the hammer, F, in the position shown and traveling in the direction denoted by G, the drift, C, would be almost sure to break; but if the drift, B, was struck by the hammer, H, as shown, and traveling in the direction denoted by I, it would draw the drift, B, upright without breaking it; or in other words, the hammer face should always strike the head of the drift level and true with it, the drawing of the drift, if any is required, being done by the direction in which the hammer travels. When it is desired to cut a very smooth hole, two or more drifts should be used, each successive one being a trifle larger in diameter than its predecessor. Drifts slight in cross section, or slight in proportion to their lengths, should be tempered evenly all over to a purple blue, those of stout proportions being made of a deep brown bordering upon a bright purple. For cutting out long narrow holes, the drift has no equal, and for very true holes no substitute. It must, however, be very carefully used, in consequence of its liability to break from a jarring blow.

REVERSE KEYS.

Crossheads, pistons, and other pieces of work which are keyed to their places upon taper rod ends, and are therefore apt to become locked very fast, are easily removed by means of reverse keys, which should always be employed for that purpose, because striking such work with a hammer, even supposing the work to be well supported underneath and copper interposed between the hammer and the work, is liable to bend and otherwise damage it with every heavy blow.

Reverse keys are simple pieces of steel, so shaped as to reverse the draft of a keyway, and are made male and female, as shown in Fig. 159, A representing the male, and B the female. The manner of using them is to insert them into the keyway, as shown in Fig. 160, in which A repre-



sents a taper rod end, B the socket into which A is fitted or keyed, C the male and D the female reverse key, and E an ordinary key. It will be found, on examination, that the insertion of C and D have exactly reversed the position of the draft of the keyway, so that the pressure due to driving in the key will be brought to bear upon the rod on the side on which the pressure was previously on the socket, and on the socket on the side on which the pressure was on the rod;

so that driving in the key will key the socket out of instead of into its place.

The keyway in Fig. 150 is shown to have draft: that is, the proper key, when driven in, will bear one edge upon the edge of the keyway in the rod only, and not on the edge of the keyway in the socket at the small end of the cone; while at the large end, the natural key would bear against the edge of the keyway in the socket only. If, however, this condition does not exist, and the edges of the key bear equally upon the cone and the socket (on both edges and all the way through), the keyway being a solid one, that is to say, having no draft, the reverse keys may be employed, providing that C is placed so as to bear upon the edge of the keyway on the large end of the cone only, and that D is placed to bear on the edge of the keyway at the small end of the cone on the socket only, thus producing a back draft, or clearance, as it may better be termed. The key, E, should be made long, and both it and the reverse keys should be made of steel and left soft.

Carbonic Acid as a Fire Extinguisher.

Messrs. Connelly and Naylor, patentees, recently fitted up an apparatus, near the grounds of the gas works, in Pittsburgh, where, according to the *Commercial*, they conducted experimental tests in the presence of a number of citizens. In general terms, the machinery consists of a generator, where the gas is evolved; three receiving tanks, thirty inches in diameter by ten feet in length; and the connecting pipes. Some fifty feet distant was an excavation, twenty by thirty feet, partially filled with water, upon the surface of which was a skim of crude oil, to test the efficacy of the gas in extinguishing an oil fire. A pipe, about an inch and a half in diameter, and supplied with small jets every few inches, was extended along each side of this tank, a little above the surface of the water.

The first experiment consisted in lighting the crude oil, and letting it burn until the flame covered the entire surface. Immense volumes of black smoke rolled upward, the flames shot up ten or twelve feet into the air, and the heat was so intense as to drive the spectators back some fifty or sixty feet. At a signal from Dr. Connelly, when the fire was at its hottest, the engineer turned a valve, the carbonic acid rushed from the receivers with a hissing noise, through the jets in the pipes, and in two or three seconds the flame was cut off as effectually as though a coating of ice had instantly formed on the surface of the oil. As soon as the gas struck the flame, it was changed to a white steam, which made a striking contrast with the dense black smoke above it, as these two dissimilar vapors floated away and were gradually dissipated in the upper atmosphere. The second experiment was but a repetition of the first, and in both cases the extinguishment of the great volume of flame was as sudden and effectual as the snuffing out of a candle. A third experiment consisted in setting fire to a pile of shavings, kindling wood, oil barrels, etc., rendered highly inflammable by the addition of crude oil. When the fire had taken a firm hold, and was rapidly consuming the woody fiber, the gas was turned on, and the fire was out. The wood continued to smoke for a few moments, but there was no fire. The experiments were highly successful, and Dr. Connelly was warmly congratulated on his achievement.

The pressure on the receiving tanks was about 200 lbs. per square inch.

Progress of the East River Bridge.

The work on the East River Bridge thus far has cost \$5,800,000; it is estimated that at least \$10,000,000 more will have to be raised. This done, the bridge will probably be completed by July, 1879. The expenditure for labor and material averages about \$78,000 per month.

The tower on the Brooklyn side was finished two months ago. On the New York tower, work will be suspended on December 1, for the winter; but it is stated that the structure will be completed and everything made ready for the throwing over of a temporary bridge early in the summer of next year. On this temporary structure the workmen will weave the wires into the permanent supporting cables. The galvanized ropes for the foot bridge are to weigh 12 lbs. per foot, and are to be 2½ inches in diameter, with a breaking strength of not less than 240 tons. As yet no contracts for wire work have been made. The work of demolishing buildings for the New York anchorage will be undertaken in May next.

St. Gothard Tunnel.

The present state of the works here has been reported on by M. Caillaux, in connection with M. Léon Say. On the side of Switzerland they are being pushed energetically forward. The tunnel is 9.3 miles long; 2,700 yards are bored on the side of Switzerland, and 2,100 yards on the side of Italy, leaving 6.21 miles to get through. According to present calculations 1,400 days will be required for finishing the works, which it therefore is possible will be completed by the end of 1880. The approaches to the tunnel are not yet begun: they will give a great deal of trouble. The tunneling is performed by the force of falling water setting in motion compressed air machines. These attack the rock, and drill blast holes of 40 or 48 inches in depth, which are afterwards charged with dynamite. Before the discovery of dynamite it is hardly possible to suppose that more than half a yard a day could have been bored from each side, and 15,000 working days, or more than forty years, would have been required, for a work which it is now supposed will not take more than ten. In the week from September 17th to September 24th, the whole amount bored was 54 yards, an average of 7.8 yards per day; the average of the preceding week was 7.9 yards.

IMPROVED WAGON BRAKE.

The improved wagon brake, illustrated herewith, while strongly constructed, is so contrived as to prevent any racking effect upon the under portions of the wagon. Its arrangement is also such as to render its pressure equal on every wheel to which it is applied, even if said wheels be of different diameters, thus comprising one of the best inventions of its kind that has come to our knowledge.

The brake shoes, A, are suspended in front of the hind wheels by arms of shafts, the inner ends of the latter being secured in a sleeve, B (dotted lines), underneath the wagon. The shafts not being connected together, and working independently in the sleeve, B, it follows that either brake shoe may be pushed against its wheel without causing a like movement of the opposite shoe. To each shoe is attached a rod, C, which is attached to pivoted lever, D, and these last by rods to the evener, E. The levers, B, it will be observed, are pivoted to the rear axle, so that the direction of the forces, imparted by them to the axle and by the shoes to the wheels, will oppose and neutralize each other through the wheels and the axles.

The evener, E, is pivoted to the end of a rod which is connected to an arm of an oscillating shaft suspended from the bolster or front part of the wagon box, and provided with a hand lever, F, for operating the mechanism. The arrangement throughout is quite simple, and is doubtless efficient in operation.

Patented through the Scientific American Patent Agency, June 25, 1875. For further particulars address C. M. Howell, Andover, N. J.

IMPROVED DRAWING PRESS.

In the annexed illustration is represented a new drawing press for the manufacture of hollow metal ware. It possesses great power and is solidly and durably constructed, though occupying but small space and weighing but little. In making articles of moderate size, it cuts the metal into proper shape before forcing it into the die, accomplishing this operation by new and ingenious mechanism, detailed reference to which is made below. It is also provided with novel means for accurate adjustment and a new device for self-adaptation of the drawing parts to metal of varying thickness. In Fig. 1 is given a perspective view of the apparatus. Figs. 2 and 3 are sections of the dies and punches. From the first engraving it will be seen that power is communicated to a large pulley which, by means of a simple clutch, operated by the treadle shown under the bed, is thrown into or out of gear at will. From this pulley, by the interposition of suitable mechanism, power is transmitted to a horizontal shaft passing through the lower portion of the frame, on which shaft is a heavy cam, A, and also two cranks, B. The cam, in its revolution, acts upon a roll above it, and so elevates the carrier C, of the cutting and drawing dies, which travels in slides in the frame. To the cranks are connected pitmen, D D, which connect with a wrought iron yoke, E, to which is secured the drawing punch rod, F. At F is a cross connection between the two sides of the frame, to which connection is attached the cutting punch.

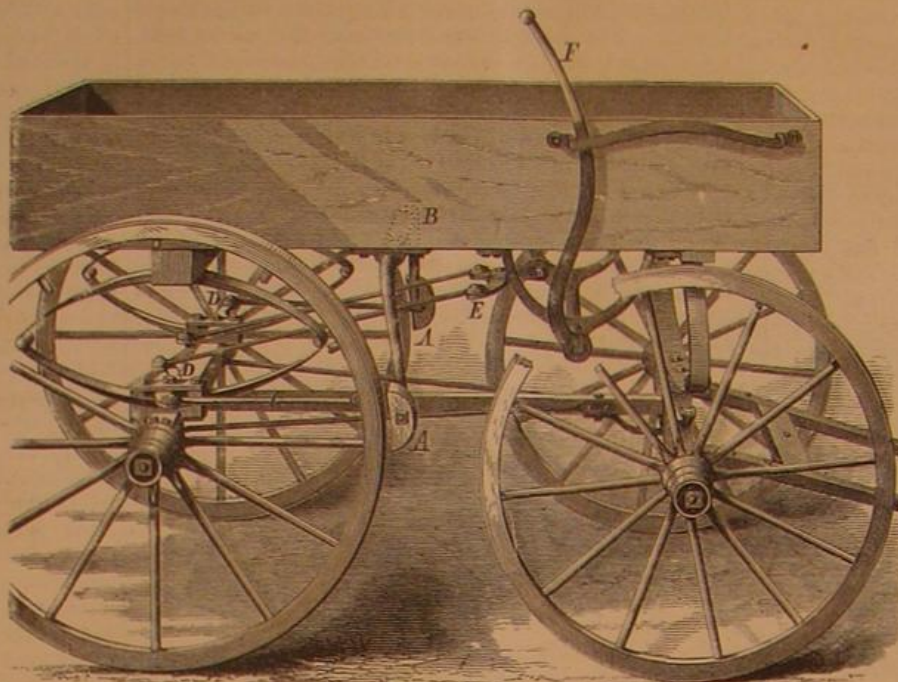
When the cam shaft is rotated, the cam, as above stated, raises the die carrier; and the cranks, pulling down the pitmen, force the cutting punch against the metal and into the die below. This will be more clearly understood from the section, Fig. 2, in which G is the drawing die, H the cutting die, I the cutting punch (stationary), and J the drawing punch. As the die carrier rises, the metal is first pressed against the cutting punch, I, between the outer edge of which and the cutting die, H, it is quickly cut, and the punch, I, entering the die, then holds the edges so cut out very firmly, as in a vise. At this point the drawing punch, J, comes down and forces the metal into the drawing die, G, thus completing the operation.

It sometimes happens that the metal is not of uniform thickness, in which case it may be easily imagined that, through the lack of a close hold between the cutting punch and die, a portion of the edge would be forced down into the drawing die on the descent of the punch. To obviate this, the lower portion of the drawing die is made hemispherical, and it sets in a corresponding socket in the bed so as to form a ball and socket joint, which of course adapts itself to the thickness of the metal pressed above it. This is a very ingenious and novel arrangement, and one which insures the tight grip of the edge of the metal without chance either of its wrinkling or of its escape. Fig. 2 shows more especially the device used for small ware, such as cups, etc., for larger articles, pans and like objects, a different arrangement is employed, which is exhibited in Fig. 3.

In this there is no cutting of the metal by the machine, that operation having to be performed previously, and hence there is neither cutting die nor punch. The drawing die is

a simple concavity, without peculiar features, the essential points of the device being found in another means of holding the edge of the blank. The punch, K, passes directly through the ball portion, L, which is confined by a ring, M, held by the screw bolts, one of which is shown on the left. The edges of the blank are compressed and held between the

devices for adjusting both slides. By these the latter, as necessarily is required from the relation of punch and die, can be adjusted with the greatest nicety. The instrument shown in the foreground is used for manipulating the eccentrics. It may also be noted that the heaviest strain comes on the wrought iron pitmen and yoke and the steel shaft, thus relieving the cast frame and allowing of the use of less metal therein. The shape of the lower cam, which is such as to hold the lower slide stationary after the blank is cut and until the drawing punch descends, is a neat piece of mechanical construction worth noting, and attention may also be called to the bowing out of the frame at the points where the drawing takes place, thus giving to the former the very slight spring which it requires, and at the same time affording a wider space where the same is needed. We have seen the machine operate, and examined samples of its products. The latter were well made. The reader will find the press itself in motion at the American Institute Fair. For further information address the manufacturers, The Stiles & Parker Press Company (N. C. Stiles, agent), Middletown, Conn.



HOWELL'S WAGON BRAKE.

surface of the die and a lower ring, N, which is upheld by another set of screw bolts, one of which is shown on the right. These bolts pass through a large bore in the ball portion, L, thus allowing the latter its free play and shoulder in said ball, as shown, so that the latter and the ring are closely united. The ring, N, therefore, follows the play of the spherical portion, and consequently automatically adapts itself to the thickness of the metal. The punch then descends in manner similar to that already described.

Referring again to Fig. 1, at the crank pins of the pitmen, and also on the lower roll actuated by the cam, are eccentric

devices for adjusting both slides. By these the latter, as necessarily is required from the relation of punch and die, can be adjusted with the greatest nicety. The instrument shown in the foreground is used for manipulating the eccentrics. It may also be noted that the heaviest strain comes on the wrought iron pitmen and yoke and the steel shaft, thus relieving the cast frame and allowing of the use of less metal therein.

National Differences as to Whistling.

One of our English contemporaries, in a lengthy article concerning the whistler, winds up as follows:

"Considering the vast annoyance caused to men and women by the prevalent vice of whistling, we may well ponder on the question: Why do men whistle? Women do not, although we could well tolerate anything from their lips but deter-

mined refusals. What impulse leads a man to enclose a circular space with his lips, and then by sheer pneumatic force to make the noise called whistling? If the lips looked more elegant in this form, there would be a plea for whistling. But this is very rarely the case. Granted a moderate-sized mouth, with upper lip rather small, the personal appearance of the whistler may be tolerated. But take a big mouth and a pent roof under lip, and the whistler presents to you a facsimile of the extremity of an elephant's trunk. Strange to say the latter class of whistlers are by far the more prevalent; and if whistling be a fine art, and not one of the ills that flesh is heir to, the big-mouthed are the most efficient though the most persevering performers. We could read with greater comfort and interest between two large saws that were being sharpened than near an inveterate whistler."

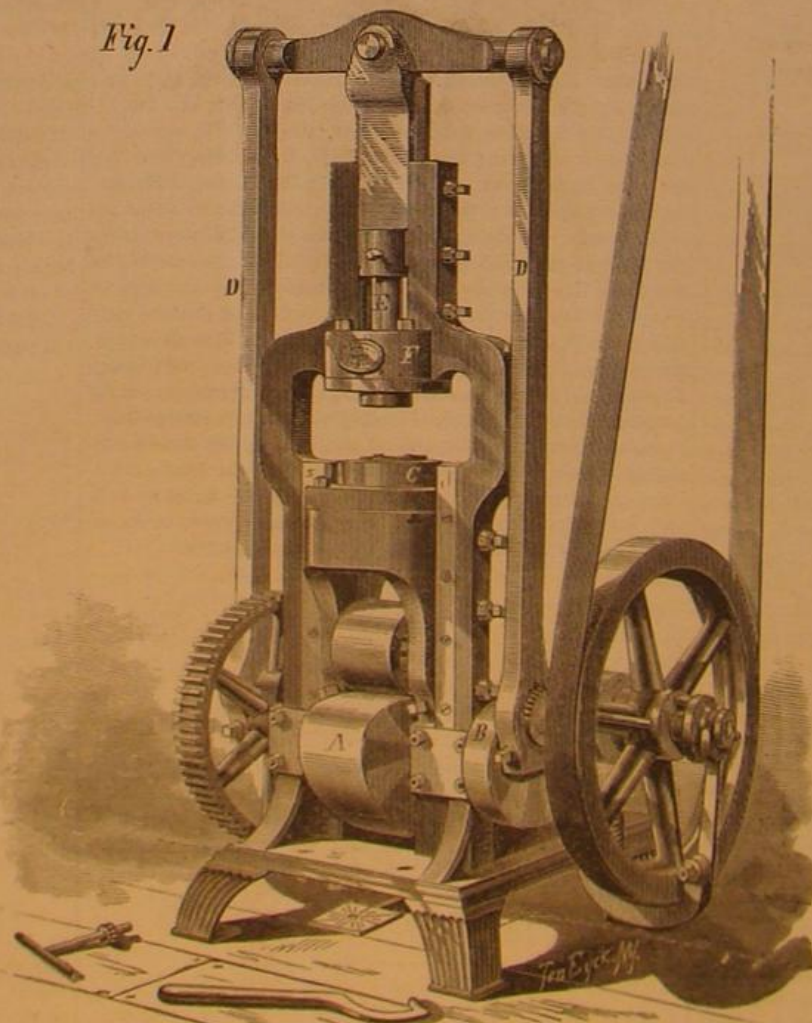
Just after reading the above, we were looking over a pile of American exchanges, when we came across the following in one of our agricultural newspapers:

"An old farmer once said that he would not have a hired man on his farm who did not habitually whistle. He always hired whistlers; said he never knew a whistling laborer to find fault with his food, his bed, or complain of any little extra work he was asked to perform. Such a man was generally kind to children and animals in his care. He would whistle a chilled lamb into warmth and life, and would bring his hat full of eggs from the barn without breaking one of them. He found such a man more careful about closing gates, putting up bars, and seeing that the nuts on his plow were all properly tightened before he took it into the field. He never knew a whistling hired man to kick or beat a cow, nor drive her on a run into a stable. He had noticed that the sheep he fed in the yard and shed gathered around him as he whistled, without fear. He never had employed a whistler who was not thoughtful and economical."

This leads us to ponder and wonder if the foreign whistler is less an artist than the American, or if the difference in opinion between the English and the home writer is owing to their individual tastes. There seems to be a principle involved. Which shall be accepted, the opinion of the foreign or the American editor? It seems to be of national consequence to have the matter decided.

In referring to the new carbonic acid motor recently patented by Mr. John Westcott (see page 266, current volume), the types made us state that the absorption of charcoal is equal to five times its volume of gas. The absorption is fully thirty-five times the volume, and the sentence should so read.

Fig. 1



STILES AND PARKER'S DRAWING PRESS.

Fig. 2

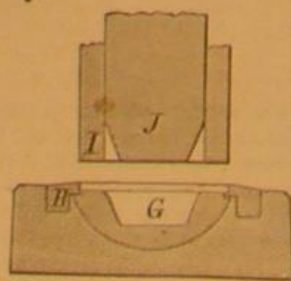
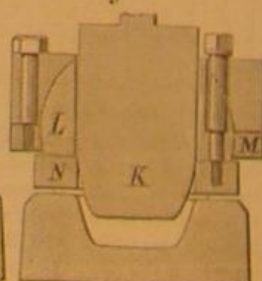


Fig. 3



THE ARTIFICIAL COLORING OF PLANTS.

A simple and well known chemical experiment, showing the action of sulphurous acid on vegetable coloring matter, consists in placing in that gas violets, which become almost instantly bleached. Sulphurous acid, by its deoxidizing properties, destroys the color of a large number of other flowers, such as roses, periwinkles, etc., and its effects may easily be noted by the little apparatus shown in Fig. 1. This consists of a capsule in which sulphur is ignited to generate the acid, covered by a conical metal chimney, at the orifice of which the flowers to be bleached are placed.



Fig. 1.—Discoloration of flower petals by sulphurous acid.

Quite recently M. Filhol has exhibited, before the members of the French Scientific Association, new results, obtained through the action of a mixture of sulphuric ether and a few drops of ammonia upon flowers, from which it seems that a large number of the latter, normally of a violet or pink color, become, when immersed in the mixture, an intense green. The editor of *La Nature*, from which journal we extract the engravings herewith given, has continued the investigations of M. Filhol, and deduces an interesting series of experiments, the description of which we present below.

Into a wine glass, Fig. 2, pour a quantity of ordinary ether, and add about one tenth its volume of liquid ammonia. Into this the flowers are to be plunged. The purple and pink tinted



Fig. 2.—Turning blossoms green by ammoniacal ether.

flowers, which become bright green, appearing as if dyed by a copper salt, are the red geranium, the violet periwinkle, lilacs, roses (red and pink), gillyflowers, thyme blossoms, blue bells, heliotropes, and myosotis. Other flowers of different shaded colors acquire different tints. The upper petal of the violet sweet pea becomes a dark blue, while the lower petal turns to a light green. Sweet William changes to yellow and light green. White flowers usually become yellow, this being the case with the white poppy, the snapdragon, which turns yellow and dark violet, the white rose, which changes to a straw tint, the white columbine, the chamomile, the syringa, the white daisy, and the white rock-rose, the honeysuckle, the bean, the white potato blossoms, the meadowsweet, and the white foxglove. In the pink sweet pea, the upper petal becomes blue, and the lower one a soft green. The pink geranium turns blue in a remarkable manner. The red snapdragon becomes of a fine metallic brown, the valerian of a grayish color, and the red wild poppy of a fine violet. Yellow flowers in the ammoniacal ether remain unaltered. Red turns green in a very curious way when put in the mixture. The action of the chemical is so rapid that the merest sprinkling of it on the leaf is sufficient to cover the

latter instantly with green spots. In the same way flowers may be spotted with white, even while they are growing.

The most interesting changes of color are those which take place in flowers which are variegated. Thus particolored fuchsias become yellow, green, and blue. All flowers which have taken a new hue may be kept from changing back again for several hours by plunging them in pure water. Eventually, however, they regain their natural colors.

Another curious fact to be noted in the present connection is that the flowers of asters, which are naturally inodorous, acquire an agreeable perfume under the influence of the ammonia. The same flowers, when violet, become red when wet with nitric acid diluted with water.

MELON CUCUMBERS.

Considerable interest has recently been manifested in the fruiting of a cross effected between *cucumis melo* and the Telegraph cucumber, a well known variety of *c. sativus*. This presumed cross or hybrid was lately seen at Kew, London, fruiting in a house, and the following are our notes on them, made at the time, together with the accompanying reduced representation of the plant: Stems slender, scabrous; leaves and flowers like those of the cucumber in size, as well as in other respects; fruit from 6 to 10 inches in length, and from 2 to 3 inches in diameter, of a dull brown russet color, or profusely dotted with whitish lines; but we observed no spines. In fact the growth and flower resemble those of a cucumber, and the fruit that of a melon. The female parent is the *concombre de Sikkim*, of Naudin, described in the *Annales des Sciences Naturelles* as a variety of *c. sativus*; so that, if the pollen from the Telegraph cucumber has taken effect (which now seems doubtful), the cross is simply one between two extreme forms of the common cucumber, and not a cross between the cucumber and melon, as the Kew label would lead one to believe. Cucumbers and melons are extremely variable in size, color, habit, and flavor; we have seen, indeed, a figure of a cucumber of the ordinary form and a globular fruit, half cucumber and half melon, growing on the same branch. This was supposed to have been brought about by a cucumber flower having become accidentally fer-



tilized with pollen from some Little Heath melons which were growing in the same house. In Darwin's "Animals and Plants under Domestication," we read that there is a race of melons of which the fruit is so like that of the cucumber, both externally and internally, that it is scarcely possible to distinguish the one from the other except by the leaves.

Major Trevor Clarke, by whom the seeds of the supposed hybrid under notice were sent to Kew, says: "This curious plant was sent to me from India as a cucumber. The remarkable scabrous coating of the ripe fruit attracted my attention, and induced me to send it to Kew, where it was at first thought to be a melon. It is now, however, thought to be a true cucumber. From the appearance of the figure the Kew plant hardly looks as if the cross with the Telegraph cucumber had taken effect. I have now growing here two plants from the (supposed) crossed and uncrossed seed. They have set fruit, but were late plants, and are not yet in a condition to be described. Many years ago I raised a cross between a melon and the Snake cucumber (*cucumis flexuosus*); but the latter, I believe, ranks among the melons. A cross, real or supposed, between a cucumber and a melon, was shown at South Kensington, some years ago. A neighbor of mine has a plant from the big pumpkin crossed by a cucumber. It was fertile, and is now growing for the second generation."

Analysis of the Human Breath.

An account published in *Nature* of some experiments, made with a view to determine the organic matter of the human breath in health and disease, presents some facts of a peculiarly interesting nature. The breath of eleven healthy persons and of seventeen affected by disorders was examined, the persons being of different sexes and ages, and the time of day at which the breath was condensed varying. The vapor of the breath was condensed in a large glass flask surrounded by ice and salt, at a temperature of several degrees below zero, the fluid thus collected being then analyzed for free ammonia, urea, and kindred substances, also for organic ammonia. Among the various results of this examination may be mentioned the fact that, in both health and disease, the free ammonia varied considerably; the variation, however, could not be connected with the time of day, the fasting, or the full condition. Urea was sought for in fifteen instances—three healthy persons and twelve cases of

disease—but it was only found in two cases of kidney disease and in one case of diphtheria; and a faint indication of its presence occurred in a female suffering from catarrh. The quantity of ammonia arising from the destruction of organic matter also varied, possibly from the oxidation of albuminous particles by the process of respiration; but in healthy persons there was a remarkably uniformity in the total quantity of ammonia obtained by the process.

THE SKIMMIAS.

Skimmia japonica was for a long time the only variety known to Europe and America. Now, however, we have five recognized species, namely *skimmia japonica*, *ablata*, *Veitchii*, *laureola*, and *fragrans*, of the first and last of which



Skimmia Japonica.

we furnish illustrations. *S. japonica* is valuable on account of its brilliant red fruit, about the size of a pea, which, growing in profusion, remains on the bush all the year round, thus giving it a very ornamental appearance, especially in winter, and perhaps not less so in the following spring when, through this strange tenacity of adhesion, it is not unusual for the plant to be seen, as in our illustration, laden with both fruit and flowers at the same time.

Skimmia fragrans, which bears a sweet smelling white flower tinged with yellow, possesses this peculiarity—that though its buds appear before winter sets in, the flowers do not open till the following April. With the exception of *laureola*, which is indigenous to Nepal, India, all the varieties of *skimmia* come from Japan; they are well worthy of extended cultivation, being very hardy and adapting themselves readily, when young, to almost any soil or climate. They may easily be increased by means of cuttings struck under glass, or in some cases from seed. Siebold and Zuccarini



Skimmia Fragrans.

state says *La Revue Horticole*, that the Japanese and Chinese class a *japonica* among poisonous fruits.

L. W. Pond.

The mystery attending the disappearance of Mr. L. W. Pond has been to all appearances cleared up in a manner which few could have suspected. When we penned the few lines which we intended as a brief tribute to a character regarding which no blame had ever reached us, we believed that we did but scanty justice to their unfortunate subject. It is excessively sad for us now to learn that we, in common with his other friends, have been grievously mistaken in our estimate, and that in lieu of the model of integrity we find the forger and defaulter. A careful examination of the missing man's papers has brought to light forged evidences of indebtedness, reaching as high as \$100,000. The plan adopted was to take an old note, already paid and bearing on its back several indorsements, erase the figures and date with a chemical preparation, fill in new date, etc., and obtain cash for it. The microscope, which showed the effects of the chemical on the paper, and a solution of nut galls which restored the erased ink to its original blackness, were the means of detection. The loss falls on those who have cashed the notes.

The Chinese Oil Tree.

Elaeococca vernicia, the oil tree of China and Cochinchina, is a plant of the family of the *euphorbiaceae*. Its seeds, when submitted to strong pressure in the cold, yield about 35 per cent of a liquid oil, colorless, inodorous, and almost insipid. Its specific gravity at 59° Fah. is 0.9303. At -32° it thickens, without losing its transparency or crystallizing. By treatment with ether, 41 per cent of oil can be extracted from the seed, slightly colored, but presenting otherwise all the character of the oil obtained by pressure. If, instead of ether, purified bisulphide of carbon is employed, the fatty matter remaining after the solvent has been evaporated off at 212° solidifies on cooling, forming a number of small reniform masses, which present under the lens a decided crystalline texture. This solidified fat has the same elementary composition as the liquid oil obtained by pressure, and melts at 93°. The oil extracted by pressure in the cold is rapidly solidified by light in the absence of air, an effect which, on further experiment, was found due to the more refrangible rays of the spectrum alone. The oil of *elaecocca* is the most drying of all oils. If spread on a plate of glass or metal, it dries in a few hours, on exposure to the air.—M. S. Cloëz.

ENGINEERING STRUCTURES.

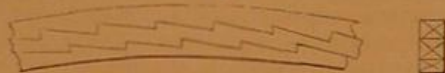
Under the above heading we classify the following descriptions of caissons and arched edifices, extracted from the pages of Knight's "New Mechanical Dictionary."

The modern or pneumatic caisson, sunk through quicksands or submerged earth or rock, is the invention of M. Triger, who contrived, by the aid of air pumps, to keep the water expelled from the sheet iron cylinders, which he sunk through quicksands in reaching the coal measures in the vicinity of the river Loire, in France.

ARCHED ROOFS.

The largest roof of one span in its day was that of the Imperial Riding House, at Moscow, built in 1790. The span is 235 feet. The members of the arched beam are notched together, as shown in Fig. 1, so as to prevent their slipping upon each other. The ends of the arched beam are held

Fig. 1.

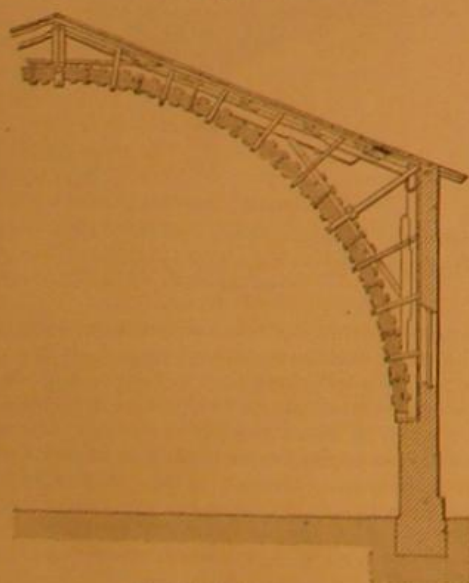


Notched Arch-Beam.

from spreading by a tie beam, and the arch and tie are connected together by vertical suspension rods and diagonal braces. Emy's arched beam roof, which is represented in Fig. 3, is constructed on a different principle. The ribs in this roof are formed of planks bent round on templates to the proper curve, and kept from separating by iron straps, and also by the radiating struts, which are in pairs, notched out so as to clip the rib between them. The principals, wall posts, and arched ribs form two triangles, firmly braced together, and exert no thrust on the walls; the weight of the roof, being thrown on the walls at the feet of the ribs and not at the pole plate, permits the upper portion of the walls to be comparatively light. This principle has been extensively adopted in wooden bridges in the United States and Europe.

Another form of arched beam is exemplified in the roof of the dining room of the Charter House School, London, England, shown in Fig. 2. The roof is formed with circular ribs in four thicknesses of inch and a half deal, four inches wide, with saw cuts half an inch in depth on the under sides, and put together with marine glue on a cradle center. The dotted lines show the collars, which are dovetailed one inch into the sides of the principal rafters. The latter, being five

Fig. 3.



Emy's Arched-Beam Roof.

inches wide, project on one side, an inch before the face of the circular ribs, which are only four inches wide. On the collars rest the purlins supporting the rafters. The ceiling joists are spiked up to the circular ribs.

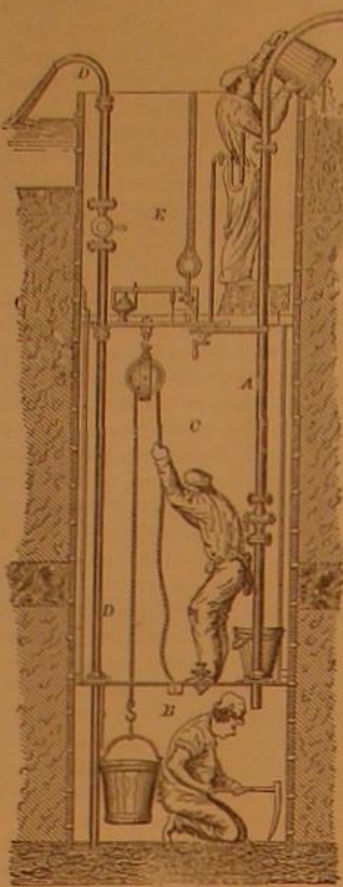
Fig. 4 illustrates

TRIGER'S CAISSON,

and shows the comparatively simple form which the appara-

us assumed when sinking a shaft.

Fig. 4.



Triger's Caisson.

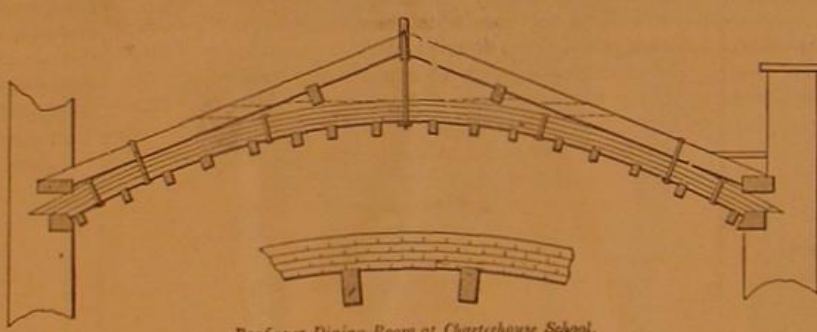
E, or the compressed air of chamber, B. The device, which thus acts as an intermediate, is termed an air lock, and is the notable point of invention in the apparatus.

In Fig. 5 is given a section of a

MOVABLE IRON CAISSON

used in building the piers of a bridge at Copenhagen, Denmark. It comprises an upper chamber communicating with the air, an intermediate or air chamber, both equal and cy-

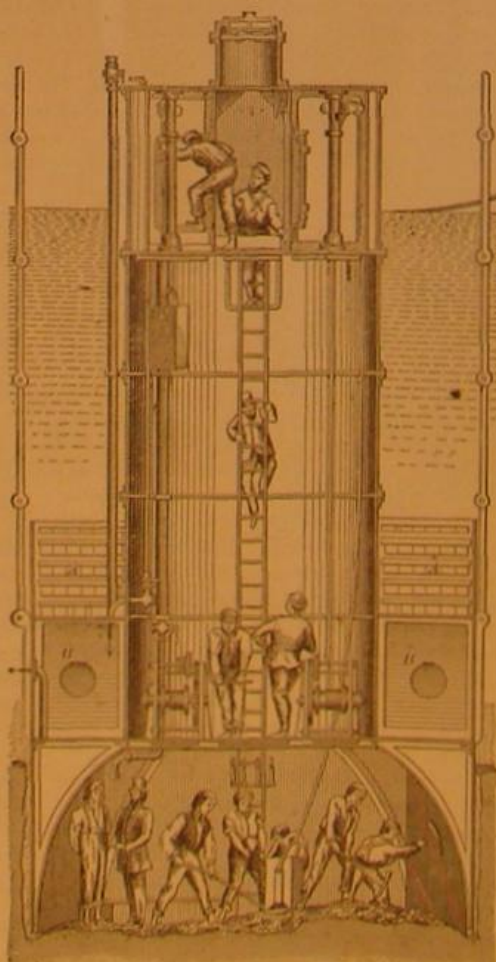
Fig. 2.



Roof over Dining-Room at Charterhouse School.

Fig. 5.

lindrical in section, and a lower working chamber, of larger section than the foregoing and adapted to the shape of the pier: the whole raised or lowered by suspension chains, and



Caisson at Copenhagen.

Air is forced in through the pipe, A, to the working chamber, B, which has a manhole in the floor above. C is the middle chamber, which has also a manhole in its ceiling. D is a pipe by which sand and water are ejected from the chamber, B, under the pressure of the compressed air in the latter. The said air pressure being such as to exclude the water, the workman descends through the manhole in the floor of the chamber, E, and closes the door behind him. Admitting air in the chamber, B, until the pressure is equal in the two, he opens the door in the floor of the chamber, C, and descends to his work. The buckets are similarly managed, the middle chamber, C, acting as the means of communication, being filled with air at normal pressure, or with compressed air, according as it is in communication with the open air of chamber, E, or the compressed air of chamber, B. The device, which thus acts as an intermediate, is termed an air lock, and is the notable point of invention in the apparatus.

ballasted with iron and water contained in two annular chambers, A and B, surrounding the lower part of the air lock. In working, the apparatus was lowered to the bottom, and an excavation made until a stratum capable of forming a solid foundation was reached; upon this a layer of concrete was laid, and then the structure completed with brickwork and faced with granite. The caisson was gradually raised as this progressed; and when it was finished up to the water line, the caisson, with its suspending stage and tackling, was removed to the site designed for another pier, where a similar operation was performed. Caissons of this kind, having an open bottom and provided with air locks, act upon the principle of the diving bell, the pressure of air in the working chamber and air locks being equal to that of the depth of water in which they are submerged. This renders the use of the air lock necessary. The piers of the bridge across the Mississippi river, at St. Louis, Mo., were constructed by means of an analogous device.

Iron and Steel Rails.

The Bulletin of the American Iron and Steel Association reports the following as the rail production of the United States for 1874, in net tons:

New iron and Bessemer steel rails over 40 lbs.	349,978
New iron rails over 40 lbs.	32,480
Rerolled iron rails of all sizes.	323,035
Steel and steel-headed rails other than Bessemer.	17,181
Steel rails.	6,739

Total. 729,413

Of this, 259,288 tons were made in Pennsylvania, including 55,488 tons unrolled; 125,103 in Illinois, including 51,234 unrolled; 82,561 in Ohio, and the residue distributed among 16 States.

The whole number of rail-rolling mills in the United States, in 1874, was 91, of which 57 make heavy rails mainly, and 34 make only light or street rails. Of the whole 91 mills, 22 made no rails in 1874. The product of the year was therefore rolled by 69 mills, and many of these ran only a part of the time. The capacity of all the rail-rolling mills of the country is at least double the product of 1874, which was 729,413 net tons. Of the 67 mills which made rails in 1874, 7 made both iron and Bessemer steel rails, 1 made Bessemer steel rails exclusively, 2 made steel-headed rails exclusively, 2 made steel-headed rails and iron rails, and 1 made solid cast steel rails and iron rails.

It will be observed that almost one half of the total rail product of 1874 was composed of old rails re-rolled.

Bleaching Cotton Yarn in the Hanks.

No. 1. Bleaching liquor stock tub.—Pound together 20 lbs chloride of lime and 40 gallons water in a tub; allow to settle five hours, when it is ready for use.

No. 2. To bleach white 60 lbs. of cotton yarn.—Boil six bundles yarn with 6 lbs. soda ash for six hours, not less. Stir them and wash in one cold water, and wring. Add to warm water 10 gallons of stock liquor; work yarn half an hour, ten turns; wash from this into a cold water for safety, but this is not absolutely necessary. Sour in a cold water with two quarts vitriol. Wash in a cold water from sour; also in a hot water containing 2 lbs. of soap (white preferred). If necessary to be blue, it should be done in soap water, with a little China blue. Wash in cold water from soap, and dry in stove.

No. 3. To bleach 60 lbs. for dyeing.—Boil as above, only dispense with the soda ash, and take a little less time in working, but it is very necessary to wash well off before dyeing.

No. 4. To set a stock tub of red liquor for dyeing aniline and other colors.—Add to each gallon water 1 gill of red liquor. This tub should be kept for further use, and takes about one quart to each 10 lbs. to keep it up to working order.

No. 5. To dye 60 lbs. light lilac.—Bleach as for dyeing, then steep a quarter of an hour in red liquor stock tub, or give five turns. Wash twice in cold water, and wring out; dissolve 1 oz. logwood extract; add this to a milk-warm water; give ten turns, lift, and add 2 ozs. dissolved alum; give three turns more; wash in cold water; dry in stove.

Finer and brighter colors can be got with aniline and many other shades of color by increasing the logwood, etc.

No. 6. To dye 60 lbs. silver drab.—Bleach as for dyeing, then dissolve 2 ozs. logwood extract; add this to warm water; give ten turns with yarns; lift and add 1 gill of black iron liquor; four turns more. Wash in cold water; dry in stove. This color will look uneven in the logwood liquor, but will come up right when black iron is added.

The Education of the Mechanical Engineer.

We continue our extracts from Professor R. H. Thurston's address, recently delivered to his graduating class at the Stevens Institute:

"Never lose an opportunity. Men rarely succeed in life who are neglectful of opportunities, and, in nearly all cases, those who are successful can count upon their fingers the several occasions which formed the turning points at which, seizing an opportunity that other men might have overlooked or neglected, they chose the path which led to their final success. Many men possess ability, intellectual and physical but yet the number who may achieve high positions is small. It is the taking advantage of these rare opportunities, which, unobserved by the careless or the obtuse, are seized upon at the right moment and in the right manner by the watchful and the acute, that usually secures most rapid advancement.

Life is short; great opportunities are rare; therefore, make it a principle never to neglect one, whether small or great; seize it promptly, and make the most of it.

"Endeavor to keep 'two strings to your bow.' However much engrossed with the work in hand, however secure apparently your position, however satisfactory your location, keep the fact in mind that life is full of unexpected vicissitudes. Spare an occasional thought to provision against loss of position, failure of business, or compulsory change of location. Do your work so well that you may feel certain that your employer or your clients cannot afford to dispense with your services, and allow none of those about you to excel you. Yet be, at all times, prepared to make a new start, with confidence in yourself and your accumulated resources, should everything fall you. To ensure this, do your work better than can those who may aspire to your position. Have a specialty in which none can compete with you. Be always on the alert to make acquaintances among those whose character, position, and disposition may enable them to assist you when you find yourselves in need of assistance. Always assist your friends and deserving acquaintances heartily and actively. You will thus gain the approval of your own conscience, and will place a strong anchor to windward. The strongest man is weaker than a child if alone in the world without friends, and few men can say that they do not owe much of such success as they may have attained to the aid and countenance of good friends.

"Endeavor to become thoroughly acquainted with the principles and with all the details of the practice of those trades which are auxiliary to the profession of mechanical engineering. Do not feel satisfied until you can tell the pattern maker how to make your pattern, the molder how to mold it, and the founder of what mixture of metals you wish the casting made; until you can tell the blacksmith where to use the best and where to place the cheapest iron, and how to make his scarfs and welds, and how to preserve the fiber of the iron uninjured; until you can instruct an unskillful boiler maker in the selection of his plate and in testing it, in the spacing of rivets and in the welding of a seam or the turning of a flange. Do not rest until you can take every piece of your machine as it comes from the foundry or the blacksmith's or coppersmith's shop, and fit it to its place, giving it the proper finish, in the cheapest, quickest, and most accurate manner. All this will require time, patience, and perseverance, keen observation, a good memory, and a certain amount of actual practice to bring out that natural sleight, that mechanic's 'knack,' that no engineer in successful practice often lacks.

"In doing your work, strive to earn a perfect self-approval. From first to last, work as if your sole object were to acquire a reputation for good work and to assume a leading place in your profession. You may then feel a perfect confidence that, if you earnestly seek to acquire and if you carefully cherish such a reputation for good work, honest dealing, professional skill, and general intelligence, your reputation will be very sure, in turn, to take care of you and to bring you competence and perhaps wealth.

"Make the most of your resources. The greatest skill is frequently exhibited by the engineer in doing inexpensive work. In some cases the production of elaborate designs and graceful forms, the use of the best materials, and the employment of fine workmanship and the adoption of a beautiful finish, are not only allowable but incumbent upon you, and such construction is at once truly economical and most creditable. In other instances, the highest art is shown in accomplishing a given object at the least expense compatible with safety. Even rude devices, cheap materials, rough workmanship, and entire absence of ornament and finish are evidences, at times, of the ability of the engineer to accommodate himself to circumstances and to accomplish large results with small means. The character of your work in this respect should be determined by the nature of the problem itself, by the means at hand, and by the value of capital. Where capital is plentiful and cheap, and where labor and good materials are plentiful and cheap, it would be inexcusable to design and to construct, in important work, anything out of the best work that you are able to produce, using the best material and demanding the best of workmanship. Where capital is difficult to obtain, materials ill supplied, and labor expensive, and where the structure is a temporary one, the really good engineer will pursue quite an opposite course. To build cheap railroads and machinery in Great Britain, where capital is worth but four or five per cent per annum, and labor four or five shillings per day, as we build them in our Western and Southern States, where money costs ten per cent and labor is worth twice as much as abroad, would be extremely unwise. If it were stipulated that all new roads in the United States should be given easy grades, curves of large radius or straight tracks, well ballasted, with cut stone masonry and iron bridges, and furnished with station buildings and permanent structures of stone and brick: if it were prescribed that they should be provided with an ample supply of the best rolling stock, heavy locomotives, cars fitted with all the most recent improvements, and with every convenience known on old and wealthy roads, we should have no new roads, and the country would remain undeveloped. A machine designed for temporary use should be made at the least possible cost at which it will certainly serve its purpose. A machine which is expected to work well until worn out, and then to be replaced by another, should be made of good materials and in the best manner. Where it is anticipated that the machine will be superseded by another of improved design before it can be expected to become useless by wear, it is waste of means to build it with a view to durability simply, and regardless of expense. It is for this reason that the light, cheap, but equally efficient

machinery, built by our mechanics for some branches of textile manufactures, and some of our lighter tools, are better, on the whole, than the heavier and more expensive machinery supplied by foreign builders. Improvements follow each other with such rapidity that it becomes necessary sometimes to throw out this finely built machinery before it is half worn out. This difference in first cost is thus simply so much capital thrown away. Here, as in many cases that will arise, a good judgment, a strong, practical common sense, guided by experience and enlightened by acquired knowledge, is your only reliance in determining where lies the golden mean.

"Make the interests of your client your own. Let me remind you of the bad policy, of the wrong of which you would be guilty, were you in any case to permit the apparent interests or the wishes of a client to induce you to adopt a plan which your judgment, your knowledge, and your experience condemn. On the other hand, never permit your own interests to dictate a course obviously opposed to the best interests of the client who has entrusted his business to you; and never pursue a line of policy and action of which you know the results will fail to meet his expectations fully in every particular. Present to him every reason, *pro* and *con*; explain the case fully; and if his interests and your own are not identical and cannot be perfectly harmonized, state the matter frankly and courteously, and decline the work. Such a course will always prove to be most correct and most satisfactory in all respects. You will retain the esteem and goodwill of your client, and the small, or even the large, amount of money surrendered will have a full equivalent in the gain of a greater self-respect.

"Be guided always, but never ruled, by precedent. Be always ready to accept what seems, all things considered, best in principle and in practice, without a prejudice arising from its novelty. Study newly discovered laws, and examine every new fact in a fair-minded spirit, and be ready to take full advantage of every evident improvement suggested to you. Respect traditional custom and common practice. They are probably founded upon good reasons and the teachings of experience; but be neither hampered nor blinded by them.

"Be radical in theory, but extremely conservative in practice. I would warn you against too free indulgence in experimental practice. Your client's money should never be risked in even the most promising of new schemes, except with most thorough understanding on his part of the uncertainty involved, and except where you are as fully absolved of all blame, aside from an error of judgment, in case of failure. Even the best of men have been misled by such absurdities as perpetual motion and kindred schemes, ingeniously presented and curiously disguised. The greatest deceptions are those which seem simplest and easiest of investigation. Yet do not hesitate to embark your own means in promising experiment or in the development of inventions if you find yourself well able to do so; never forgetting, however, that the perfecting of a new design and the opening of a market is usually a matter of vastly greater expense than at first estimated.

"Help the inventor whenever an opportunity offers to do so with propriety and to do so effectively. Lend him your most effective aid. Encourage him when his schemes appear to promise well. Never refuse to assist him in detecting fallacies or by exposing the errors into which his enthusiasm may have seduced him. Respect him and honor him as one of a class whose services to you and to the world are beyond estimate or recompense, and who are rarely rewarded for a tithe of their freely expended time, means, and health. You will meet schemers, dreamers, and ignorant pretenders, every day. Do not hesitate to expose them to themselves, and, if necessary, to the world. But, as you demand the respect of your fellow men, and expect credit for good intent and earnest attention to duty, see that you yield the same respect and accord the same credit to every honest inventor. Remember that he is a brother of Savery and Newcomen, of Watt and Evans, the inventors of the steam engine, a colleague of Wheatstone and Morse, who gave us the telegraph, and of Stephenson, who made the railroad a daily convenience; that he is of the same race with Gutenberg, who gave us types, and of Hoe, who, with his wonderful printing press, made possible the modern newspaper and that multiplication of books of 'which there is no end.' He is of the same blood with Arkwright, who gave us the loom, and with Howe who responded to the touching 'Song of the Shirt' by producing the sewing machine. He is one of a noble army of the truest benefactors of the human race. Respect the inventor though his hand may be hard and soiled, his clothing worn, his manners rude, and his language ill chosen. He is one whose name may be remembered long after you and I and all of us, who pride ourselves upon fortune of birth, property, breeding, or education, have passed away and are quite forgotten.

"Do not give up your studies, however pressed by business, but see that you make your foundations deep and solid by future acquisitions.

"Take care of your health. Keep this wonderful machine which we call the body—this mechanism which is at once the domicile and the servant, the transporter and the feeder, of the soul and of the mind—in the highest state of efficiency. Study the laws of health, and obey them as conscientiously as the laws of morals or of civil and social duty. A mind diseased is often but the exponent of a body diseased. Restore the body to health, and the mind will often be restored to its activity and its intellectual and even moral strength.

"President Porter, of Yale College, gives you terse and sound advice in regard to your conduct and bearing as men. 'Young men,' said he to his pupils, 'you are the architects of

your own fortunes. Rely upon your own strength of body and soul. Take, for your star, self-reliance. Inscribe on your banner: 'Luck is a fool; pluck is a hero.' Don't take too much advice; keep at your helm, and steer your own ship, and remember that the great art of commanding is to take a fair share of the work. Think well of yourself. Strike out. Assume your own position. Put potatoes in a cart over a rough road, and the small ones go to the bottom. Rise above the envious and the jealous. Fire above the mark you intend to hit. Energy, invincible determination, with a right motive, are the levers that move the world. Don't drink; don't chew; don't smoke; don't swear; don't deceive; don't read novels; don't marry until you can support a wife. Be in earnest; be self-reliant; be generous; be civil. Read the papers. Advertise your business. Make money, and do good with it. Love your God and your fellow men; love truth and virtue; love your country, and obey its laws."

REDUCTION IN THE COST OF FOREIGN PATENTS.

Messrs. MUNN & Co. take pleasure in announcing that they have effected arrangements by which the cost of Patents, in all Foreign Countries, for American Inventions is Greatly Reduced, and they are now ready to receive applications for such patents at the annexed rates, which include both Government and Agency fees for all ordinary cases.

Some applications may require a number of drawings, and a specification of unusual length, for which an additional charge will be made. But the annexed very low prices will be adhered to, except in special cases, when the inventor will be notified of any additional cost before any expense is incurred.

CANADA.

The expense of applying for a Canadian Patent is reduced to \$50, currency.

A Canadian Patent is granted for 15 years, divided, if the applicant desires, into three terms of five years each. The expense of applying for the 5 year patent is \$50. Model and drawings required as in this country. American inventions already patented here can be patented in Canada if the application is filed within the one year from the date of the American patent. Caveats can be filed in Canada. Expenses, \$25 in full. Send for pamphlet giving all particulars.

ENGLAND.

The expense of applying for an English patent, which covers England, Scotland, Wales, Ireland, and the Channel Islands, is \$75, currency, payable in advance, and an additional fee of \$175, payable within 3½ months, to complete the patent. Certain government taxes are required after 3 years. Patents granted to the first person who files in the complete specification and pays the fees, whether he is the original inventor or merely the introducer. For full particulars, send for pamphlet.

FRANCE.

The expense for applying for a French Patent is reduced to \$100, currency, payable \$75 on making the application, and \$25 on arrival of the Patent. A small annual tax is required after the first year. For amount of this tax and particulars about working the patent, see pamphlet. Sent free.

BELGIUM.

The cost of a Belgian Patent, and the conditions, are substantially the same as in France. For full particulars send for pamphlet.

GERMANY AND AUSTRIA.

The expense for applying for Patents in Germany and Austria is \$100 each, payable in advance. Send for pamphlet giving details.

MUNN & Co. obtain patents also in NORWAY, SWEDEN, RUSSIA, SPAIN, PORTUGAL, ITALY, all the British Australian Colonies, including VICTORIA, NEW SOUTH WALES, TASMANIA, QUEENSLAND, NEW ZEALAND, and BRITISH INDIA, on the most favorable terms, and at reduced rates from former charges.

GENERAL REMARKS.

No models required in any of the Foreign Countries except Canada; and sometimes in Prussia, the officials require a model when in doubt about the novelty of the invention, but it is seldom that one is demanded, and never till the application is secure.

All persons who desire to take out Foreign Patents are requested to communicate with the undersigned. They may depend that their cases will secure prompt and careful attention. We have had an experience of nearly Thirty Years in the business of soliciting American and Foreign Patents; and as it is well known, a very large proportion of all patents obtained by American citizens, both in this country and in foreign lands, are solicited through the Scientific American Patent Agency.

To secure a foreign patent, all that is necessary is to write to the undersigned, transmitting the fees and a copy of specifications and drawings. We can then at once proceed. The personal presence of the applicant is not necessary.

A pamphlet, giving full detailed information regarding each country, sent free. Address, MUNN & CO.,

Office of the SCIENTIFIC AMERICAN, New York.

NEW BOOKS AND PUBLICATIONS.

PROBLEMS IN STONE-CUTTING, for Students of Engineering and Architecture. By S. E. Warren, C.E., Professor in the Massachusetts Normal Art School, etc. Illustrated with Ten Plates. Price \$2.50. New York city: John Wiley & Son, 15 Astor Place.

Professor Warren has elaborated the science of stone-cutting into a branch of the higher mathematics, and his volume now before us contains some of the most instructive and interesting problems in the geometry of solids that we have ever seen. The numerous examples are taken from cases which actually occur in erecting buildings, and are therefore of the greatest practical value. The illustrations are very explicit, and the book altogether is an exhaustive treatise on a difficult and important industrial science.

THE AMERICAN STAIR-BUILDER'S GUIDE. By Lucius D. Gould. Illustrated with Thirty-two Plates. Price \$4.00, post-paid. New York city: A. J. Bicknell & Co., 27 Warren street.

This is an excellent treatise on the most puzzling question which the ordinary house carpenter encounters; and it is judiciously treated in a clear and elementary manner, presenting no difficulties to the reader of average education. It describes the subject thoroughly, giving instructions for solving all the problems that may arise in practice, and this without departing from the simple and perspicuous plan which characterizes the whole book.

THE MECHANIC'S FRIEND; a Collection of Receipts and Practical Suggestions. Illustrated. By William E. A. Axon. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This book is a compilation from the pages of the *English Mechanic*, and consists chiefly of descriptions of mechanical devices and tools, more or less known to practical workers in the various trades.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION, FOR THE YEAR 1874. Washington, D. C.: Government Printing Office.

This annual is too well known to need description here. It is a compendium of scientific progress during the year, and worthily represents the labors of our national scientific institution.

A GRAPHIC METHOD FOR SOLVING CERTAIN ALGEBRAIC PROBLEMS. By George L. Vose, Professor of Civil Engineering in Bowdoin College, etc. Price 50 cents.

WATER AND WATER SUPPLY. By W. H. Corfield, M.A., M.D., Professor of Hygiene at University College, London. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

These handy and useful volumes are Nos. 16 and 17 of Mr. Van Nostrand's compendious "Science Series."

BROWNE'S PHONOGRAPHIC MONTHLY, a Journal devoted to the Interests of Phonography and Phonographers. \$2 a year. New York city: D. D. Scott-Browne, 737 Broadway.

This periodical contains much useful information as to the science of phonography, and some interesting news relating to the profession.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From October 2 to October 7, 1875, inclusive.

AIR GUN DART, etc.—H. M. Quackenbush, Herkimer, N. Y.
BATTERY GUN.—J. P. Taylor, Elizabethton, Tenn.
FIREPROOF SAFE, etc.—W. A. Shepard, New York city.
GELATIN PRINTING, etc.—E. Edwards, Boston, Mass.
LUBRICATING OIL, etc.—C. H. Green, New York city.
NAIL MACHINE.—W. Wickersham, Boston, Mass.
PRESERVING FRUIT, etc.—A. J. Reynolds, Chicago, Ill.
RAISING WRECKES, etc.—J. T. Parlour (of Brooklyn, N. Y.), London, Eng.
STOPPING BOTTLES.—E. A. O'Brien, New York city.
VALVE.—T. Shaw, Philadelphia, Pa.

Recent American and Foreign Patents.

NEW WOODWORK AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED CROSSCUT SAW HANDLE.

Lewis Shepard, Mace, Ind., assignor to himself and D. W. Kennedy, of same place.—A stiffening back piece is attached at the end of the saw, it being grooved to fit on the back of the same, and retained by two rods, that are arranged at opposite sides of the saw blade, so as to lock with the hook ends into the recesses of the saw teeth. The main handle is made of curved shape, and fastened to the blade in the usual manner. When the saw is worked by two men, a second curved handle is applied to the opposite end of the saw blade. The stiffening back piece carries on an extension of the foremost rod a second handle, which enables the operator to steady the saw, put his full strength on the same, and work the same in a quick and effective manner.

IMPROVED DRAFT EQUALIZER.

James M. Buckner, Salem, Neb.—This is an improved three-horse evener, consisting of a long lever on the side for the two horses, and a short lever on the side for the one horse, all pivoted to the tongue, and coupled together by connecting the short arm of the short lever to the long arm of the long one in such manner that the one horse has the necessary leverage to counterbalance the two horses. This is a compact arrangement, well adapted for use on harvesters, for which it is more especially designed.

IMPROVED ROOFING COMPOUND.

James A. Craig, Philadelphia, Pa.—This inventor calls attention to the resistance to atmospheric influence peculiar to soapstone, which substance, after reducing it to a granulated form, he mixes with hot pitch, to form a durable and tight roofing compound.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN PLANTER.

Albert Hodgson, Humboldt, Kan.—The seed slides are the novel portions of this device. Between said slides are formed two dropping holes, which are adjustable as to size. Near these are projections, which, as either hole passes beneath seed, guides the latter into the aperture, so that the latter are always filled. There is a cut-off in the lower portion of the seed hopper, suitably constructed with reference to the slides.

IMPROVED BUTTER WORKER.

Patrick Rooney, Fairfield, Vt.—This consists of a tray suitably supported on legs. There is a frame, the lower bar of which travels in guide bars, under the central part of the table, and the upper cross pieces of which carry a smaller frame, which enters the tray. With the main frame is connected a spring treadle, so that the former, while being oscillated, may be moved up and down, thus causing the small auxiliary frame to act upon the butter.

IMPROVED FLOUR SACK PACKER.

Charles M. Fuller and Robert M. Parkerson, Batavia, N. Y.—This invention consists of a tube having movable plates on which the flour rests. When these plates are raised, the flour flows into the sack until arrested by the replacing of the plates when the sack is full. Devices suitably arranged then press and pack down the flour, and the platform on which the filled sack stands is lowered so that a new bag can be set in position. The apparatus is of novel and ingenious construction, and doubtless will prove of much utility to millers.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED EYEGLASS.

James T. L. Anderson, Brooklyn, E. D., N. Y.—The novel feature in these eyeglasses is a movable nose clamp which is pivoted to each frame. Instead of resting against the sides of the nose transversely, it may be turned to fit into the angle between nose and brow, thus accommodating itself to the form of the nose.

IMPROVED AUTOMATIC TELEGRAPH KEYS.

Lucien S. Crandall, New York city.—Two new and ingenious telegraphic improvements of the above description have been devised by Mr. Crandall. The first consists of a series of pivoted spring keys or finger levers, marked with the different letters of the alphabet. These levers come, by cams of varying shapes, in contact with projecting arms of a shaft, that operates, by a spring pawl, a ratchet wheel. The latter closes the circuit by the contact of the teeth with a metal tongue connected to one pole, while the key shaft and ratchets are connected to the other pole. As every cam is shaped in suitable manner by steps and extensions, so that the Morse character of the letter of its key is produced, words may be telegraphed mechanically by simply depressing the required keys. By some practice a very rapid and reliable mode of transmitting messages is produced, as each key, when depressed, produces the exact corresponding Morse character on the sounder, one shaft, ratchet wheel, and tongue serving for all the keys jointly.

The second invention also consists of a series of spring keys or finger levers, representing the letters of the alphabet, which move on being depressed. A series of wheels are divided along their circumference into insulated and non-insulated portions, so as to close or break the circuit by the contact with spring tongues or riders connected to one pole, while the wheels are connected to the other pole of the battery. The insulated and non-insulated portions of each wheel are so proportioned that the Morse character of the letter of its key is produced at each depression of the same, and the subdivision of the circumference and of the ratchet wheel is accurately constructed, so as to repeat the same letter regularly and uniformly by the exact contact of the tongue or rider. Thus the mechanical transmission of words and messages can be accomplished in rapid and reliable manner.

IMPROVED BALE TIE.

William H. Walker, Charleston, S. C.—One end of the hoop is first permanently secured in a slot in a plate. Then the other end is brought around the bale and is turned under and over two bent arms of said plate. The hoop can thus be easily detached or fastened, admitting of the device being repeatedly used.

IMPROVED REGISTER.

Frederic J. Hoyt and William H. Hoyt, Batavia, N. Y.—This is a seal for the protection of freight cars on railroads, to prevent them from being tampered with; and it consists of a combination of numbers (or letters), which numbers may be changed without destroying the seal. It also consists in bolts, dog, ratchet wheel and shaft, with the necessary changeable ring disks and apparatus. A movement of the ring takes place at each opening of the car door, which changes the number of the seal. From this it will be seen that a simple means is offered of determining when and where the door was opened, and further, that the seal is not broken or otherwise injured, as is the case with several other devices for a like purpose.

UNITING THE SOLES AND UPPERS OF BOOTS AND SHOES.

George V. Sheffield, New York, assignor to himself and Martin Bennett, Brooklyn, N. Y.—This inventor has devised a new way of uniting the soles and uppers of boots and shoes. A doubled wire is passed through both parts to be joined. Then a thread is passed through the loop of the wire on the under side of the sole, and drawn through the leather by means of said wire. This quadruples the thread in the hole, making a very strong fastening.

IMPROVED CIRCUIT CLOSERS FOR RAILROAD SIGNALS.

Lloyd B. Dennis, Sandusky, Ohio.—This is an improved circuit-breaking device that produces, by the passage of the train, the registering of the position of the same at any desired station, so that the track is within full control, and the danger of railway accidents reduced. A rod which rises beside the track is pressed down by the wheels of the train. This moves a lever, which enters between and separates two pivoted wire-carrying spring clamps. The electric current through the latter is thus interrupted, and the sounders at the stations worked.

IMPROVED COMBINED TRAVELING BAG AND CHAIR.

Celine Laumonier, New York city.—This is a folding chair with which several bags are conveniently combined. When the chair is closed up, a satchel, which is locked by suitable devices, encloses it. The whole forms a simple and convenient means for carrying a chair, well adapted for travelers.

IMPROVED HAIR CRIMPING PIN.

Maria Gardner, New York city.—The number of hair pins which are destroyed by being used for hair-crimping purposes, though probably never computed, must be something enormous, since the majority of ladies who wear their hair in that becoming fashion usually bend and break several each time that the hair is twisted. Mrs. Gardner's invention will doubtless prove economical, therefore, as well as convenient. It is a pin of the usual U shape, having several holes in its arms through which, after the hair is wound around them, a small straight pin is inserted and fastened in place by a key.

IMPROVED SKID FOR OIL BARRELS.

David M. Haight, Oswego, Ill.—The object of this invention is to enable carbon oil, naphtha, benzine, and other oils to be retailed directly from the cask in which they are received without waste from the drip or leakage. The oil-cask skid is provided with a sheet metal lining or pan, and a sheet metal facing upon the concave and inclined upper edges of its end pieces.

IMPROVED SAFETY POCKET.

Joseph Colton, New Orleans, La.—This pocket is made of stout cloth or leather, into which small chains are mingled in a kind of network. The mouth is protected by semicircular bars, to which the fabric is riveted, said bars being fastened, when required, by a novel catch. The pocket may be conveniently attached to the garment, and probably would baffle the skill of the pickpocket.

IMPROVED POCKET BOOK FASTENER.

Louis Prabar, New York city.—This is a simple and yet secure form of spring latch which may be easily attached to the pocket book. The latter has a ball-shaped end, which enters a socket in the fastening plate.

IMPROVED METHOD OF MAKING MAIL BAGS.

Henry Stephens, Brooklyn, E. D., N. Y.—This is an improved method of attaching a shield to the lower portion of the bag, to protect the stitches of the seam by which the bottom is sewed on from wear. The invention will doubtless add considerably to the lasting qualities of the bags.

IMPROVED DEAD CART.

Thomas F. White, New York city.—In order to cart dead animals through the streets without exposing people to offensive odors, this inventor proposes a box provided with doors at each end, said doors being arranged with packing, so that when they are shut the box is hermetically sealed.

IMPROVED PROCESS OF TREATING OLEAGINOUS SEEDS.

Alfred B. Lawther, Chicago, Ill.—The object of the invention is to improve the process of working flaxseed, linseed, and other oil seeds in such a manner that a greater yield of oil is obtained at a considerable saving of time and power in the running of the crushing, mixing, and pressing machines, while also a cake of superior texture is produced. The process consists mainly in conveying the oil seeds through a vertical supply tube and feeding roller to powerful revolving rollers, at such degree of pressure that each seed is individually acted upon, and the oil cells fully crushed and disintegrated. They are then passed directly, without the use of muller stones, to the mixing machine, to be stirred, moistened, and heated by the admission of small jets of water or steam to the mass, and then transferred to the presses.

NEW HOUSEHOLD ARTICLES.

IMPROVED SMOKED BEEF SHAVER.

Caleb R. Turner, Brooklyn, N. Y.—This invention consists of a slicing knife, swinging forward and backward at the end of a trough holding the beef, so as to make a shear cut. The knife is suspended from a pivot above the trough, on which it can be swung up out of the way of the trough, to be sharpened without being detached. The knife frame carries a cam, which feeds the meat up to the knife. A pawl mechanism is contrived to vary the feed, making thick or thin slices, and a pusher is so engaged with the feed screw that it can be shifted along the screw quickly to adjust it to the meat.

IMPROVED KEY HOLE GUARD FOR LOCKS.

Henry Cochems, Easton, Pa.—This is a door lock that may be securely locked from the inside or outside, so as not to be opened by the introduction of skeleton keys or other instruments. The invention consists, mainly, of a sliding guard block that is thrown into position to close the key holes by a fulcrumed elbow lever, and a sliding and spring-acted knob spindle and plate. The spindle is prevented from releasing the guard block by a safety locking plate set by a small key from the outside. The knob, latch, bolt, and guard block are separately locked by additional safety stops to secure them. Some such device as this is now needed on the doors of hotel rooms, and of state rooms on steamers.

IMPROVED WINDOW SCAFFOLD.

Heinrich Kruger, Jr., New York city.—This is an improved folding window scaffold that may be readily secured outside of the window. It is available for use as a step ladder, and capable of folding up into narrow compass for storage after use. The idea is to give the servant, who cleans the exterior of the panes, a safer and better seat than the window ledge. The principal point of novelty is the insertion in the bracket which secures the supporting pieces in the window.

IMPROVED BASE FOR REVOLVING CHAIRS.

William T. Doremus, New York city.—This inventor has already patented a large number of new and ingenious devices relative to the improved construction of furniture. In the present arrangement, we have still another, which consists of a strong and simple chair base, which can be easily taken apart or put together. The legs radiate about a central pivot or screw socket, to the flanges of which they are connected by suitable ring plates and bolts.

IMPROVED COMBINED KNOB LATCH AND LOCK.

James F. Cooper, Syracuse, Ohio.—In this lock the key bolt is fastened by the latch bolt and tumbler, while the entire withdrawal of the latch bolt is prevented by the said tumbler. The door, or article to which the lock is applied, is thus doubly secured.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED HYDRANT.

Christian F. Rapp, Cincinnati, Ohio.—This invention consists of a hydrant connected, by three-way cocks, with the supply pipe and two separate exit pipes, of which one is provided with a pump to force out the water remaining in the supply and other pipes. In the warm season the pump-connecting pipe may be closed by the governing rod, so that it is thrown out of operation. The hydrant is, by this anti-freezing arrangement, protected against any interruption of its operation, and the frequent digging and repairing of damage. If the predictions of those who foretell a coming winter as severely cold as the winter of last year are verified, there will be a great necessity for inventions of this kind.

IMPROVED DIKING ATTACHMENT FOR DREDGERS.

George Washington Parsons, Salisbury, Md.—This invention consists of an inclined hopper and chute, supported on vibrating cross pieces placed on suitable framework of lighters. Vertically adjustable screw bolts allow the raising or lowering of the chute, while water supply pipes and spurt holes of the hopper produce the flow of the dredged mass, in connection with a proper inclination of the chute. The new features are the devices which allow of the oscillation of the chute on the settling of the lighter when the material is dumped from the dipper, and also the arrangement of water pipes in the hopper.

IMPROVED MACHINE FOR ROUNDING LEATHER.

James Lewis, Prattville, N. Y.—The object of this invention is to round leather for making traces, round belting, etc. The material is inserted in a proper groove, a frame is turned down upon it and closed and locked. A crank is then operated, carrying the leather through between the rollers, and bringing it to an exact and uniform round, leaving its surface smooth and unrudded.

IMPROVED ICE-BREAKING VESSEL.

Erich Jacob Weederemann, Copenhagen, Denmark.—This inventor proposes to build steamboats provided at each end with sharp, strong, and powerful prows. The prow is not placed immediately under and in line with the stern post, but at some distance back of the same, leaving a bow portion with sharp inclined keel in front. This produces the same inclined position of the vessel when propelled against the ice as if weighted by a water reservoir, being raised above the same, so that the ice is cut and broken by the weight of the vessel.

IMPROVED MILLSTONE STAFF.

James See, St. Louis, Mo.—This is simply an iron hoop provided with four adjustable surfacing points, arranged to support the traversing level when marking high places on the surface of the burr. The device enables the bed stone and runner to be readily staffed for being dressed.

IMPROVED CRANE.

Jesse M. Caswell and Addison R. Worth, De Soto, Wis.—This is an ingenious and strong form of crane, easily constructed and having all its parts arranged in the same vertical plane, so that when not in use it can be turned against the side of the building near which it may stand, so as to be out of the way.

IMPROVED EXTENSION LADDER.

William T. Core, Norfolk, Va.—In this ladder, the pulleys around which the cords for raising the sections pass are mounted on the rounds, and are kept in position and strengthened by parallel bars, the ends of which are connected with the rounds above and below the said pulley rounds, thus distributing the strain, and preventing the pulley rounds from being broken.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Brass Plating on Zinc without battery. Instructions for sale by W. Key & Co., 183 Allen St., N. Y. City.
Steam Engines—25 per cent extra power or saving in fuel, guaranteed, by applying the R. S. Condenser, T. Sault, Consult'g Eng'r, Gen. Agt., New Haven, Ct.

Go where you will! Anywhere in the United States, you will see the results of advertising through Messrs. Geo. P. Rowell & Co.'s Advertising Agency, No. 41 Park Row, New York. The name of the firm is in every town and city. Through this advertising house you can reach every person in the Union. They are the best organized house, and the finest men to deal with.—(Clinton, Hartford, Conn.)

Wanted—Some one to take an interest in, and manufacture one of the best Sewing Machines ever offered to the public. Address, with reference, Desideratum, Station A, New York City.

To Manufacturers of Small Novelties—Send your address to J. Knight, Box 184, Denver, Col.

Traction Engines, good order, for Sale cheap—International Chemical Works, 39th St., Hunter's Point, N. Y.
Speed Indicator, \$2.00; Drill Gauge, 1 to 60, \$1.00. By mail, Samuel Harris & Co., 45 Desplaines St., Chicago.

Patent for Sale—Balancing Acrobat. A new Toy. It performs all kinds of motions. T. C. Leyboldt, 243 North 5th St., Philadelphia, Pa.

A Moulder, experienced in all branches, wishes a situation to work or take charge. First class references. Address G., 35 5th Avenue, New York.

New Money Making Business—Now is the best season. Canvassing Salesmen wanted. Address P. O. Box 364, New York.

Double Entry Book-Keeping Simplified. The most successful book on the subject ever published. Cloth, \$1. Boards, 75 cts. Sent post paid. Catalogue free. D. B. Waggener & Co., 434 Walnut St., Philadelphia, Pa.

Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 & 39 Park Row, New York.

The London Mfg Co.'s Varnishes are rapidly taking the place of all others in the market. They make a better finish, are more durable and more satisfactory in every respect than even the best imported.

Bolt Headers, both power and foot, and Power Hammers, a specialty. S. C. Forsyth & Co., Manchester, N. H.

Main Driving Belts—Pat'd Improvement. Address for circular, Alexander Bro's, 412 N. 3d, Philadelphia, Pa.

Amateurs and Artisans, see advertisement, page 211. Fleetwood Scroll Saw, Trump Bro's, Manufacturers, Wilmington, Del.

Electric Burglar Alarms and Private House Annunciators; Call, Servants' & Stable Bells; Cheap Telegraphs; Batteries of all kinds. G. W. Stockly, Cleveland, O.
For Sale, cheap—One 60 H.P. Boiler, 40 Engines and Boilers. Address Junius Harris, Titusville, Pa.

Steam and Water Gauge and Gauge Cocks Combined, requiring only two holes in the boiler, used by all boiler makers who have seen it, \$15. Hillard & Holland, 62 Gold St., New York.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Wanted—The best Machine for pointing Horse Shoe Nails. William Morehouse, Buffalo, N. Y.

Saw Teeth Indicator—Showing improved form for filing teeth on saws for use in different kinds of wood, &c. Sent free for 50c. E. Roth, New Oxford, Pa.

For reduced prices of Surface Planers and Mitre Dovetailer's Machines, send to A. Davis, Lowell, Mass.
"Pantect," or Universal Worker—Best combination of Lathe, Drill, Circular, and Scroll Saw. E. O. Chase, 7 Alving Street, Newark, N. J.

Scale in Boilers Removed—No pay till the work is done. Send for pamphlet. Geo. W. Lord, Phila., Pa.

To Manufacturers—Pure Lubricating Oil, Sample Package (24 gals.), \$7. Send to Geo. Allen, Franklin, Pa.

Educational Lantern Slides—Send for Catalogue to Prof. W. A. Anthony, Cornell University, Ithaca, N. Y.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Sale—Second Hand Wood Working Machinery. D. J. Lattimore, 31st & Chestnut St., Phila., Pa.

Price only \$3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

Small Tools and Gear Wheels for Models. List rec. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Peck's Patent Drop Press. Still the best in use Address Milo Peck, New Haven, Conn.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

All Fruit-can Tools, Ferracite Wks., Bridgeton, N. J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 479 Grand Street, New York.

Temples and Oilcans. Draper, Hopedale, Mass.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

Magic Lanterns and Stereopticons of all sizes and prices. Views illustrating every subject for Parlor Amusement and Public Exhibitions. Pays well on small investments. 72 Page Catalogue free. McAllister, 49 Nassau St., New York.

Water, Gas, and Steam Goods—New Catalogue packed with first order of goods, or mailed on receipt of eight stamps. Batley, Farrell & Co., Pittsburgh, Pa.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$6, with good Battery. F. C. Beach & Co., 246 Canal St., New York. Makers. Send for free illustrated Catalogue.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven Conn.

The Baxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, Park Place, New York.

Brass Gear Wheels, for Models, &c., on hand and made to order, by D. Gilbert & Son, 212 Chester St., Philadelphia, Pa. (List free.) Light manufacturing solicited.

American Metaline Co., 61 Warren St., N. Y. City.
Genuine Concord Axes—Brown, Fisherville, N. H.

Faught's Patent Round Braided Belting—The best thing out—Manufactured only by C. W. Army, 148 North 3d St., Philadelphia, Pa. Send for Circular.

For 13, 15, 18 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Moles & Queries

M. W. K. will find directions for preparing oxygen gas on p. 299, vol. 33.—C. E. K. Jr. can produce satin finish on gold or silver ware by the use of the sand blast. Nickel plating is described on p. 171, vol. 30.—J. P. A. can make pasteboard fireproof by the process given on p. 171, vol. 33.—G. G. can mold rubber by the process described on p. 283, vol. 29.—F. G. W. will find a description of tests for impurities in water on p. 155, vol. 33.—W. J. S. will find that the proportions of safety valves are described on p. 339, vol. 32.—C. W. L. can cement pieces of iron together by using the preparation described on p. 251, vol. 28.—L. L. L. can gild picture frames by the method detailed on p. 99, vol. 30.—E. should French polish his walnut panels; see p. 11, vol. 32.—J. M. A. will find directions for silvering mirrors on p. 234, vol. 30.—G. H. O. can solder brass to copper by the process described on p. 251, vol. 28.—H. J. E. will find a recipe for pickle for castings on p. 139, vol. 31.—H. E. S. will find a recipe for black ink on p. 233, vol. 29.—A. V. can purify rancid butter by following the directions on p. 119, vol. 30.—J. L. will find directions for making hard soap on pp. 331, 379, vol. 31.—W. H. M. will find a recipe for blackboard composition on p. 91, vol. 30.—O. C. T. will find directions for staining wood in imitation of black walnut on p. 90, vol. 32.—W. H. J. will find directions for proportioning screw-cutting gears on p. 187, vol. 29.—E. B. W. can dissolve india rubber by following the directions on p. 283, vol. 29.—J. H. O. K. will find a recipe for brown gun barrels on p. 11, vol. 32.—G. A. McL. should decline to listen to superstitious nonsense as to the influence of the moon's phases.—W. P. should read the SCIENTIFIC AMERICAN, and he would not then waste his time on the circle-squaring problem.—W. H. McC. can protect polished steel from rust by the method described on p. 283, vol. 31.—J. D. F. will find a recipe for a cement for china and glass on p. 346, vol. 24.—F. W. S. can make a paper canoe by following the directions on p. 163, vol. 27.—J. S. W. can test his safety valve by the process described on p. 273, vol. 31.—E. H. B. will find directions for bronzing iron castings on p. 283, vol. 31.—H. H. D. will find a description of the stereotypy process on p. 363, vol. 30.—C. E. will find a recipe for hair stimulant on pp. 267, 363, vol. 31.—W. H. M. and C. P. N. can cement glass to brass by the process given on p. 236, vol. 30.—J. H. D. and S. F. B. will find a recipe for liquid bronze on p. 139, vol. 32.

(1) C. C. says: I am making a boiler of tin, 15 inches long and 5 inches in diameter. What pressure will it stand per inch? A. The safe pressure is about 25 lbs. per square inch.

(2) A. A. H. says: I have a spring of water which I have brought to a barn through 3/4 inch lead pipe. I wish to let the trough fill to within 3 inches of the top, and then to carry the water down a fall of 5 feet. Last winter I had trouble with air filling in the pipe running from the trough to the yard. How can I arrange it so as to have no trouble with the air or the frost? A. To prevent the accumulation of air, lay the pipe with a continuous fall, free from abrupt bends; and cover it well to prevent freezing.

(3) J. B. P. says: I have a hand and foot sawing machine in which the power is taken from balance wheel to saw arbor by means of gear. I wish to get more speed, and propose using a 36 inch balance wheel and a 3 inch pulley on saw arbor to be driven by friction. Is it practicable to drive a 3 inch pulley by a 36 inch one? A. It will probably be best to use a V-shaped gearing, of cast iron.

(4) W. E. W. asks: A substance accumulates in my boiler. It mainly floats on the top of the water, causing inconvenience at the gage cocks. The water used is from an artesian well 118 feet deep. But little sediment or scale is formed. After blowing off and cleaning out the boiler, I have lately been using tallow, putting a few pounds into the boiler; and until I did so this substance never was troublesome. Lately it comes over with the steam; and in the vicinity of even small leaks, the iron of the engines, steam pipes, etc., is covered with a white coat of this impalpable powder. What will precipitate it (magnesia?) before it enters the boiler? A. Stop using tallow or any lubricant in the boiler, and let us know the result.

(5) A. F. E. asks: What are vernier callipers? A. We shall shortly publish an illustrated description of these instruments.

(6) J. H. asks: What is the best method of gumming postage stamps? A. Make a clear white solution of gum arabic, and add a little powdered sugar. The sugar prevents the paper from curling up when dry.

(7) M. T. asks: How can I clean a white ostrich feather? A. Put 1 oz. Castile soap in 1 pint water. Wash the feather in this, and rinse in pure water.

(8) L. S. asks: What is the best method of reducing buffalo skins to a uniform thickness? A. This is best done by perching them, that is, scraping them on the flesh side with a semi-circular knife.

(9) A. S. asks: How are purple, red, and violet inks made? A. For purple, use a strong decoction of logwood, to which a little alum or chloride of tin has been added. For red, take Brazil wood 1 oz., white vinegar 1 pint; macerate for 4 or 5 days; boil down to one half; add roche alum 1/4 oz., gum arabic 5 oz.; bottle for use. For violet, proceed as for purple, but make the ink thinner.

(10) J. I. R. and many others ask: How can I make an aeolian harp, to be strung with fine violin strings? A. Make a box of very thin cedar, pine, or other soft wood, 5 or 6 inches deep, 7 or 8 inches wide, and of a length just equal to the width of the window in which it is to be placed. Across the top, near each end, glue a strip of wood half an inch high and a quarter of an inch thick, for bridges. Into the ends of the box insert wooden pins, like those of a violin, to wind the strings around; put two pins in each end. Make a round hole in the middle of the top, and string the box with small catgut or first (E) fiddle strings. Fastening one end of each string to a metallic pin in one end of the box, and carrying it over the bridges, wind it around the tuning pin in the opposite end of the box. The ends of the box should be increased in thickness where the wooden pins enter, by a piece of wood glued up on the inside. Tune the strings in unison, and place the box in the window. It is better to have four strings as described, but a harp with a single string produces an exceedingly sweet melody, of tones which vary with the force of the wind.

(11) H. C. S. asks: Are any scales formed on the inside of a boiler above the water line? A. Generally, no.

Will hard rubber, either red or black, soften under a pressure of 250 lbs. to the square inch on the inside of the boiler? A. We think so.

(12) G. T. S. asks: To whom is due the credit of the revolving or repeating fire arm? A. It was first practically introduced by Colonel Samuel Scott, his first patent being dated in 1835. There is, however, in the Tower of London, a match-lock gun, used four centuries ago, having a revolving breech made on a principle somewhat similar to that employed in the Colt's revolver. There is a pistol similarly constructed at Warwick Castle, England.

(13) B. B. asks: Which of the two link motions, Stephenson's or Gooch's, was invented first? A. The two were invented at almost the same time. What is commonly known as the Stephenson link was applied by the inventor, Mr. Howe, in 1843.

(14) C. C. says: My steam gage indicates 5 lbs. when everything is cold. I called the attention of my employer to it, but without success. Is it safe to continue the use of it in its present condition? A. It should be tested immediately. I have a dog that is pestered with fleas. What will exterminate them? A. Carbolic soap.

(15) A. L. C. asks: Please give me a process for galvanizing small wrought iron rods. A. Clean the iron, cover it with a solution of sal ammoniac and hydrochlorate of zinc, and dip it into molten zinc.

(16) J. F. asks: What have I to learn in order to pass an examination as railroad or steamboat engineer? A. You must be able to answer questions about the construction, management, and repairs of engines and boilers, and must present evidence of your former experience with steam machinery.

(17) S. C. asks: How many tons of hay are contained in a stack whose circumference is 67 feet and height 26 feet, a tun measuring 512 cubic feet? A. About 143.

(18) J. H. C. asks: On what principle does the air railroad brake work? A. Under each car there is a cylinder with piston. The latter is connected with the levers of the brakes. Pipes lead from the cylinder to an air chamber on the locomotive. The chamber is charged with air at a high pressure by means of a small steam air pump on the locomotive. To operate the brakes, the engineer opens a cock by which the compressed air is allowed to act on the brake pistons under the cars, thus instantly working all the brakes at once.

(19) E. asks: Is there any particle of a car wheel in a moving train perfectly still? It is said by some that that atom of matter directly under the center of the wheel, touching the rail, is perfectly still for an infinitely short space of time; that if such was not the case, the wheel would slide on the rail. It is said to have been discussed at a meeting of railroad engineers and decided affirmatively; but I cannot believe it without the SCIENTIFIC AMERICAN decides that such is the case, and even then I am afraid that I cannot understand it. A. The answer to this question depends upon what is meant by "perfectly still." The facts of the case are as follows: If the car wheel is revolving at a uniform rate, every point in the circumference is moving at the same rate of speed in a circle; but each point in the circumference is moving away from a fixed station, say a post by the side of the track, at a different rate of speed; and any point in the circumference, when it touches the rail, is at rest momentarily, with respect to the fixed station.

(20) J. B. asks: Will an overshot water wheel, 20 feet in diameter and 3 feet wide, run a 50 inch circular saw, with proper gearing? A. Yes, if there is plenty of water.

(21) B. F. F. asks: What quantity of water will be forced through a pipe 1 inch in diameter, under a pressure of 62 lbs. per inch? A. Mr. R. H. Buel gives the following formulas, which give average results: L=length of pipe in feet. D=diameter of pipe in feet. A=area of pipe in square feet. V=velocity of water, in feet per second. H=head of water, in feet, to give the required velocity. h=theoretical head required for same

velocity. P=head, in feet, required to overcome friction. P=pressure per square inch equivalent to a given head. Q=number of cubic feet of water delivered by pipe per second. $H = \frac{0.000025 \times L \times V^5}{D^5}$
 $h = \frac{V^2}{64.4}$ $P = H - h$ $P = H \times 0.433$ $H = P \times 2.308$ $V = \frac{Q}{A}$

(22) C. M. B. asks: How can I cement a hair bracelet into a gold clasp? A. Melt together equal parts of clear resin and pure gum rubber. Apply hot.

(23) M. F. asks: What are gold pens pointed with? A. Gold pens are now almost universally tipped with the native ore of the metals iridium and osmium. Diamonds and rubies were formerly employed for this purpose.

(24) Q. Q. Q. asks: What preparation, when written with on blue paper, produces a white mark by discharging the color from the paper? A. Use a dilute solution of oxalic acid in water.

(25) W. B. H. says: You speak of water conducted through galvanized iron pipe tending to dangerous results. I have a reservoir holding 50 gallons, made of galvanized iron. The water comes in lead pipe into the bottom of the reservoir, and discharges through lead pipe near the top, leaving the reservoir to stand nearly full of soft water. Is this water injurious? If so, what paint or other substance can I apply to the inner surface, that will prevent the poisonous effect of the zinc, without injury to the water? A. The question as to whether the water is rendered unwholesome by its passage through the pipes and reservoir depends upon the character of the water itself. Waters containing a small quantity of certain mineral substances in solution are not affected by these metals, while, on the contrary, but a small quantity of other mineral salts may have a very deleterious action upon the quality of the water when in contact with the same metals. You should have a chemical examination made of your water.

(26) W. H. H. M. and others, who ask as to the qualities of certain waters: We are not able to give you decisive answers without first having given the waters a chemical examination.

(27) G. W. W. says: Please tell me how to prepare lime for the oxyhydrogen light. A. Select a piece of good, thoroughly and newly burnt lime, as free from sand as possible; and by means of a saw and knife, cut out a piece about 2 inches long and 3/4 inch in diameter. Trim this down to the form of a cylinder, and it is ready for use. These limes, when not in use, should be kept in small, dry, airtight bottles.

(28) C. H. asks: What substance is used on the cushions of hard rubber plate frictional electric machines? It is a powder very much like coarse gold bronze. A. Take zinc and grain tin, each 1 oz.; melt in an iron ladle, and add mercury (hot) 8 oz.; stir with an iron rod, pour into a well chalked wooden box, and agitate until cold; or stir till cold, and then powder. Keep in a well corked glass bottle.

(29) K. L. asks: 1. What is the best and most convenient article for covering steam pipes, running to radiators for heating public or private buildings? A. Felt bound in canvas. 2. When laid in a box under ground, what is the best filling? A. Plaster of Paris. 3. Would you paint the pipes with coal tar before covering or filling? A. Give them a coat of red lead paint. 4. Is coal tar a conductor of heat? A. Yes.

(30) J. C. B. asks: At what season of the year is it best to trim trees and bushes, and why? A. Timber trees are usually felled in the winter, when the trunks and bark are free from sap. Fruit trees are trimmed in the spring, that the vigor of the tree may be expended in the fruit instead of on the growth of the tree.

(31) M. W. asks: How is the metal calcium obtained? A. By igniting the iodide of calcium with an equivalent quantity of sodium in an iron crucible, having its lid screwed down.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. D. E.—Both specimens consist, chemically speaking, of siliceous and silicates of lime, alumina, and iron, with some carbonate of lime and iron. They are valuable only for polishing purposes.—D. H.—Your box, which came to hand some time before your letter, contained (if we remember rightly) particles of decomposed mica.—J. F. B.—It is iron pyrites imbedded in talcose schist. No further results are given by analysis.—B. F. B.—No. 1 contains a very minute percentage of silver. It is galena. No. 2, no silver detected.—C. H.—One is a piece of water-worn coral. The other is part of a tibia of some animal.—E. C. M.—We will require the root of the unknown plant, with the leaves, stem, and blossom, before we can classify it.—D. W. S.—It is sulphuret of iron.—D. K.—No. 1 does not contain nickel. No. 2 does not contain silver.—F. A. W.—It has a very slight trace of tin.—H. N. L.—It is not gold.—D. M. S.—They are very nice specimens of sulphuret of lead or galena.—R. H. C.—It is mica in quartz.—A box of specimens forwarded by S. D. M. contained many pieces of bituminous coal, marked with the curious disks referred to in the SCIENTIFIC AMERICAN of June 12. In opposition to the explanation there given, S. D. M. says: "While the material forming the coal was in a semi-fluid state, the bitumen in part composing it contained an oil of some kind not chemically mixed with it, which, when the enormous pressure took place on the stratum forming the coal, attempted to escape, and, finding space to spread, did so in the very slight openings left by the coal crystals. These, becoming dry as it were, formed those pellicles or films, which in turn protected the spots from being oxidized by

the atmosphere or water with which the then forming coal was surrounded." The author of this theory has of course considered the probability of the existence of so peculiar an oil, and of its forming when squeezed into cracks. He has also considered the fact that these structural peculiarities exist in many different varieties of coal, anthracite included. Mineral impurities are apt to accumulate along planes of cleavage or structure. We have no experimental data to prove the justness of the theory heretofore given in this particular instance. The specimens of specular and pot ore are fine. The kaolin is much colored by yellow hydrated oxide of iron. The pinkish gray stone is an inferior variety of asbestos.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

- On a Cheap Telescope. By W. K.
- On the Origin of Man. By H. M. S.
- On a Magic Square. By A.
- On Exterminating Grasshoppers. By J. P.
- On Veneered Diamonds. By J. W. M.
- On Sleeping Cars. By J. L. S.
- On a New Explosive Agent. By M. O. N.
- On American Inventions in Europe. By T.
- On the Wants of the Age. By H. B. C.
- On Coal. By S. F. V. P.
- On the Persecution of Galileo. By C. J. W.
- On Preventing Colds. By G. F.
- On Weather Predictions. By M. O. R.

Also inquiries and answers from the following:

- H. W. A. K. - A. B. R. - O. W. M. - R. B. R. - H. P.
- A. W. P. - G. R. B. - A. A. R. - W. T. S. - H. C. P.
- W. F. H. - R. E. P.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells giant powder, vulcan powder, etc.? Who sells acetometers? Who sells draining machines? Who sells bicycles? Who makes wire fencing? Who sells fittings for model boats? Whose is the best process for drying timber? Who makes chains of malleable cast iron? Who sells small steam engines? Who sells twine-making machinery? Who sells the best boiler and steam pipe covering?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the change mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week ending

October 12, 1875.

AND EACH BEARING THAT DATE.

(Those marked (r) are retained patents.)

Aerial vessel, F. E. Schmidt.....	168,788
Agricultural implements, etc., E. Wansbrough.....	168,689
Air and gas engine, G. W. Daimler.....	168,623
Air, purifying, A. S. Lyman.....	168,654
Air injector, W. M. Storm.....	168,678
Alarm, burglar, J. Pennepacker.....	168,777
Barge coal, Martin and Preston.....	168,655
Barrels, manufacture of, Phillips & Reid (r).....	6,696
Bed salt, T. L. Odell.....	168,661
Beefsteak tender, T. Billington.....	168,602
Bell, door, C. Coleman.....	168,721
Blank book, pocket, A. V. S. Smith.....	168,796
Boiler sediment collector, J. Popp.....	168,799
Bolt and rivet cutter, D. M. Kelley.....	168,568
Book-stitching machine, L. Godda.....	168,736
Boot counters, skiving, T. Andrews.....	168,596
Boot uppers, embossing, E. B. Stimpson.....	168,801
Box machine, J. Kisor.....	168,752
Brick machine, J. R. Cross.....	168,724
Brick machine, W. L. Gregg.....	168,564
Brick machine, L. Patterson.....	168,667
Bricks, pressing, Durand & Marais.....	168,730
Bricks, etc., drying, A. Morand.....	168,765
Broom winding machine, Walrath & Bronson.....	168,814
Brush, sponge, H. S. Kerr (r).....	6,692
Building materials, elevating, G. H. Kammacher.....	168,749
Burial case, glass, S. H. Brooks.....	168,606
Burner, gas, E. Blackman.....	168,554
Burner, gasoline, J. C. Riley.....	168,733
Button fastening, J. H. Harrington.....	168,628
Button hole cutter, J. A. Bidle.....	168,794
Car brake, J. N. Hawkins.....	168,565
Car doors, operating street, D. Shield.....	168,791
Car, sleeping, F. W. Parsons.....	168,879
Car, street, J. Stephenson (r).....	6,696, 6,697
Car ventilating screen, C. F. Bridgman.....	168,713
Cars, rider warmer for, J. J. W. Taylor.....	168,691
Carburetor, W. D. Snow.....	168,797
Card, playing, A. Dougherty.....	168,636
Carpet stretcher, H. Goss.....	168,608
Carriage axle, A. E. Smith (r).....	6,664, 6,665
Carriage axle nuts, die for forging, H. Hammond.....	168,740
Carriage, child's, E. Krueger.....	168,647
Cartridge, blasting, Smith & Egge.....	168,735
Chair, folding, I. N. Danna.....	168,725
Chair, tilting, S. Hoffman.....	168,744
Chandelier, B. Marsh.....	168,728
Chimney cow, T. E. Griffith.....	168,728
Churn, W. P. Jones.....	168,720
Circus seat, G. F. Fisher.....	168,631
Cigarette maker, J. Shepard.....	168,739
Clamp, Walker & Derow.....	168,593

Clams and oysters, preparing, C. Alden.....	168,703
Clock lock work, Covell & Robinson.....	168,620
Clothes dryer, A. Dragonier.....	168,605
Clothes dryer, S. R. Kidder.....	168,731
Clothes dryer, S. P. Meay.....	168,658
Clothes dryer, L. A. Walt.....	168,698
Cock, compression, J. McLaughlin.....	168,657
Compass, mariner's, N. H. Dibble.....	168,726
Corn husker, W. A. Dick.....	168,624
Cradle, folding, Welch & Jefferys.....	168,691
Curry comb, C. A. Hotchkiss.....	168,743
Curry comb, B. F. Walsh.....	168,815
Cutter and cutter holder, T. T. Nash.....	168,576
Damper, automatic, S. F. Gold.....	168,737
Dental filling, L. W. Sutton, Jr.....	168,690
Desk and wash stand, E. E. Everitt.....	168,732
Diaper pin, L. W. Stewart (r).....	6,698
Door securer, G. Hurt.....	168,556
Doors, hanger for sliding, L. A. Cook.....	168,618
Drill, planter, and roller, S. Brown.....	168,714
Drill stock, J. Hammond.....	168,741
Dropper, potato, G. H. Zane.....	168,702
Dry dock, hydraulic lift, T. A. Blake.....	168,663
Eaves trough hanger, W. E. Manrow.....	168,572
Egg carrier, W. Wells.....	168,692
Electric machine, magneto, L. Drescher.....	168,560
Emery wheel, turning, J. D. Huntington.....	168,643
Engine, road, J. H. Bange.....	168,600
Engine, steam, G. B. Stevenson.....	168,603
Engine packing, W. Peters (r).....	6,698
Equalizer, draft, S. E. Winsor.....	168,699
Equalizer of spring power, J. W. H. Doubler.....	168,729
Fare box, A. J. Cortis.....	168,619
Fare box, W. J. Cowling.....	168,722
Fare box, H. Tupper (r).....	6,699
Feather renovator, H. I. Linn.....	168,571
Fence, iron, T. J. W. Robertson.....	168,735
Fence wire, barbed, Armstrong and Doolittle.....	168,550
Fire arm, revolving, W. H. Elliot.....	168,562
Fire extinguisher, B. F. Cleminshaw.....	168,730
Fire extinguisher, P. M. Doughty.....	168,677
Fire place, portable, E. White.....	168,821
Flat iron, F. Sterzing.....	168,800
Flooring board, S. A. Reed.....	168,672
Flour, packing, L. Mowry.....	168,767
Fruit dryer, J. P. Neale.....	168,769
Furnace for brick kilns, W. S. Colwell.....	168,617
Furnace for steam boilers, S. Moses.....	168,766
Furnace grate, J. Old.....	168,770
Furniture caster, J. F. Ohmer.....	168,773
Game board, W. F. Lamb.....	168,570
Gas, making, P. W. Mackenzie.....	168,758
Gas governor, F. D. Baldwin.....	168,551
Gas heater, G. Mooney.....	168,764
Gas holders, vertical bar for, J. W. Starr, Jr.....	168,799
Gas lighting, electric, R. Chamberlin.....	168,614
Gas shade support, F. F. McGann.....	168,761
Gate fastening, W. Leach.....	168,754
Glue, apparatus for cutting, H. Stevens.....	168,801
Glue, preparing and drying, H. Stevens.....	168,802
Gold from other metals, separating, C. Wiegand.....	168,695
Grate and stove front, J. Old.....	168,771
Grate bar, W. C. Childs.....	168,615
Grate bar, G. W. Todd.....	168,684
Grinding and amalgamating pan, C. Cummings.....	168,621
Grindstone frame, G. A. Whitney.....	168,694
Hame, S. Shultz.....	168,793
Hame and collar, combined, T. C. Love.....	168,756
Harness, W. H. B. Diehl.....	168,625
Harrow, C. H. McGinnis.....	168,762
Harvester, J. E. Buxton.....	168,609
Harvester, C. Lidren.....	168,653
Harvester, A. Palmer.....	168,575
Harvester dropper, Ratliff and Towle.....	168,670
Hat bodies, stretching, R. Eickemeyer.....	168,731
Hatchway brace, J. Fleming.....	168,630
Heater, feed water, G. L. McCahan.....	168,760
Heater, fire place, J. B. Oldershaw.....	168,772
Heater, gas, G. Mooney.....	168,764
Hinge, B. Turner.....	168,592
Hoe, A. A. Porter.....	168,780
Hog lifter, N. Caldwell.....	168,612
Holisting machine, J. Wallace.....	168,594
Hooks, wardrobe and other, C. H. Thurston.....	168,682
Horse collar, E. B. Crawford.....	168,723
Horses from cribbing, preventing, A. C. Tickner.....	168,693
Hydrant, G. C. Bailey.....	168,599
Ice machine, J. M. Beate.....	168,706
Indicator, station, P. H. Harris.....	168,639
Inkstand base, L. Rosenfeld.....	168,673
Insole, Blossom and Clark.....	168,694
Jack, lifting, S. E. Mosher.....	168,663
Jack, lifting, J. L. Vall.....	168,811
Jack, hunting, H. L. Dalgre.....	168,622
Jigger, J. B. Wilford.....	168,698
Journal box, J. Schellkopf.....	168,737
Key fastener, W. W. White.....	168,695
Knife sharpener and polisher, E. A. Hushell.....	168,717
Knife, shoemaker's, A. C. Wetherbee.....	168,818
Lamp bracket, D. Barcellos.....	168,705
Land marker, J. Angsperger.....	168,598
Lantern, Clark and Kintz.....	168,616
Lard-rendering tank, N. Caldwell.....	168,611
Lard tank skimmer, N. Caldwell.....	168,610
Lath machine, J. C. Mackey.....	168,739
Ledger rest, F. O. L. Buck.....	168,615
Lever power, H. C. Bell.....	168,691
Lever, track lifting, W. H. Hargis.....	168,742
Lubricator, J. W. Reed.....	168,671
Measure, variable, C. P. Sullivan, Jr.....	168,679
Mechanical device, J. F. Kelley.....	168,645
Mechanical movement, J. McCloskey.....	168,575
Mill, disintegrating, J. M. Hendricks.....	168,642
Mining machine, J. J. Wefel.....	168,817
Mortising machine, Wilder et al.....	168,696
Mower, lawn, Turnbull and Frost.....	168,810
Mowing machine, D. Wolf.....	168,700
Neck tie, R. B. Parker.....	168,666
Nut fastening, H. C. Watson.....	168,690
Nut lock, J. B. Atwood.....	168,597
Oil reservoir, safety, T. Scantlin.....	168,676
Oil, burning, E. E. Rice.....	168,702
Ordnance, shell for, G. E. Walker.....	168,813
Organ etc., B. Dufner.....	168,591
Organ coupler, J. R. Perry.....	168,778
Pad and collar fastener, A. Racine.....	168,781
Padlock, W. Baether.....	168,669
Pan, J. C. Milligan.....	168,662
Paper collar, S. S. Gray (r).....	6,691
Paper fastener, J. M. Blanchard.....	168,709
Paper machine staff regulator, J. W. Huested.....	168,746
Pavement, brick, H. M. Stow.....	168,803
Pensary, T. Brauns.....	168,711
Piano and organ ottoman, J. Miller.....	168,661
Pipe coupling, Flagler and Dodge.....	168,738
Planing machines, feed of, Lawrence et al.....	168,650
Planter and cultivator, combined, C. F. Keller.....	168,750
Planter, corn, A. Fox.....	168,602
Planter, seed, W. C. Champion.....	168,718
Plow, gang, D. Kendig.....	168,646

Plow, sulky, S. F. Woodworth.....	168,595
Power, transmitting, J. W. Woodruff.....	168,701
Press and former, brick, A. J. Haws.....	168,743
Press, cotton, B. F. Platt.....	168,668
Press for baling cotton, etc., C. B. Churchill.....	168,557
Press, punch, A. H. Merriman.....	168,763
Printing press, Griffith and Byrne.....	168,635
Printing press feed gage, S. D. Tucker.....	168,685
Pulley, Belts and Howie.....	168,708
Pump, plunger, Hartley and Marshall.....	168,640
Pump, steam and vacuum, O. Jackson.....	168,747
Punch press, A. H. Merriman.....	168,763
Radiator tube, E. Russell.....	168,674
Railroad rail joint, H. Allen.....	168,704
Railroad rail joint, C. Dittman.....	168,558
Railroad track gage, S. Holbrook.....	168,567
Railroad track scales, T. Fairbanks.....	168,629
Rake, horse hay, Barclay and Kennedy.....	168,552
Rake, wheel hay, C. La Dow.....	168,648
Regulator, pressure, J. Taylor.....	168,807
Revolvers, locking catch for, F. H. Allen.....	168,549
Roll for rolling metal, G. P. Salisbury.....	168,584
Roof, iron, M. A. Shepard.....	168,587
Running gear, L. C. A. Schmidt.....	168,586
Sash holder, J. B. Wilford.....	168,697
Sash lock, McGregor & Voll (r).....	6,690
Saw for cutting stone, diamond, H. Rung.....	168,786
Saw handle, crosscut, C. M. Tanner.....	168,590
Saws, dressing circular, W. Potter.....	168,530
Sawing machines, driving, F. Miller.....	168,660
Screen holder, adjustable, G. A. Blodgett.....	168,710
Screw thread cutters, making, T. T. Nash.....	168,577
Separator, grain, H. Mielke.....	168,659
Sewing machine, L. Lyon.....	168,757
Sewing machine bobbins, filling, G. Gowing.....	168,634
Sewing machine gatherer, A. Everess (r).....	6,690
Sewing machine hemmer, W. L. Kotzum.....	168,753
Sewing machine, short thread, J. S. Hall.....	168,637
Sewing machine treadle, W. B. Higgins.....	168,563
Shade fixture, Brooks & Morell.....	168,713
Shoemaker's knife, A. C. Wetherbee.....	168,818
Shutter bower and fastener, Fellows & Finnecan.....	168,563
Spindle bolster, W. Jenckes.....	168,641
Spinning ring traveler, H. Halvorson.....	168,739
Square, slotted framing, J. H. McInnes.....	168,656
Stereoscope, W. H. Lewis.....	168,652
Stone, artificial, P. B. Doty.....	168,559
Stone, artificial, Lemon & Metcalf.....	168,651
Stove attachment, cooking, T. R. Timby.....	168,809
Stove door knob, M. W. Gardner.....	168,726
Stove leg, W. Tanner.....	168,586
Stove platform, S. L. Warren.....	168,814
Street sweeper, O. W. Kellogg.....	168,569
Sugar, splitting hard, Dinkel & Elmenhorst.....	168,728
Temple teeth, setting, N. Chapman.....	168,719
Tobacco-cutting machine, A. A. Hagen.....	168,636
Tool handle, J. C. Sears.....	168,789
Toy, J. J. White.....	168,819
Toy spring gun, P. R. Voorhees.....	168,812
Trap, animal, W. A. Shibley.....	168,792
Trunk fastening, R. Hilton.....	168,591
Trunk fastening, J. F. Simpson.....	168,677
Tubes, sealing ends of iron, D. C. Stillson.....	168,658
Tubing sectional core, Lemon & Cameron.....	168,735
Type-setting machine, D. B. Thompson.....	168,591
Tyre tightener, W. H. Swarthout.....	168,606
Umbrella, cane, W. E. Engelhardt.....	168,628
Valve, W. Painter.....	168,775
Valve, G. T. Taylor.....	168,808
Vehicles, elevator for, R. R. Robert.....	168,784
Vehicles, running gear for, C. M. Murch.....	168,768
Violin, H. W. White.....	168,820
Violin, guitar, etc., J. Oehrlin.....	168,665
Wagon, dumping, J. Bond.....	168,555
Wagon jack, B. W. Stanton.....	168,798
Wagon wheel scraper, N. Sage.....	168,675
Washer cutter, E. Bruid.....	168,607
Washing machine, G. W. Gilbert.....	168,735
Watch, E. J. Pacaud.....	168,774
Watches, barrel arbor for, A. H. Potter.....	168,583
Watch compensation balance, A. H. Potter.....	168,581
Watch escapement, A. H. Potter.....	168,582
Water closet, W. S. Carr.....	168,613
Water wheel, J. L. Helmer.....	168,641
Wells, apparatus for walling, Beach & Marshall.....	168,707
Wind wheel, horizontal, F. Burt.....	168,608
Windmill, J. M. May.....	168,574
Wire sign and banner, Upham, Garrett, & Tully.....	168,687
Wood splitter, W. Latus.....	168,649
Wringer, H. A. Buck.....	168,716
Wringer, T. J. Dickerson.....	168,727

DESIGNS PATENTED.

5,706.—LANTERN.—C. Herter, New York city.	
5,707.—NEWELL LIGHT.—C. Herter, New York city.	
5,708.—BOTTLES.—G. Jacques, Boston, Mass.	
5,709.—COFFIN HANDLE TIPS.—G. Rogers, West Meriden, Conn.	
5,710.—BUTT RINGERS.—E. J. Steele, Westville, Conn.	
5,711.—LATCH HANDLES.—E. J. Steele, Westville, Conn.	
5,712.—DRAWER PULLS.—E. J. Steele, Westville, Conn.	
5,713.—FOUNTAIN.—W. Tweeddale, Brooklyn, N. Y.	
5,714.—TYPES.—J. M. Connor, Greenville, N. J.	
5,715.—SHIRT BOX.—C. H. Horsfall, New York city.	
5,716.—INKSTANDS.—C. M. Jenckes, New York city.	
5,717.—MONUMENTS.—W. T. Price, Circleville, Ohio.	

SCHEDULE OF PATENT FEES.

On each caveat.....	\$10
On each Trade mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On filing a Disclaimer.....	\$10
On an application for Design (3 1/2 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
October 5 to 20, 1875.

5,254.—J. Shirred, Chatham, N. B. Freezing and refrigerating machine. Oct. 5, 1875.	
5,255.—J. S. Rogers, Gloucester, Mass., U. S. Process of manufacturing gelatin. Oct. 5, 1875.	
5,260.—D. Hawkesworth, Digby, N. S. Spark arrester. Oct. 5, 1875.	
5,261.—D. Steele, Hamilton City, Ont. Apparatus for extinguishing fires. Oct. 5, 1875.	
5,262.—P. Wood, Uxbridge, Ont. Shaft coupling for cutters. Oct. 5, 1875.	
5,263.—I. Hahn, Pittsburgh, Pa., U. S. Hydraulic crane. Oct. 5, 1875.	
5,264.—A. Bettles, Warrensburgh, Miss., U. S. Heating stone. Oct. 5, 1875.	

Advertisements.

Back Page - - - - - \$1.

MAGNETS—Permanent Steel Magnets
of any form or size, made to order by F. C. BEACH
& CO., 345 Canal St., New York. Makers of the cele-
brated Tom Thumb and Miniature Telegraph instru-
ments.

Advertisements.

Back Page \$1.00 a line.
Inside Page 75 cents a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

Engine, Splindle, & Cylinder Oil. E. H. KELLOGG, 17 Cedar St., N. Y., manufactures the best. Established '58.

THE ADVERTISER WANTS TO PROCURE a Stationary Steam Fire Pump. Among its good qualities it must, 1st, be able to draft water through a 12 inch suction, having a perpendicular rise of 30 ft., without any previous priming; 2d, while so drafting water, throw six streams, at least through 1 1/2 inch nozzles, maintaining 100 lbs. water pressure and using steam at 60 to 70 lbs. Any one having such a pump (new) may find a cash customer by sending description and price to C. T. CO., P. O. Box 75, N. Y. City.

FREE 100 page Book and samples of Rubber Roofing. Complete materials for new roof, 4 1/2 c. a sq. ft. Fire-proof, durable, cheap. Easily applied with positive satisfaction. Write at once and save money. N. Y. Slate Roofing Co., CEDAR ST., N. Y.

PATENT Gas Fitter's Lamp Saves time and alcohol—is used with one hand. Three tools in one. A child can use it. No first-class workman can afford to be without it. Sample by mail, \$2.25. Address inventor, J. D. GALLOWAY, 345 North 10th St., Philadelphia, Pa. Send for Descriptive Circular.

THE TANTITE COMPANY Emery Wheels, Emery Grinders, STROUDSBURG, MONROE CO., PA. **PURE EMERY.** guaranteed equal to any in the market at prices lower than any other first class emery.

Engines & Boilers new & 2d h'd. perfect condition. Very cheap. Address BINGHAM & RICH, Oil City, Pa.

Todd & Rafferty Machine Co. MANUFACTURERS OF The celebrated Greene Variable Cut-Off Engine; Lowe's Patent Tubular & Blue Boilers; Plain Slide Valve Stationary, Hoisting, and Portable Engines. Boilers of all kinds. Steam Pumps, Mill Gearing, Shafting, &c. SIK, Tow Oaken, Bagging, Rope, Flax, and Hemp Machinery. Agents for the New Haven Manufacturing Co.'s Machinery Tools; for Judson's Governors and Stop-Valves; Sturtevant Blowers; and Differential Pulley-Blocks. WORKSHOPS, 10 BARCLAY STREET, NEW YORK. WORKS PATERSON, NEW JERSEY.

PATENT Planing and Matching and Molding Machines, Gray and Wood's Planers, Self-feeding Saw Arbors, and other wood-working machinery. S. A. WOOD'S MACHINE CO., 91 Liberty St., N. Y. Send for Circulars, etc. 46 Sudbury St., Boston.

NOYE'S Mill Furnishing Works are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for catalogue. J. T. NOYE & SON, Buffalo, N. Y.

THE CHRISTIAN UNION. REV. HENRY WARD BEECHER, Editor.

Elliswood's authorized verb tim reports each week of Mr. Beecher's

Sermons in Plymouth Church. All his literary productions, including the characteristic "STAN PAPERS," will be given. Serial Stories by

REV. EDWARD EVERETT HALE, D.D., (Author of a "Man without a Country," &c.)

HON. ALBION W. TOURGEE, Judge of the Superior Court of North Carolina, (Author of "Tollette," &c.)

MRS. HARRIET BEECHER STOWE, (Author of "Uncle Tom's Cabin," &c.)

A Comprehensive Family Religious Newspaper. Terms \$3.50 per year, postage prepaid.

New and Unusual Terms to Agents. Cash Commissions and Competitive Premiums in Cash.

\$2,000 Given Away!

Send for particulars.

HENRY M. CLEVELAND, Publisher.

HORATIO C. KING, Asst. Publisher.

27 Park Place, New York.

10 DECALCOMANIE or TRANSFER PICTURES, with book of 100 pp., giving full instructions in this new and beautiful art, sent post-paid for 10 cts. 100 are in pictures, 100 are in text. They are Birds, Landscapes, Animals, Ships, Islands, Flowers, Automata, Comic Figures, &c. They can be easily transferred to any article so as to include the most beautiful painting. Also, 5 beautiful GEM CHROMOS for 10 cts., 50 for 50 cts. Agents wanted. Address J. L. FATTEN & CO., 303 William Street, New York.

THE BASTET MAGNETIC ENGINE.

FOR RUNNING SEWING MACHINES, PUMPS, DENTISTS' AND JEWELERS' LATHES, PRINTING PRESSES, BLOWING FAN-LOBS AND CHURCH ORGANS, OR WORKING ANY MACHINERY THAT CAN BE MOVED BY HAND OR FOOT.

Simple, Durable, and Economical.

SEND FOR CIRCULAR.

State Agents wanted.

THE BASTET MAGNETIC ENGINE CO.,

619 Broadway, N. Y.

In Press. Ready November 13th

WRINKLES AND RECIPES

COMPILED FROM THE Scientific American

An Illustrated Hand-Book of Practical Hints and Suggestions for Mechanics, Engineers, Farmers, Housekeepers, and Workmen generally.

EDITED BY PARK BENJAMIN.

Contents.

DEPARTMENT OF MECHANICS. Master-Tools, accurately represented. How to make and use them. Valuable suggestions for management of Machine Tools. Hints for Casting, Forging, Tempering, etc. Trade Secrets and Wrinkles. The whole supervised by JOSHUA ROSE.

DEPARTMENT OF ENGINEERING. The management, construction, and repair of Boilers, Engines, Valves, Shafts, Belts, Pulleys, and Hangers. Brief rules for practice, etc., prepared by Mr. R. H. BUEL. Also, New Paper on Testing Metal, expressly written by PROF. R. H. THURSTON, C.E., who also supervises the entire Department.

DEPARTMENT OF PRACTICAL TECHNOLOGY. Supervised by PROF. P. H. VANDER WEYDE, M.D. Metallurgical Operations: Cements and Glues; Painting and Varnishing; Making simple Instruments, etc., etc. Hundreds of Recipes for every variety of Industrial Work.

DEPARTMENT OF THE FARM. How to construct Farm Buildings. The Dairy. Hints for care of Stock, about Manures, Plants, Vegetables, Trees, Farm Machinery, etc., etc.

DEPARTMENT OF THE HOUSEHOLD. Cleansing Processes of all kinds. Window Gardens. Destruction of Vermin. Care of China, Glass, and Furniture. Papering Walls. Simple Remedies, etc., etc.

The volume comprises 250 pages, is printed on fine paper, with gilt edges, and is of large pocket-book form, flexible covers, neatly ornamented.

Mailed, post paid, on receipt of \$1.50.

1 copy Scientific American, 1 year, and 1 copy Wrinkles and Recipes..... \$4.20

Address

H. N. MUNN,

PUBLISHER,

P. O. BOX 772,

37 Park Row, New York City.

HARTFORD STEAM BOILER

Inspection & Insurance

COMPANY

C. E. FRANKLIN, V. P. J. M. ALLEN, PRES.

J. E. STURGEON, Sec.

HARTFORD, CONN.

THE NATIONAL

Steel Tube Cleaner.

PATENTED JULY 28 1874.

Adopted and in use by U. S. Navy. For sale by dealers. Send for Circular. THE CHALMERS SPENCE CO., foot E. 9th Street, N. Y. Agents for the U. S.

NON-COMBUSTIBLE STEAM BOILER & PIPE COVERING

WITH AIR SPACE IMPROVEMENT. Saves 10 to 20 per cent. CHALMERS SPENCE CO., foot E. 9th St., N. Y.; 1202 N. 2nd St., St. Louis, Mo.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC

ROTOR MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Gunpowder, Oil Cake, Feed, Corn, and Cob, Tobacco, Snuff, Sugar, Salts, Hoots, Spices, Coffee, Cacao, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

Pyrometers, Ovens, Hot blast pipes, Boiler flues, Super-Heated Steam, Oil Stills, &c. HENRY W. BULKLEY, Sole Manufacturer, 24 Liberty St., New York.

PATENT COLD ROLLED SHAFTEING.

The fact that this shafting has 75 per cent greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the celebrated COLLIER'S PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLIN, Try Street, 2nd and 3rd Avenues, Pittsburgh, Pa.

Stocks of this shafting in store and for sale by FULLER, DANA, & FITZ, Boston, Mass.

GEO. PLACE & CO., 211 Chambers St., N. Y.

PIERCE & WHALLEN, Milwaukee, Wis.

DITCHING and EXCAVATION.

RANDOLPH'S DITCHER AND EXCAVATOR: Simple, strong, and adapted to all soils reasonably free from stumps or large stones. Will do the labor of 100 men, steadily, at the cost of ten. Machines of all sizes, cutting from three inches wide, three feet deep, to 36 inches wide, four feet deep. Extra sizes made to order. Circulars, &c., sent on application to RANDOLPH BROS., 111 Broadway, New York.

Corrugated Iron Iron Buildings, Roofs, Shutters, Doors, etc. MORELY IRON BRIDGE AND ROOF CO., Office 5 Day St., New York. Send for circulars.

HAIR-FELT---HAIR-FELT. FOR COVERING BOILERS & PIPES. Discount to the Trade. AMERICAN HAIR-FELT MILLS, 316 Front Street, New York

GENUINE CONCORD AXLES

The Standard—Best Stock—Finest Finish.

MANUFACTURED ONLY BY

D. ARTHUR BROWN & CO., Fisherville, N. H.

Polisher, Can Opener, Knife Sharpener. Agents wanted. Centennial Novelty 651 N. 7th St. Phila. Pa.

W. C. DUYCKINCK,

IMPORTER, MANUFACTURER, AND DEALER IN

Railway, Machinists' and Engineers' Supplies,

50 AND 52 JOHN STREET, NEW YORK.

P. O. Box 4101.

TO DYERS AND MANUFACTURERS.

Thomas's Fluid Tannic Acid, or Black Color Base, for Coloring Hats, Carpets, and all Feit Goods, and Textile Fabrics, and for making Ink. Price 6c. per lb. Address N. SPENCER THOMAS, Elmira, N. Y.

WIRE ROPE

Address JOHN A. ROEBLING & SONS, Manufacturers, Trenton, N. J., or 117 Liberty St., New York.

Wheels and Ropes for conveying power long distances. Send for Circular.

THE BEST INJECTOR

For Locomotive and Stationary Boilers. FRIEDMANN'S PATENT.

Over 15,000 Now in Use Here and in Europe

Throws more and hotter water, with less steam, than any other. It has two Waterways, fixed Nozzles, and no movable parts to get out of order.

NATHAN & DREYFUS, Sole Manufacturers, 108 Liberty St., New York.

Send for Catalogue.

ROGERS' TANNATE OF SODA BOILER SCALE PREVENTIVE. JOS. G. ROGERS & CO., Madison, Ind. Send for book on Boiler Incrustation.

Portland Cement.

From the best London Manufacturers. For sale by JAMES BRAND, 55 CHIT ST., N. Y. A Practical Treatise on Cement furnished for 25 cents.

Excelsior Do Your Own Printing

Portable \$3 Press for cards, labels, envelopes, etc. Larger sizes for larger work. Business Men do their printing and advertising, save money and increase trade. Amateur Printing, delightful pastime for spare hours. BOYS have great fun and make money fast at printing. Send two stamps for full catalogue presses type etc to the Mfrs KELSEY & CO., Meriden, Conn.

Printing Presses

RICHARDSON, MERIAM & CO.,

Manufacturers of the latest improved Patent Danfells' and Woodworth Planing Machines, Matching, Sash and Molding, Tenoning, Mortising, Boring, Shaping, Vertical and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-Off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufacturing, Worcester, Mass. Warehouse, 107 Liberty Street, New York.

DAMPER BEST AND LEVER

REGULATORS GAGE COCKS. MURRILL & KEIZER, 44 Holliday St., Balt.

Machinery of Improved Styles for making SHINGLES, HEAVING AND STAVES.

Sole makers of the well known IMPROVED LAW'S PATENT SHINGLE AND HEAVING SAWING MACHINE. For circulars, address TREVOR & CO., Lockport, N. Y.

WROUGHT IRON BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa.—The attention of Engineers and Architects is called to our improved Wrought-Iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided. We are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph, address Carnegie Brothers & Co., Union Iron Mills, Pittsburgh, Pa.

IRON PLANERS,

ENGINE LATHES, DRILLS, &c. Send for Price List, NEW HAVEN MANUFACTURING CO., New Haven, Conn.

PORTLAND CEMENT

For Walls, Cisterns, Foundations, Stables, Cellars, Bridges, Reservoirs, Breweries, etc. Remit 6 cents postage for Practical Treatise on Cements. S. L. MERRICK & CO., 76 South St., New York.

THOMAS'S FLUID TANNATE OF SODA—

Never fails to remove Scale from any Steam Boiler, using any kind of water. It is in Barrels 500 lb., 4 Bbls. 250 lb., 2 Bbls. 125 lb. Price only 10c. per lb. Address N. SPENCER THOMAS, Elmira, N. Y.

WHIPPLE'S

Patent Door Knob.

Awarded a Bronze Medal at the American Institute Fair for 1874. The Judges say: "We consider this method of fastening DOOR KNOBS a great improvement over anything yet invented for the purpose, as it obviates the use of side screws and washers, and can be regulated to suit any thickness of Doors." Send for Circular.

THE PARKER & WHIPPLE COMPANY, West Meriden, Conn., or 97 Chambers St., N. Y.

Munn & Co.'s Patent Offices.

Established 1846.

The Oldest Agency for Soliciting Patents in the United States.

TWENTY-EIGHT YEARS EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draftsmen that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions, and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office paying the government fees, and watch each case step by step while pending before the examiner. This is done through their branch office, corner F and 7th Streets, Washington. They also prepare and file caveats, procure design patents, trademarks, and reissues, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interference give written opinions on matters of infringement, furnish copies of patents in fact attend to every branch of patent business both in this and in foreign countries.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1

A copy of the claims of any patent issued since 1836 will be furnished for \$1

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this Agency, with name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

A pamphlet of 110 pages, containing the laws and full directions for obtaining United States patents, also a circular pertaining exclusively to Foreign Patents, stating costs in each country, time granted, etc., sent free. Address

MUNN & CO.,

Publishers SCIENTIFIC AMERICAN

37 Park Row, N. Y.

BRANCH OFFICE—Corner F and 7th Streets Washington, D. C.

PROSPECTUS

OF THE

SCIENTIFIC AMERICAN,

FOR 1875.

THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTIETH YEAR

VOLUME XXXIII—NEW SERIES

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the third day of July 1875, a new volume commenced. It will continue to be the aim of the publishers to render the contents of the new volume more attractive and useful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pursuits should think of doing without the SCIENTIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

The SCIENTIFIC AMERICAN is devoted to the interests of Popular Science, the Mechanic Arts, Manufactures, Inventions, Agriculture, Commerce, and the industrial pursuits generally; and it is valuable and instructive not only in the Workshop and Manufactory, but also in the Household, the Library, and the Reading Room.

TERMS.

One copy, one year (postage included)..... \$3.20

One copy, six months (postage included).... 1.60

One copy, three months (postage included).... 1.00

One copy of Scientific American for one year, and one copy of engraving, "Men of Progress"..... 10.00

One copy of Scientific American for one year, and one copy of "Science Record" for 1875..... 5.20

Remit by postal order, draft, or express.

Address all letters and make all Post Office orders and drafts payable to

MUNN & CO.

37 PARK ROW, NEW YORK.

MODELS and MECHANICAL DRAWINGS

PHOTOGRAPHED TO A SCALE OF 1/2 INCH TO AN INCH. ROCKWOOD, 339 N. 4TH ST., PHILA. PA.

The "Scientific American" is printed with CHAS. KNEU JOHNSON & CO. 8 INK, Tenth and Lombard Sts. Philadelphia and 59 Gold St., New York.