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IMPROVED REBOLTING MACHINE.

The invention herewith illustrated is a sawing apparatus, contrived for rebolting large bolts of timber without quite separating the smaller bolts from each other, so that they will hold together, admitting of handling or dogging in the shingling or other machine, in which they are to be finally cut up. By this means the machine may be supplied with timber to its full working capacity, while, at the same time, cutting the shingles or other pieces as narrow as desired.

In the perspective view, Fig. 1, A is the carriage which moves under the saw, B. The depth of the carriage under the blade is such that the latter does not reach the bottom, so that the bolt, secured in saw carriage, will not be cut entirely through. This will be understood from the sectional view, Fig. 2, in which the bolt is represented by dotted lines, D. C is a tilting rest for the bolt, upon which the sap side of the latter, generally bevel to the other sides, is placed, and held so that the saw kerf will pass down to the axis of the rest, thus leaving sufficient wood to hold the portions together, no matter how much the bottom may be inclined as regards the sides.

At E is a pair of clamps which work upon right and left hand screws, F, Fig. 2, and are operated by the crank, G, Fig. 1. These serve to hold the bolts securely while being cut. A portion of the carriage, H, is elevated, in order to accommodate pieces which are to be divided entirely, as in ordinary sawing machines. The track of the carriage is made in two portions, one above the other, so that the upper part can be vertically adjusted as may be required, for saws of different sizes, or as the blade wears away.

Patent pending through the Scientific American Patent Agency. For further particulars address W. A. Fletcher, Beaumont, Jefferson county, Texas.

THE COMBINATION FOOT LATHE.

For the use of amateurs, and for mechanics who desire to economize both in the cost of, as well as in the space occupied by, their tools, the novel device herewith illustrated will be found of much utility. It is a simple foot lathe, with which are combined a jig and a circular saw.

The former, which is represented on the right of the machine, is actuated by a pitman which connects eccentrically with the end of a shaft, A, passing under the apparatus. Motion is communicated to this shaft by a separate belt from the main pulley. The pitman operates a pivoted lever which, by an adjustable connection, B, transmits its motion to the saw arm. The saw works through a suitable table, and is tightened by a set screw in the connection, B. We are informed that it penetrates timber an inch and a half in thickness with perfect readiness.

At the opposite end of the lathe, and attached to the main arbor, is a small circular saw. This has an adjustable table which is provided with the usual guides, etc. By turning back the table, and removing the saw, an emery or buffing wheel may be substituted in its place upon the arbor.

Regarding the lathe itself, other than to notice that it is neatly and substantially built, and appears to be an efficient and reliable tool, no particular description is needed.

The apparatus is manufactured by Strange's Cylinder Saw Machine Company, of Taunton, Mass. For further particulars address O. W. Leonard, sole agent—40 John street, New York city. Patent now pending.

IRON HAIL.—Professor Eversman has had occasion to examine, at Kasan, hailstones containing crystallized iron pyrites. The cause of this rare phenomenon, no doubt, was that small crystals of pyrites, proceeding from the disintegration of a rock, had been transported by a tempest into the clouds, where they were iced and converted into hailstones.

Rattan.

Rattan comes from the East Indies, principally from Singapore, Pedang, Penang, Samarang, and St. Simon's Bay. The United States consumes three quarters of the total product, the imports amounting now to something more than 6,000,000 pounds. The *Calamus Rotang* belongs to that peculiar species

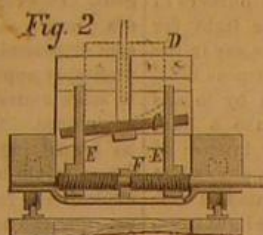
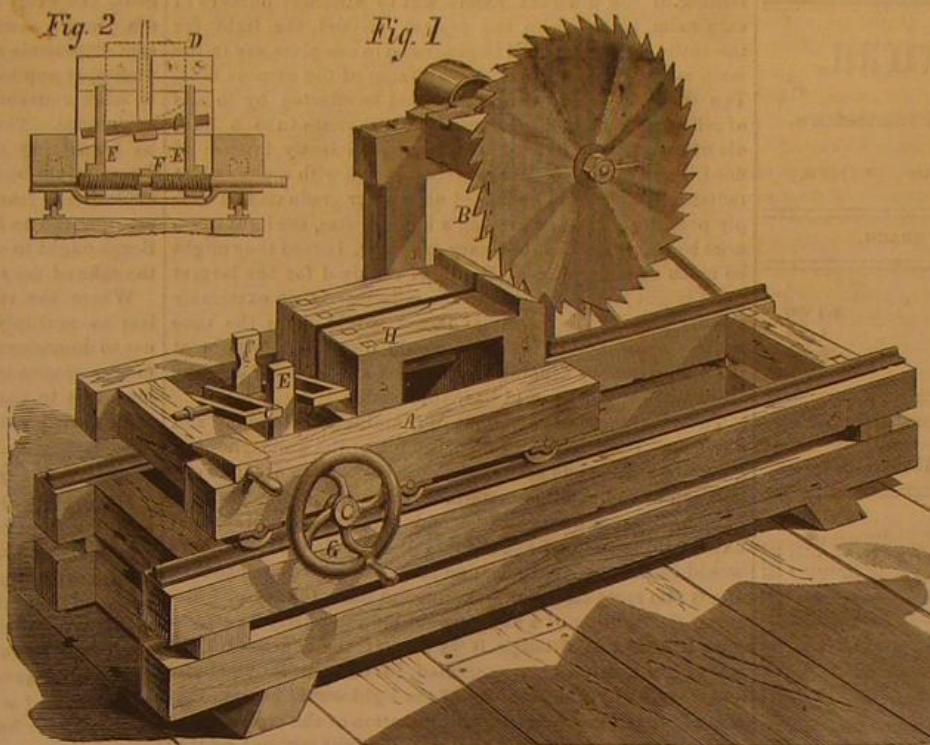


Fig. 1

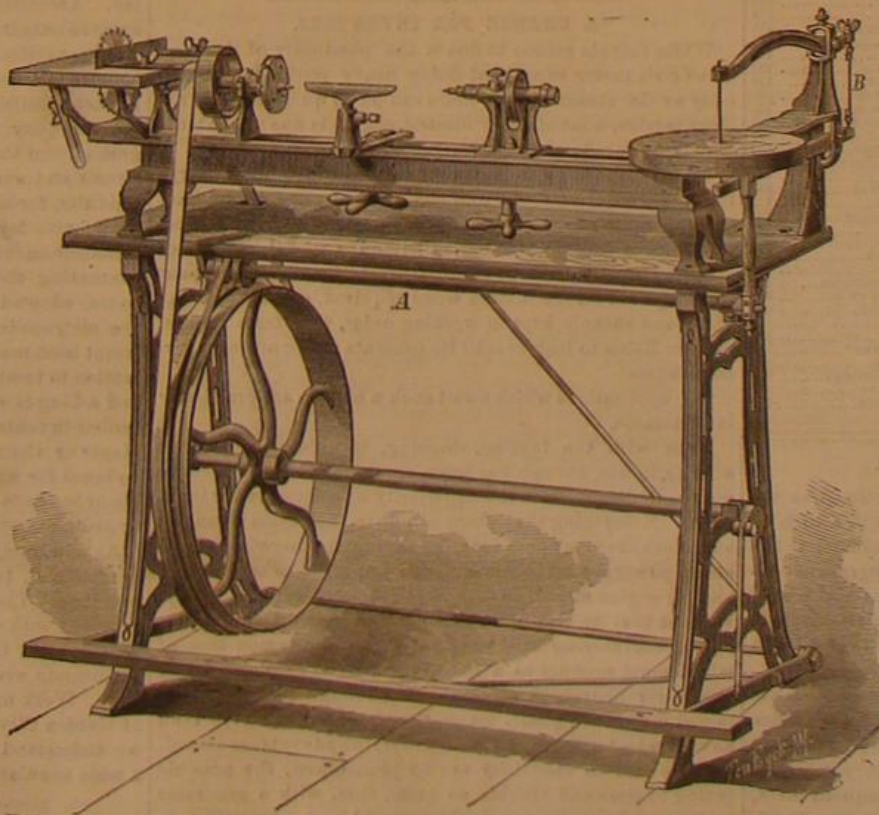


FLETCHER'S REBOLTING MACHINE.

ies of palm which secretes in its cuticle a very considerable amount of silica, while its inside is made up of tough and fibrous filaments. The outside, with the smooth natural varnish, when stripped off by particular machinery, is used for seating chairs. The inside of the rattan is employed in a variety of ways. It is shaped by machinery either round or flat, and so worked up into innumerable articles. Baskets, brooms, mats, matting, are all made from the inside of the rattan, and an immense quantity of it is worked around demijohns. Split rattan is made up into some half dozen different sizes, and

to introduce, twelve are erected and in operation. The stones are each 4 feet 3 inches in diameter by 12 inches thick, and the cost is about \$150. They are made of French burr, an interesting and not very common form of silica, of a cellular texture, which, for industrial purposes, is almost entirely derived from the mineral basin of Paris and a few adjoining districts. Considerable care and skill are required in their preparation. The revolving stone usually makes about 120 revolutions per minute. Four movable balance weights are set in its upper surface, so fitted that by the motion of a screw the stone can be made to lie

perfectly level when in motion, this being a most essential condition in good grinding. The opposite surfaces of the stones, from the peculiarity of their dressing, act upon the grain like the blades of a pair of scissors. The white meal, being carried to the uppermost floor, enters a cooler, which is a circular vessel, about 9 feet in diameter, and about 27 inches high, the sides being formed of galvanized sheet iron. There is a vertical spindle in the center, and at the bottom of this a horizontal arm provided with twelve wooden blades, so set that they spread the meal as evenly as possible, and gradually move it out to the circumference of the cooler. At one part of the latter, there is a hopper opening into a spout, by which the meal is conveyed to the floor below, where it is subjected to the first dressing process, the object of which is to separate the bran. The dressing machine may be described generally as a large wooden case, in which revolves horizontally a six-sided framework of wood, having a peculiar kind of silk fabric stretched over it. Inside the silk covered framework there are a number of wooden blades set obliquely, so as to carry the bran forward to the further end of the machine, the coarse dressed flour meanwhile passing through the silk into the screw elevator, which conveys it to another cooler in the floor above. There are four of these coolers, all in the fifth or upper floor of the mill. Messrs. Tod & Co. are also preparing to erect, in addition



THE COMBINATION FOOT LATHE.

is then sold by the 1,000 feet. The finest qualities of rattan are used by whip makers. This large and constantly increasing business may be estimated by the fact that one factory in New England alone employs 1,000 operatives, and that the total number of people working in rattan (the schoolmasters excluded) is fully 1,800. The capital used in the manufacture of rattan is about \$2,000,000.

tion to the grinding stones, a number of steel rollers, similar to those used in the mills of Hungary for the production of that superior class of flour known in the trade as Hungarian whites. When the mill, as at present designed, is complete, the making power will not be less than 3,000 sacks per week. The steam power for these varied operations is generated in a pair of horizontal multitubular boilers, 19

feet long by 16 feet in diameter, working to a pressure of 70 lbs. per square inch, and supplied by Messrs. Lees, Anderson & Co., Clyde street, Anderston: the pair of fine engines by which the machinery is driven have also been supplied by the same firm, and are diagonal compound high pressure, both high and low pressure cylinders working on the same crank pin. The high pressure cylinder is 16 inches in diameter, that of the low pressure cylinder being 24 inches, and length of stroke 30 inches. In the former there is an expansion valve so arranged as to cut off the stroke at any point, from 5 inches to 20 inches, and which can be varied at will while the engines are working at full speed. They are regulated by Scott's Moucrieff patent governor. There will also be a small engine for the hoisting machinery in the grain store, and working separately. The architect of the building is Mr. W. Spence; while Mr. W. Young, flour mill engineer, has constructed and superintended the erection of all the varied and complicated mechanism of store and mill, with the exception of the engines, boilers, and millstones. Mr. Young's new cooler has been adopted here for the first time.

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THE LIGHT OF COMING DAYS.

The light of other days—practical, not poetic—was the tallow dip, and, further back, a bunch of moss in a dish of grease. The advance from this primitive illuminator to the gas jet covers a most important stage in the progress of domestic economy. To make the illuminating material distribute itself was a capital stroke of policy. By most people it is regarded as the final stroke in the conflict with the shades of night. But it falls very far short of it.

Before we can truly say that our streets and houses are lighted scientifically, another and more important advance must be made. We must get rid of the offensive and poisonous products, the heat and flickering, the sharp contrasts of light and shade, the needless expense and frequent fires, and the thousand other disadvantages attending the distribution and local combustion of our illuminating material, by distributing instead pure light.

The problem is simple and easily solved. What we want in our rooms is a clean, white light, like diffused daylight. The popular mistake lies in supposing that the light must necessarily be generated where it is used. The remoteness of our natural illuminators ought to teach us the absurdity of such a position.

Every tyro in optics knows that light is the most tractable of material effects. It is obedient to the last degree. You can send it where you will, to any distance, through the crookedest channels, through the darkest passages, and it will emerge undimmed, ready to be absorbed or dispersed as the operator may wish.

It is well known also that there are many ways of producing a brilliant light, much more easily and economically than by carbon combustion in small and scattered flames. Yet, curiously, this familiar knowledge does not appear to have ever been put to practical use in producing a simple, wholesome, agreeable, scientific illumination for public and private buildings. To our children, the old fashioned candle snuffers are unknown, or known only as relics of an antiquated system of domestic economy. It is possible that, to their children, gas pipes may be equally obsolete as articles of household use, light tubes furnished with reflectors and terminal radiators taking their place.

The working of the predicted system can be sketched in few words. Given, say, a large hotel to be furnished with artificial light: Instead of having a network of gas pipes leading to the different rooms and to different burners in each room, according to the present method, the light for the entire building would be generated in one place, say in the main ventilating shaft for the utilizing of the surplus heat. The distribution of the light would be effected by means of reflectors, each throwing into its appropriate tube a bundle of rays (made parallel by a lens) sufficiently intense to flood the room to which they were directed with a pure white radiance, which could be turned on or off or graduated by simply pressing a knob or turning a key. In size, the light tubes need be no greater than ordinary gas pipes. Indeed they might be much smaller, since all the light required for the largest room might be transmitted to the reflector as an extremely slender beam. The terminal lenses would close the tube against smoke and dust, which would dim the reflectors at the angles; and by keeping the enclosed air pure and dry, the absorption of light would be inappreciable.

The advantages of this mode of illumination are many and obvious. There would be no poisoning of the atmosphere by local combustion; no scattered flames to occasion fires; no circulation of combustible material to encourage fire, should it happen to break out; children and careless servants would have nothing to handle that could possibly do damage; there would be no misplaced heat; no smoke or odor to sicken or annoy; no cross lights or flickerings to hurt the eyes. Besides, the lighting of a house would help to purify its atmosphere, instead of vitiating it as now, if the source of light were placed, as we have suggested, in the ventilating shaft; and, very likely, the economy of the light would be such that means for the instantaneous illumination of the entire house could be maintained at all hours of the night without costing more than our present imperfect and partial lighting does.

For churches, theaters, and other places of public resort, this method of lighting is specially available and inviting. The source of light might be in an absolutely fireproof vault or chamber, or in a separate building, so that the danger of accidental fires, with their attendant evils, would be reduced to the minimum. Similar advantages would attend its application to shipping. For mines, especially coal mines, it is unapproachable for simplicity and safety. Smoky torches and treacherous "safety lamps" might be entirely abolished, and the deepest pits flooded with white light, without flame or the shadow of a risk of explosion.

A CHANCE FOR INVENTORS.

While there is reason to doubt the possibility of devising an electric motor capable of doing heavy work as economically as the steam engine, there can be no question that, for light service, a satisfactory electric engine is one of the most widely felt needs of the age.

All that is lacking to meet this want is a suitable battery; in other words, a simple, compact, portable, and, if possible, dry apparatus, capable of generating a steady current of electricity for a considerable period without renewal, capable of standing unused without material waste, yet able to give out its full power on the instant when required, capable of being easily and cheaply kept in working order, free from fumes, and not liable to leak or spill its contents under ordinary circumstances.

The applications which await such a battery are practically innumerable.

Even with the fuming, slopping, troublesome batteries already in use, enough has been accomplished with electric motors to demonstrate the superiority of electricity for light work. Everything that steam can do in such cases it can do; and there are many occasions, domestic and otherwise, where steam power cannot be conveniently employed, where a small electric engine might do the required work quickly, neatly, without heat or risk of explosion, and without calling for special engineering skill or knowledge, the common lack of which must ever act as a bar to the general employment of steam for household service. And though the power obtained may be, in itself, many times more expensive than an equivalent amount of steam power, the advantages attending the use of electricity are so pronounced, the possible saving of time and trouble so great, that, with a generator such as we have described, there would be no hesitation in giving it the preference in thousands of cases where a little power is wanted for continuous work, or where there is occasional need of a small but instant effect.

Take, for example, that almost universal household necessity, the sewing machine. How immensely would its usefulness be increased by an acceptable means of running it: a motor which would require no winding up, which would not easily get out of order, which would be always safe, always

ready, and perfectly under control! A man who should devise a battery to meet this demand alone would be sure of a fortune.

But this is only one of a countless number of uses to which such a battery might be put.

In almost every civilized home, there is water to pump, washing machines to operate, wood to saw, coal to lift, and a multitude of other labors, all of which might be done advantageously by simple electric motors, provided the requisite battery were forthcoming. Besides, there is light to furnish, doors and windows to guard against burglars, errands to run, and accidental fires to report. It is not impossible that the common dwelling house of the future will rival Houdan's in the diversity and completeness of its electrical appliances; yet, without entering the region of speculation or looking beyond the simple daily needs of ordinary households, there is a present call for the services of this fleetest, neatest, and most tractable of servants, sufficient to ensure wealth and renown to whoever shall capture and harness him satisfactorily.

For light manufacturing purposes, the call is equally urgent. In every workshop where steam is not used, there are presses, saws, lathes, drills, and numberless other present or possible machines, to which electric motors might be profitably applied. For amateur workmen, nothing could be more desirable or more likely to meet with immediate acceptance. Then what an admirable contrivance it would be for driving light wagons or propelling pleasure boats! There would be no fuel to carry, no fire to watch, no possible explosion to fear: there would be no stabling or grooming to pay for, and no food to buy for the hours of idleness. Mr. Bergh ought to offer a premium for the invention, simply for the sake of the animals he loves.

Where the range of application is so great, it is needless to multiply examples. Our purpose is to suggest, not to demonstrate, the multitudinous uses to which a satisfactory electric motor may be put, and to call the attention of inventors to the certain reward that will come to whoever shall overcome the last remaining obstacle.

A CITY BUILT BY ONE MAN.

History affords numerous instances of the foundation of cities by single individuals, and the beautification and enlargement of portions of the same through the munificence of others; but nowhere, as we believe, is it recorded that any one man from his private fortune has ever attempted the actual construction of a complete town. All the more remarkable, therefore, is the enterprise which for some five years past has been quietly pursued by Mr. A. T. Stewart, a gentleman of whose immense wealth no accurate information has ever been made public. The high rates of taxation and the consequent exorbitant rents incident to ownership and occupation of dwellings in New York city have been the means of virtually banishing a large number of persons doing business therein, whose moderate incomes forbid the necessary expenditure, to the adjacent suburban districts. Hence arose a great demand for cheap homes; and as a result, village after village has sprung into existence in Long Island, New Jersey, and in fact at every point within a radius of forty miles of the metropolis.

Mr. Stewart, in view of this constant exodus of the city population, conceived the unique idea of building a model suburban city, where comfortable homes, provided with all modern improvements, could be obtained for a moderate outlay. Accordingly, he purchased a plot of land, ten thousand acres in extent and embracing that portion of Long Island known as Hempstead Plains. This is in a compact tract of about ten miles in length by one mile in width, and nearly a perfect parallelogram in shape. Surveying and staking out the new city followed close upon the acquisition of the ground, and the first work taken in hand was the making of streets and avenues, with pavements, sewers, culverts and conduits, for blocks of buildings yet to be erected. Simultaneous with laying the foundations of the houses, was the commencement of gas and water works, and of a railroad connecting the city with New York. Unlike the usual course adopted in projecting new towns in the vicinity of the metropolis, no lots were advertised; nor has any attempt been made to dispose of the property, as it is the intention to treat the city as a single house, finishing it first, and selling it subsequently. The New York Sun aptly describes the enterprise as a new city springing up, with no Mayor or Council, no assessments for street improvements, no taxes for water and gas, no entangling alliances or issuing of bonds to secure railroad transportation, no scrambling or grumbling to secure immigrants.

An admirably kept hotel, situated in the middle of a fine garden plot, together with some forty houses, are thus far complete. The latter are located in lots of 200x200 feet and provided with outhouses and handsomely laid out grounds. They rent for from \$250 to \$800 per year on three year leases, and contain every convenience found in the best city dwellings. Work upon this remarkable town, to which the name of Garden City has been given, is rapidly progressing, and we understand that the advantages offered are meeting with a wide popular appreciation.

GERMAN RAILWAYS.—It appears that, in consequence of the increased cost of railway working in Germany, as well as in other parts of the world, the rate of interest realized, on the capital expended on first establishment account, declined last year to 4.4 per cent. In 1869, the corresponding return stood at 6.4 per cent. An augmentation of 10 per cent in goods rates is required in order to secure an average interest of 5½ per cent on the capital expended.

FIRE DAMP EXPLOSIONS PRODUCED BY SOUND.

The paper recently read by Mr. William Galloway, Inspector of Mines, before the English Royal Society, is a valuable and important contribution, marking, we trust, the beginning of further investigations into the prevention of the accidents and large loss of life in mines, due to explosions of fire damp. The Davy safety lamp has been heretofore considered safe under all circumstances except when exposed to the action of an explosive current, when the flame might be driven through the meshes of the wire gauze and so cause an explosion. But disasters occurring in British collieries where the lamp was used becoming too frequent to be reasonably ascribed to the existence of the above exceptional conditions, various theories have been suggested; and in cases where no plausible ground for the same could be found, carelessness of workmen appears to have been the general assumption.

In the year 1866, a great explosion, occurring in the Oaks Colliery, happened simultaneously with the firing of a heavily charged shot in pure air. Attention was drawn to the coincidence; and from examination of the reports of the mine inspectors, it was found that shot firing was carried on in seventeen of the twenty-two collieries in which explosions had happened since the date of that above mentioned, and the details given prove that shots were fired at or about the time of each disaster.

In 1872 Mr. Galloway conceived the idea that a sound wave, originated by a blown out shot, in passing through a safety lamp burning in an explosive mixture, would carry the flame through the meshes of the wire gauze in virtue of the vibration of the molecules of the explosive gas; and to test this view, he instituted a series of experiments under the auspices of the Royal Society which adduced perfectly conclusive results.

We find in *Nature* a record of these interesting trials. The first consisted in directing a slow current of gas and air from a Bunsen burner through a sheet of wire gauze inclined at an angle of 70°. Part of the explosive mixture passed through the gauze and produced a flat flame. A glass tube, 3 feet 4 inches long and 3½ inches in diameter, was placed horizontally with one end opposite the flame on the same side of the wire gauze, and distant from it about 1½ inches. At the other end of this tube, a sound wave was produced by exploding a mixture of coal gas and oxygen contained in bubbles. When the sound wave passed through the tube, the flame was carried through the gauze and ignited the gas in the Bunsen burner on the other side. Paper and other diaphragms, inserted at a distance of 10 feet from the origin of disturbance, ensured that only the sound wave was propagated through the tube.

More elaborate apparatus was then constructed, so arranged that the sound wave of a pistol shot was conveyed through tin plate tubes to a distance of about 20 feet, where it passed through a safety lamp burning in an explosive mixture. The Davy, Clanny, Stephenson, Mueller, and Elvin lamps were all tested, with, however, the results that, while the flame passed easily through the Davy lamp, it passed with more difficulty through the Clanny, and not at all through any of the others.

After this, experiments were made on a larger scale in a sewer, where it was found that 109 feet was the greatest distance a sound wave could be propagated of sufficient intensity to pass the flame, when caused by the discharge of a pistol loaded with 59 grains of powder. The sewer was built of brick, and was 6 feet high by 4 feet wide.

Mr. Galloway's discovery, that, when the vibration of the air which constitutes a sound wave has a certain amplitude, it can transmit flame through the wire gauze of the Davy and Clanny lamps, furnishes an additional argument against trusting the lamps in use among ordinary workmen. It is now almost universally admitted, says the discoverer's paper in conclusion, to be highly dangerous to continue work in an explosive atmosphere; so that safety lamps should be used only as a precaution against possible outbursts of gas, or when work is carried on in the neighborhood of gas that cannot be easily dislodged; it is evident therefore that lamps, constructed on the principle of the "safety lantern," such as the Stephenson, Mueller, etc., which are extinguished in an explosive mixture, are far safer than lamps like the Davy and Clanny, which continue to burn under the same circumstances, and are then liable at any instant to have the flame driven through the wire gauze, and communicated to the external explosive atmosphere.

PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

This association opened on August 12, its twenty-third session, at Hartford, Conn., under the presidency of Dr. J. L. LeConte, of Philadelphia. Judging from the numbers, as well as the high standing of the attending members, the meeting bids fair to be one of much interest. The President, in his

OPENING ADDRESS.

said that the past year was noteworthy for four events. The first was the appearance of Coggia's comet, from the spectroscopic examination of which the happiest results may be expected. Already the spectroscope has proven to us that even though the largest of comets should strike the earth no possible harm could ensue. We may learn that our planet has been in fact benefited by occasional collisions and absorptions. The second event is the establishment of the Anderson School, at Penikese, for instruction in Natural History. This fact connected with the organization of this school, and its munificent endowment by Mr. Anderson,

were briefly rehearsed. The third event of the year is the act of Philadelphia in the establishment of a zoological garden. The last event is the introduction into the United States of civil hospitals built on the plan which is known in every other civilized nation as the American system.

The matters of interest that were to come up before the Association were then briefly summarized, chief among which was the adoption of a new constitution.

The formal opening of the session included a speech from the chairman of the Local Committee, Hon. H. C. Robinson, and a reply by President LeConte. The work of organizing was then proceeded with, and the officers of the various sections elected.

We give below our usual abstracts of the papers thus far read:

Professor H. P. Armistead, of Milbury, Mass., on the subject of

THE NITROGEN OF THE SOIL.

said that it has become an important problem in agricultural chemistry to ascertain the source whence plants derive their supply of that element. Lawes, Gilbert, and Pugh showed that the cereals, at least, are incapable of assimilating free nitrogen from the air; and this is probably true of all plants. The author made a series of experiments to throw light upon the loss and gain of nitrogen, the method adopted being to allow organic matter, containing a known amount of nitrogen, to decay under circumstances in which all the nitrogen given off or accumulated could be measured. The results show a loss of nitrogen in nearly all cases. The following conclusions sum up our present knowledge: 1. The loss of free nitrogen during the decomposition of nitrogenous organic matter is generally due to oxidizing action. 2. An increase of combined nitrogen in soil may take place by oxidation of free nitrogen to nitric acid. 3. Some organic substances in the presence of a caustic alkali are able to fix free nitrogen without the agency of oxygen or the formation of nitric acid.

The results of Professor Pliny Earle Chase's communication, on

THE VELOCITY OF PRIMARY UNDULATION,

are that, adopting Struve's constant of aberration, we find that the constant velocity which would account for all the gravitating motions of the solar system is almost, if not exactly, identical with the velocity of light. The well known thermodynamic principles which point to a gaseous structure of the sun seem to be confirmed by this investigation. The following relationship may, perhaps, prove to be something more than merely curious: The number of vibrations in the unit of time of the mean thermodynamic rays is very nearly, if not exactly, equivalent to the cube of twice the sun's mass divided by Jupiter's mass.

Professor E. T. Cox, State Geologist of Indiana, followed with an account of an ancient stone fort, existing in Clarke county, Ind. It is a relic of the moundbuilders, and presents some peculiar features of construction adapting it excellently for a defensive work.

Professor A. S. Packard, Jr., read a paper on the

CAVE FAUNA OF THE MIDDLE STATES.

The results show a great uniformity in the distribution of life—more than would at first be expected, though these caves lie in a faunal region nearly identical as regards the external world, and the temperature of the caves is very constant. Still some notable differences occurred.

The basis of life in the caves is without much doubt the living and decaying animals found in them. While 25 to 30 species were known to inhabit our caves, chiefly through the labors of Tellkamp, Cope, Cooke, Dr. Sloan and others, we are now able to add 50 species to the number, which will probably be carried up to 100.

DIFFERENCES IN SOLAR HEAT.

Professor J. P. Langley remarked that there is a variation in both the heat and light, and probably also in the actinic force, of different parts of the sun. The difference is due principally, but not wholly, to difference in atmospheric absorption.

It does not appear, as the result of experiments, that there is so great a selective absorption of heat, in the lower regions of the sun's atmosphere, that, when rays come from the edge of the disk and pass through a greater proportional thickness of his atmosphere, the heat is filtered from them and the light allowed to go through. We find that the heat falls so very rapidly toward the edge as to indicate a much greater thinness, of the solar chromosphere, than has been hitherto admitted. We appear to have been led to the conclusion that there is a local obscuration over the spot, very remarkable both in degree and kind.

Professor E. S. Morse, in a paper on the

NORTH AMERICAN UNIONIDE.

explained why the union or fresh water mussels are so much more abundant in the United States than in Europe. He emphasized particularly the fact that most fresh water families of mollusks were closely related to those families in the sea which survive the admixture of fresh water, and that commonly occur between high and low water marks.

Professor LeConte gave an interesting account of the rite of cremation as practiced among the Yuma Indians, and noted among other proceedings the removal of the eyes of the deceased, which were put on pointed sticks and held out toward the sun. This indicates a feeble remnant of the widely diffused sun worship of former times.

Professor Lovering, President at the last meeting of the Association, read an address on

RECENT ADVANCES IN SCIENCE.

Wheatstone, he said, by a revolving mirror, determined the velocity of electricity, the duration of electrical discharges, and the duality in the direction of the transmitted disturbance. Feddersen, and more recently our own associate, Rood, repeated his experiments. Indirectly the velocity of electricity thus ascertained (and the greatest known except that of gravitation) has been tested by signals through long lines of land and ocean telegraph, giving a lower figure than that of Wheatstone. But the anomaly is due to a misinterpretation. That electricity moves through a quarter of a mile of wire at the rate of 288,000 in a second is not evidence that it would move over 288,000 miles in one second. Electricity has no velocity, in the ordinary sense. The transmission of the electrical disturbance is proportional to the square of the distance to be traveled; therefore the velocity varies with the length of the journey.

Had the results of Ohm been sooner heeded, Science would have long ago been materially advanced. Arago, making use of Wheatstone's method, proved experimentally that the velocity of light was greater in air than in water, giving a fatal blow to the corpuscular theory of light and establishing the undulatory theory. The mean of the two values obtained for the velocity of light in the experiments of Fizeau and Foucault, comes very close to the astronomical estimate. Cornu has repeated Fizeau's experiment, eliminated its errors, and brought it into accord with Foucault.

Foucault's experiments intensified the doubt that astronomers had long entertained as to correctness of the received distance of the sun. The "black drop" in the transit of Venus has been found the basis of uncertainty. Mr. Stone, an astronomer, has examined this source of error, and, by calculations that give due weight to this source of discrepancy, has suddenly brought about a reconciliation between the experiments of Cornu and Foucault, the motions of the moon and the transit of Venus, which is as perfect as it is surprising.

In reviewing the advances of natural history, Professor Lovering spoke of the discoveries in that science made by Maupertuis and Lamarck, and considered them in connection with the nebular hypothesis as originated by Laplace and carried forward by the elder Herschel. The fate of the nebular hypothesis is as yet uncertain, but it will answer the purposes of Science till a better theory is brought forward.

The motion of the fixed stars involves a most interesting inquiry. A motion has been observed, absolute in the case of the sun, and capable of estimate in the different stars as fast as their distances are determined. Here again spectroscopy has come to our aid. The alteration of wave lengths of light, by the motion of the observer or the object observed, has helped and is helping to solve this problem. This discovery was then historically reviewed, going back to the discovery of the velocity of light by observations on the calculations of Vogel and Huggins on the displacement of star spectra, which are to be received as somewhat doubtful approximations. There is, too, the possibility that the misplacing of the lines of sodium, hydrogen, and other elements may be due to conditions different from any we know on earth in the gaseous atmospheres of the stars.

The observations of Huggins on star drift open a new series of questions, and may possibly throw discredit upon the accepted estimates of star distances, made independently by Struve and Argelander. Van der Willigen, in the present year, has published a well considered memoir on the fallacies which he regards as vitiating the conclusions of Huggins. Except under certain improbable conditions, he shows that the motion of the luminary will not interfere with the time of oscillation. If this be accepted, the supposed motion of the stars must receive another interpretation. On the other hand, if the motion of a luminary is ascertained, and it is found to accord with spectrum displacement, the mathematical theory will have to be reconsidered.

Professor Challis, in an elaborate work, has discussed the interplay between ether and atoms, and the theory may now be regarded no longer as a speculation, but as a physical reality, with substantial mathematical supports. He does not yet claim full mathematical proof, but his work is a guide post that unmistakably points the way. In one respect the theories of Le Sage and Challis coincide: the driving storm of atoms must come from outside the world of stars; the universe is not even temporarily automatic, but must be fed continuously by an agency external to itself. Our Science thus is not a finality.

The law of conservation of energy, the child of the correlation of physical forces, was then considered in a brief historical review. Physical science can only assert that it possesses no evidence of the destruction of matter. We have no conception of inert matter or disembodied force. All we know of matter is its pressure and its motion. If it could be shown that all the phenomena displayed in the physical world were simply transmutations of the original energy existing in the molecules, physical science would be satisfied.

The great problem of the day is how to subject all physical phenomena to dynamical laws. The obstacles are innumerable, but we shall not rest till they are overcome. We applaud with good reason the brilliant results of experimental research, but mathematical analysis, with its multitudinous applications, is the only key which will fit the intricate wards in the treasury of Science.

A CORRESPONDENT, C. R., says: A worn out watch key can be made as good as new by simply filing off about 1/8 of an inch of the end, as the socket is usually twice as deep as the post of the watch is high.

A PORTABLE RAILWAY.

We give herewith two illustrations representing a novel portable railway, lately devised in France by M. Corbin. The invention is one having a wide range of applications, since it may be employed in any locality about which it is desirable to transport masses of bulky material. Our engravings, which we extract from the *Magasin Industriel Belge*, show the railway in use in a brickyard and also in a harvest field.

The track used is of wood, and consists simply in longitudinal pieces joined by cross bars, and made in lengths of a size to be easily transported. These are laid in position wherever required, and serve as ways for the trucks, which are nothing more than rectangular platforms, having a pair of small wheels at one end and an attaching apparatus at the other. A number of these vehicles are joined together to form a train. In brickyards the bricks are piled directly upon the platforms, as shown in the engraving. In the gathering of agricultural products, baskets are employed, which are carried to various portions of the field, and thence taken to the trucks for transportation.

The inventor says that, with ten trucks and twenty baskets, half of the latter being constantly in use, four workmen can pull and transport, to a distance of 800 feet, 40 tons of beets or like vegetables in a day. One man, he adds, can easily draw the ten loaded trucks, with over a ton of contents, along the ways.

The railway is excellently adapted for transporting material over soft or plowed ground, and might be used in all operations requiring the removal of stone and earth. With the aid of a horse, a still larger number of trucks than above mentioned may be moved at once.

Foundry Charcoal.

The part which the charcoal plays in the molds is to give porosity and facilitate the escape of the gases and steam caused by the molten metal. There are three sorts in use in French foundries, known as mineral charcoal, vegetable charcoal, and stove charcoal. The first of these is made from coal finely pulverized, and is mixed with the sand used for casting pieces of small dimensions and little thickness; these molds are called green sand molds. But all sorts of coal are not equally good for the purpose; some kinds give a white appearance to cast iron, and produce on the surface, and chiefly at the extremities of the castings, rough spots which the file will not touch, and which have the appearance of having been run at too low a heat. M. Mailfert has tried many kinds and finds that *gras* or bituminous coal is the best, and says that, when used in small quantities and finely sifted, its action is perfect, and it gives to the casting that bluish luster which is highly esteemed.

The vegetable charcoal is made from carefully selected wood, burnt in a special manner. The principal quality required in it is that it should not catch fire, and it is used principally for powdering the surface of the mold so as to prevent the contact of the molten metal with the green sand. It is reduced to such impalpable powder that the spatula used for spreading it in the mold gives it a surface almost as brilliant as glass; it is called *gras* or fat charcoal, a quality derived from the mode of burning, and it will neither roll before the trowel or spatula nor stick to it.

Stove black is used for the same purpose in the case of large castings, as the other kind will not bear excessive heat. This is simply mixed with water and applied rather thinly. A thick coating is not considered good.

The Remarkable Quicksilver Mines of Colusa County, Cal.

The Elgin mine is as yet undeveloped, but the richness of the prospect is self-evident. Everywhere seams of the richest ore are revealed to view, and ere long it will turn out to be one of the richest mines in that vicinity. The Elgin company opened their mine about six months ago, and have now

a force of ten men, together with a retort, from which they run four flasks per week. They are busily engaged in running tunnels, and ere long we will hear of a big strike for the Elgin. This mine is under the superintendence of J. Melbourne. While we were present, they ran off a retort of 34 per cent ore.

The Abbot in richness is undoubted. Ten experienced miners are continually employed in extracting furnace ore, and the work goes on night and day. They are now busily preparing to build a furnace at a cost of \$10,000.



PORTABLE RAILWAY IN A BRICKYARD.

The Buckeye is the best developed mine in this region. Seams of the richest cinnabar are plainly visible wherever the eye glances, and from this mine very little waste rock is extracted. The Buckeye runs a force of twenty eight men steadily, and retorts weekly fifteen flasks of quicksilver. A flask is considered worth \$100.

The Empire is a new and rich prospect, struck but a month ago. The value of this mine is in the small amount of labor necessary to work it, it being all clay soil, composed of magnesia, lime, and cinnabar.

The mines in this section of our county excel all we have seen in richness. The very best ores, which will average 30 per cent, are found on the surface of the hills.

A WONDERFUL GAS WELL.

We cannot forget, says the *Colusa Independent*, to make mention of the gas fire which issues from the mountain in close proximity to the Elgin mine. The side of a hill is all ablaze,

The construction of the station was commenced in February, 1872, and necessitated the removal of a large area of old buildings that were alike unsightly and unsavory.

The works were designed by Mr. W. Mills, C. E., engineer-in-chief of the London, Chatham, and Dover Railway.

The station works commence at Ludgate railway bridge, and extend for the low level through lines to a point on the north side of Holborn Viaduct, on which the low level station is situated, with entrances from the viaduct and from Snow hill. At the end of the Ludgate bridge the four lines of the Chatham Company diverge, two lines being carried to the high level terminus, at which they spread out to seven lines, and an engine line. Two lines descend by the low level to the Metropolitan underground system. The rails at the bridge are 59 feet above Ordnance datum; at the platform they are 4 feet higher. The ascent is by a gradient of 1 in 100 for 400 feet; thereafter the rails are level for about 900 feet. The descent to the low level is by a gradient of about 1 in 40.

One of the remarkable features of the works is the extraordinary strength of the piers and girders that bear the west end of the superstructure that faces the Viaduct. The piers that carry girders have first of all beds of concrete about 7 feet thick resting upon the London clay. The foundations are 19 feet by 16 feet at the base and are built first of beds 2 feet thick, of gault brick, diminishing upwards to the dimension of 11 feet of Staffordshire blue brick for 4 feet in height; again, to a width of 7 feet 3 inches, and, finally, they are contracted to the massive stone piers of 3 feet 9 inches on the side. There are five of these piers in all; they and the girders are so constructed and placed as to admit of a future widening of the road by the addition of other two lines of rails. The box girders that carry the end of the hotel above are 5 feet by 3 feet 9 inches dimensions, and weigh each about 45 tons. The extreme length, supported in the center, is 74 feet; the maximum span is 30 feet continuous. The girders—which weigh about 400 tons in all—were placed in their respective positions without any interruption to the traffic.

The high level station is about 750 feet in length by 137 feet in width. The roof, in three bays, is on lattice girders, and supported upon three ranges of columns of twelve each, 21 feet high. There are ornamental iron spandrels at the heads of the columns. The angularities of the station area are covered in with lateral Paxton roofs. The cab approach is by a winding entrance after the manner of Charing Cross station, from Farringdon street and Bear lane; the exit is by the front from the arrival platform to the viaduct. Lifts are provided at convenient points for the interchange of luggage between the high and low level platforms, between which excellent communications are also provided for passengers. The ground floor of the front building is appropriated to booking offices, station master's office, waiting rooms, restaurant, and other accommodation required for the traffic. A communication is open with the hotel at the east end of the cross platform. The main front building has a façade 235



PORTABLE RAILWAY IN A HARVEST FIELD.

and has been so for eight years, when fire was communicated, to the gas which emitted, by M. G. L. Eaton, and has been burning steadily ever since. This accrues enormously to the richness of the Elgin, as they can run their furnace with little or no expense. An escape is now taking place of 125 cubic feet, sufficient to run a dozen furnaces.

This portion of our county abounds in quicksilver wealth, and those owning mines will at first have to encounter difficulties, but ere long they will overcome the hardships of developing their mines; and in all experience with regard to mineral wealth, Colusa has the richest.

Holborn Viaduct Station, London.

This commodious station is at once an important addition to the railway accommodation of the city of London, and one of the most notable among the many remarkable transportation that have occurred.

feet long, of which 182 feet by 29 feet is a covered fore court to the station, with a range of arched openings to the street. It is roofed with transverse arches, filled in with white glazed tiles, and, for the carriage way, paved with Charley Forest 3 inch cubes, with a foot pavement along the inner sides and the ends of the court. A massive trussed cornice is carried along the front over the arched openings, which are closed at the bottom by a balustrade. Gas lights, with an ornamental wrought iron railing, will be fitted on the coping of the balustrade. Ornamental pateras are introduced in the spandrels of the arches.

The station roofs give abundant light by the broad belts at the ridges that are filled with 21 oz. rolled plate glass. Appliances for ventilation by louvre openings are also very complete.

The arches beneath the high level station are utilized by the Company for stables.

FABRIC PRINTING MACHINE.

We present herewith an engraving of a machine for printing textile fabrics in eight colors, the invention of Herr C. Bialon, of Berlin, Germany. It is of the form known to calico printers as a perrotine, a term used to distinguish those presses in which the printing is effected by flat forms which produce an embossed design, thus imitating the work of hand printing. *Engineering*, from which we copy the illustration, describes it as follows:

$a_1 a_2 a_3 a_4 a_5$ are the forms, fastened to iron supports, which are carried by the pressure bars, $b_1 b_2 b_3 b_4 b_5$. These latter execute an interference motion, which, as may be examined in the case of the pressure bar, b_1 , is produced by the two crank pins, c and d —of which c makes twice as many revolutions in a given time as d —by the joint levers, e and f , and the stay or frame, g . Through the rotation of the crank pins, c and d , the forms are at first fully drawn back, while, by means of a special combination of levers, all the color plates, h , are placed between the forms, $a_1 a_2 a_3 a_4 a_5$, and the printing tables, $i_1 i_2 i_3 i_4 i_5$. The color plates are flat cast iron plates covered with an elastic material, upon which color is transferred while passing the color rollers, $k_1 k_2 k_3 k_4 k_5$. The printing tables, which are also covered with an elastic material, serve as a support for the stuff during the operation of the printing. The stuff to be printed is rolled

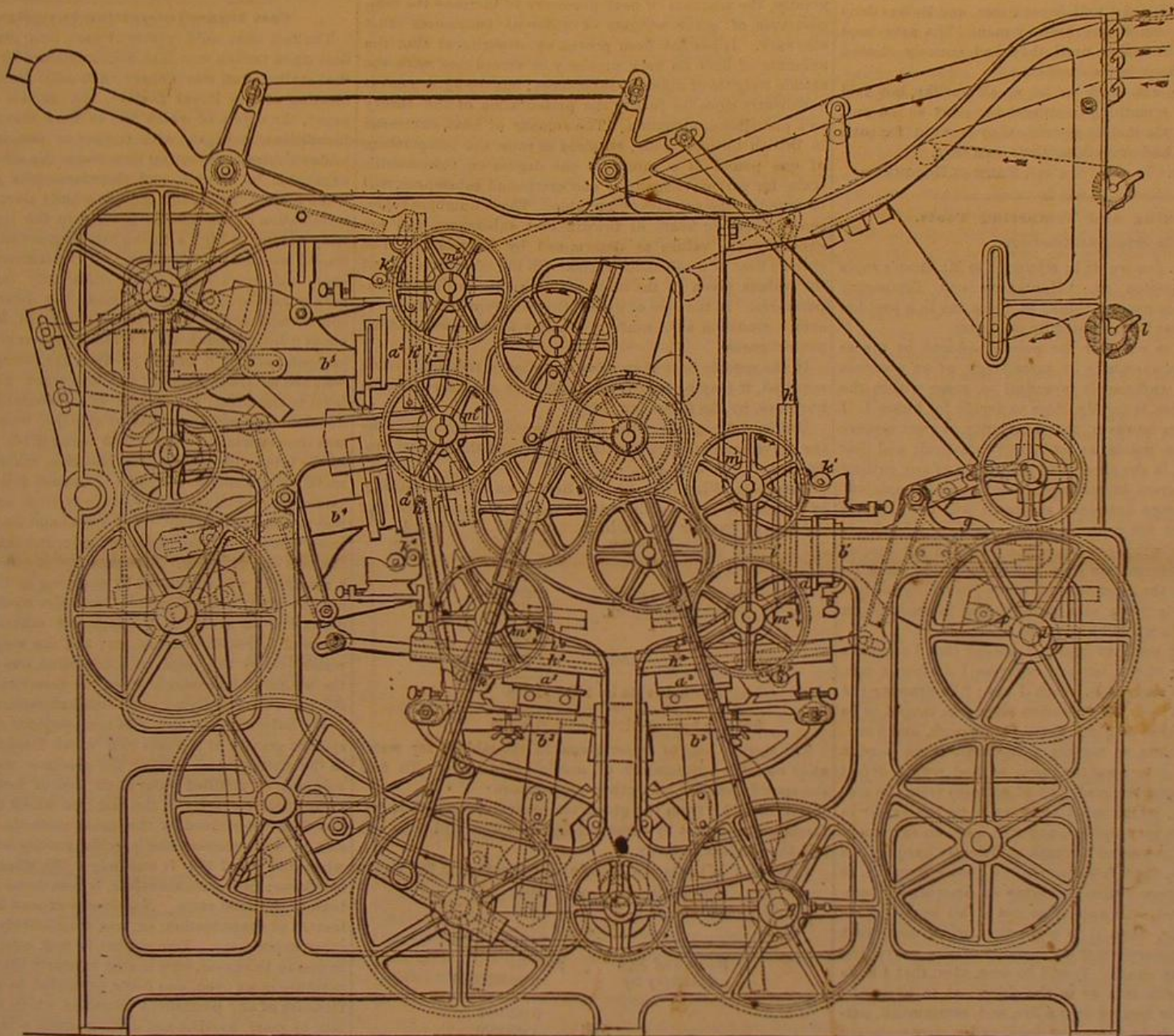
and the wheel, p , but only in the direction indicated by the arrow, the wheel, n , not being moved when the rack is drawn back; this effect is attained by transferring the motion by means of a ratchet with wheel and brake. In order to shift the stuff exactly as much as required by the width of the form, the rack has to be adjusted for each width, and the position of the draw pin of the former, with respect to the center of the wheel, n , has to be altered accordingly, for which purpose the sliding piece is provided with a scale.

By a special contrivance it is rendered possible to cause each form to strike the stuff on one and the same place twice successively, after having taken up color in the intermediate time. This is accomplished by throwing the guide motion out of gear between the first and second print, whence the stuff remains in the same position during the two impressions. For this purpose the shaft, q , carries in front of the spur wheel an eccentric, which transfers during one revolution of the shaft, q , an oscillating motion to the lever, r , with its fulcrum at s , while at the following revolution the lever is kept in its position. In this manner the short arm of the lever, r , moves a conical slide, disengaging the trigger or catch which transfers the motion from the main guide wheel, n , through the spur wheels to the needle rollers, whence the latter are prevented from rotating. If the lever, r , passes back again into its original position, the guide again follows

and thence is lifted by elevators so as to flow into the machine. This is composed of a floor of iron heated by a fire under the feeding end. On the floor is a frame carrying a series of transverse scrapers which are so arranged as to revolve and scrape the bed. Their construction is also such that from each scraper, at its return stroke, a portion of the sludge is passed to the next scraper; so that the material travels the length of the floor, and emerges dry and pulverized. The heated air passes first under the floor and then over it. The machine is self-feeding, self-acting, and easily adjusted; it requires very little power to work it, and produces from three to four tons of dried manure per day of twenty-four hours, with a consumption of one ton of common slack coal.

QUICK REMEDY FOR SUNSTROKE.

Thirty or forty years ago, when our cities were not so crowded with ignorant laborers as now, and when ice water was almost unknown, there were but few cases of sunstroke. Yet, occasionally a native farm hand in the haying field would get overheated and chilled, and become senseless. A good doctor of that period used to use the following simple remedy in such cases, and never failed to restore the sufferer: As soon as possible, he poured a teaspoonful of laudanum down the man's throat; and in a very brief time, the



IMPROVED FABRIC PRINTING MACHINE.

off the beam, l , and passing over one stretching roller, three stretching bars, and a wooden guide roller, is carried by means of the needle rollers, $m_1 m_2 m_3 m_4 m_5$, over the printing tables, passing out of the machine at u , and being then led off to a drying apparatus. With a further rotation of the crank pins, the pressure bars advance so far only that the forms touch the color plates, the embossed designs of the former thus being caused to receive color from the latter. The pressure bars, $b_1 b_2 b_3 b_4 b_5$, are now withdrawn with the form covered with color, while the color plates pass back in the meantime to the coloring apparatus, where they receive a fresh supply. Another rotation of the crank pins advances the forms close to the printing table, and presses the design covered with color upon the stuff in front of the printing tables. After this operation the forms are drawn back, the color plates are again placed between the forms and the printing tables, and the same operations are repeated during the following rotations of the crank pins.

During the time the coloring plates are moved up and down again, or, in other words, during the time in which the forms are not in contact with the stuff, the latter advances as much as the width of the form (length of guide), so that the next impression takes place close behind the one previously executed. The stuff is moved forward by means of the guide mechanism, while the five needle rollers, $m_1 m_2 m_3 m_4 m_5$, are moved by means of spur wheels gearing into the main guide wheel, n ; this latter is put in rotation by the rack, o ,

the action of the rack. This arrangement facilitates finishing heavy stuffs, of which large surfaces have to be printed uniformly with color, in a clear and proper manner.

These machines are constructed for one, two, three, four, and five colors, and nearly 500 of them have been supplied to Germany, Switzerland, Austria, Russia, England, and this country. They are preferred to the cylinder printing machines, on account of the flat forms being considerably cheaper to produce than the engraved copper rollers of the cylinder machines, and on account of their being readily worked by manual power, while the cylinder printing machines require steam or other motors.

SCIENTIFIC AND PRACTICAL INFORMATION.

MACHINE FOR DRYING SEWAGE.

In preparing town sewage so as to render it available for fertilizing purposes, the most difficult part of the precipitation process is the drying of the deposit after the superfluous defecated water has been allowed to run off. Messrs. Milburn & Co., of Hatcham Iron Works, England, have, we learn from *Iron*, recently introduced a new machine for this purpose, which has given excellent results. The General Sewage and Manure Company of Whitby use the apparatus as follows: The sewage is first strained, then mixed with a chemical solution and partially defecated. Milk of lime is added, and precipitation takes place in large tanks. The precipitate drawn off from the latter goes to drying rooms,

sweat would start out and the man begin to revive. The quickness with which laudanum produces perspiration is remarkable.

A NEW NIAGARA BRIDGE.

Surveys are now in progress for a new bridge to cross the Niagara river just below Black Creek. The structure is erected in the interest of the Canada Southern Railroad in order to render that line independent of the present single track bridge, and also to allow its trains to go around Buffalo instead of passing through the city at slow speed. Suitable branch roads, connecting with the Erie and Central lines, will be built to carry out this purpose. The new bridge is to have a double track and double carriage, and will be completed, it is expected, in August, 1875.

THE WELLAND CANAL IMPROVEMENTS.

Canada is evidently omitting no effort in her plans for diverting our Western trade through her highways. The improvements now contemplated upon the Welland Canal include an entirely new and separate canal from Marlott's Pond, above Thorold, to Port Dalhousie; while from the Pond to Lake Erie the old work will be enlarged. The new line will be a trifle shorter than the old one, and will have one lock less. The average depth of water will be fourteen feet, so that, as regards the capacity of sailing vessels and propellers, Lake Ontario will be placed on a par with Lake Erie.

all such part of the immersed solid as is in a horizontal plane, or can be reduced to one. The repellent force has also relations to the difference in temperature between the solid and the molten metal on which it floats. The author then extends his experiments to lead and solidified iron furnace slag, with analogous results.

WHY SOLID IRON FLOATS IN MOLTEN IRON.

Two explanations, says Dr. Vander Weyde, are given of the floating of solid iron in molten iron. The first is that the iron expands in solidifying, as water does, and that therefore solid iron when heated is specifically lighter than liquid iron, and floats upon it as ice floats upon water. This supposition, however, is incorrect, inasmuch as it is based upon an erroneous assumption. Iron does not expand in solidifying, a fact of which any one may convince himself by brief observation in a foundry. The fact is just the reverse; the metal shrinks during solidification, after having been cast in a mold. By casting, for instance, a long piece in a vertical mold, the solidified piece will not fill the mold to the top, as did the liquid iron. The explanation given by Dr. Vander Weyde himself is that the iron is surrounded by a film of air adhering to it, which repels the molten iron and prevents contact; on which account the solid piece displaces more liquid metal than its own weight amounts to, and consequently it floats.

PRACTICAL MECHANISM.

NUMBER VII.

BY JOSHUA BORE.

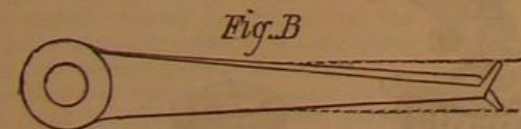
VISE WORK—TOOLS.

The tools used by the vise hand being nearly all supplied to him ready made, but few remarks need to be made to him upon the subject of their form.

CALLIPERS.

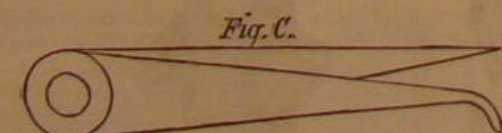
Outside callipers, that is, those used for measuring external diameters, should have larger rivets in them than they are generally given, a fair proportion being a rivet of one half inch diameter for a pair of callipers intended to measure up to diameters of seven inches. The points of such callipers should be tapered to a wedge shape, the tapering face being on the outside edge, so that the same part of the points of each leg will touch the work, whether the latter is of small or large diameter; the points where they meet together should be slightly rounding, so that they will touch the work at the middle of each point.

Fig. A represents an excellent proportion and shape for outside callipers. For use on threads, the points must either be made very broad, and come together level and even so as to gage the tops of the thread, or be made very thin, to gage the bottom of the thread. The proper shape for inside callipers is that given in Fig. B. The points and legs being made of the form here represented enables the callipers to have a large rivet and washer, and to enter a smaller hole, and clear a longer distance, than is possible where the points are bent round in the manner commonly employed. The dotted lines denote the distance the callipers would clear when in the position shown.



Another feature to the advantage of this form is that, when the legs are extended, the points are still at the extreme end of the callipers, so that the points will measure to the extreme end of the hole, even though the latter is closed by metal, that is, terminates in the metal. This is not the case when the calliper ends are bent round to the usual extent, for the curve of the bend will touch the end of the hole and prevent the calliper points from reaching it. In measuring with callipers, let the points be set to touch the work very lightly indeed, or they will spring from the pressure due to forcing them over the work.

Compass callipers, such as illustrated by Fig. C, are



valuable tools. When opened in the manner here shown, they may be employed to mark off the centers of holes or to try if a center already existing is in the exact center of the hole. Or they will mark off a face, so that it will fit another face, whether it be regular or irregular, the curved point being kept against the irregular face, and the point describing (by moving the compass along) a similar line on the face to be fitted. They will answer for many of the uses to which a scribing block is put; and being lighter and more easily handled, and, furthermore, capable of doing duty without the use of a surface or scribing plate, they are in such cases far preferable.

The legs may be crossed so that the curved point inclines to the straight point, in which position they will mark the

centers of shafts or rods, either round, square, or any other shape, or try such centers, when they already exist, more accurately than can be done by any other tool. They will, in this case, mark off a line at the distance to which they are set, round any surface; they are employed to mark off keyways, or the taper of a gib when the key and one edge of the gib is placed, and for a variety of other uses too numerous to recapitulate, being among the most useful tools the fitter can possibly possess. The points of callipers should be tempered to a blue, and of compass callipers to a straw color.

THE SQUARE.

The square is too common a tool to require any description of its form. The best method to make one is to make the back of steel, and in two halves, one half being the thickness of the blade thicker than the other. The slot for the blade must then be filed in the thickest half, to the depth exactly equal to the thickness of the blade. The two halves composing the back must then be riveted together, and the edges surfaced each true of itself (using a surface plate to try them), and also true with each other. The blade, which should be made of saw blade, may then be put into its place, ready to have the holes for the rivets drilled. It should be placed so that the outer end is a little depressed (on the inside angle) from the right angle; this is done so that what ever there may be to take off the blade (after it is riveted to the back), to make its edges form right angles to the back, will require to be taken off the outer end of the inside angle and the end of the blade forming the corner of the outside angle, so that no work will require performing on the blade in the corner, formed by the blade entering the back on the inside angle, where it would be difficult to file or scrape without injuring the edge surface of the back. The best way to true a square is to turn up a piece of round iron equal in length to the square blade, being careful to make it quite parallel, and then true up the end of the iron, making it hollow towards the center, or cutting it away from the center to within an eighth of an inch of its diameter, so that it will stand steadily on its end. If the piece of iron be then stood on its end on a surface plate, its outline on each side, which represents its diameter, will form a true right angle to the surface of the plate, and hence a gage with which to true the square.

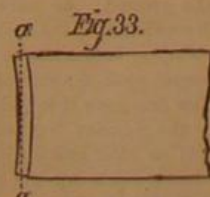
THE SCRIBING BLOCK.

This tool is made in a variety of forms, but the simplest and best form is that shown in Figs. D, E, and F. Fig. D is the block complete, the scriber being a simple piece of round steel wire. The dotted line on the foot is the distance to which the foot is hollowed out to make it stand firm. Fig. E is the bolt and nut; the bolt has a flat side filed on each side of it to fit it to the slot in the scribing block stem, so that the bolt cannot turn when it is being tightened. Fig. F is a face and edge view of the piece or clamp for the scriber which passes through the hole in the slot.

The advantages possessed by this form over other forms of scribing block are that it is easy to make, and that the scriber, being a piece of wire, is easily renewed. It holds the scriber very firmly indeed, and the scriber may be moved back and forth without the nut becoming slack, an object of great importance not attainable in the common form of this tool.

CHIPPING.

The chisel requires special notice, since it is frequently made of the most ill-advised shape (for either cutting smoothly or standing the effects of the blow), that is, hollow, as in Fig. 33, in which case there are two sections of metal, represented by the dotted lines, *a a*, which are very liable to break, from their weakness and from the strain outwards placed upon



them by the cut, which, acting as a wedge, endeavors at each blow to drive them outwards instead of inwards, as would be the case in a properly shaped chisel, as shown in Fig. 34, *a* being the cutting edge.

When using, hold it firmly against the cut, and it will do its work smoother and quicker.

The cape, or, as it is sometimes called, cross-cut chisel, is employed to cut furrows across the work to be chipped, which furrows, being cut at a distance from each other less in width than the breadth of the flat chisel, relieve the flat chisel and prevent its corners from "digging in" and breaking. If a large body of metal requires to be chipped off cast iron or brass, the use of the cape chisel becomes especially advantageous, for the metal, being weakened by the

furrows, will break away in pieces from the force of the blow, without requiring to be positively cut by the chisel; but care must be taken to leave sufficient metal to take a clean finishing cut, for when the metal is broken away, by the force of the blow, it is apt to break out below the level of the cut. It is also necessary to nick deeply with a chisel the outside edges of the work at the line representing the depth of the metal to be chipped off, so that the metal shall not break away at the edges deeper than the cut is intended to be.

FILING.

Large files should be fitted to their handles by making the line of the file a low red heat and forcing it into the handle, so that it will burn its way into the handle, and thus prevent the handle from splitting, as it would do if the file line were driven in; the file and handle should be turned in the hands occasionally to guide the eye in detecting whether the file is entering in a line with the length of the handle. Care should be taken to wrap a piece of waste around the end of the file, and to keep it wetted with water so as to avoid softening the teeth of the file while heating the line. For small files, it is sufficient to bore a small hole in the handle and force the line in by hand. A file should be held so that the butt end of the file handle presses against the center of the palm of the hand, the forefinger being beneath the body of the file handle.

In selecting a file, choose one that is thickest in the center of its length, and of an evenly curved sweep from end to end, so as not to make the surface of the work round by filing away the edges. Files that have warped in the hardening may be used on very narrow surfaces, or on round or oval work; or, if they are smooth files, they may be used on lathe work. Keyways or slots, especially, require an evenly rounded file; and if the keyway is long and the file parallel or uneven upon its surface, the end of the file only should be used to ease away the center of the keyway or the high spots. It is also highly advantageous to rub chalk on the teeth of the file, so that, after a little using, the eye can detect the part of the file which is highest, and govern its use accordingly.

Half round files should be rounded lengthwise of the half round side of the file, because it is difficult to file out a sweep evenly, even with a well shaped file, and it is impossible to do so with a file whose half round surface is hollow in the direction of its length.

These files must be used with a side sweep, caused by gradually bending the wrist at every stroke of the file, so that the file marks are not at a right angle to the curve, the sweep of the file being varied occasionally from right to left or from left to right, so that the file marks cross one another, otherwise there will be high ridges or waves in the curve.

In draw filing, be careful to note the higher parts of the file and use them only for flat surfaces, also to clean the filings out occasionally to prevent scratches in the work, and to rub chalk upon the file, which will prevent the filings from getting locked in the teeth; then, after every few strokes of the file, brush the hand over it to loosen the chalk and filings, and strike it lightly against the screw box or other soft part of the vise, which is more expeditious than, and equally as effective as, using the file card every time; when, however, the file requires chalking again, which will easily become apparent, the file card may be advantageously applied before applying the chalk.

Rough or bastard files are used to take off metal in quantity; but if the surface of the work is unusually hard, a second cut file will better answer the purpose. For finishing work very finely, cross file it with a smooth file and then draw file it with the same; then cross file it with a dead smooth file, and draw file it with the same, using very short strokes of the file and applying chalk to it.

A worn dead smooth will finish finer than a new one, and better results will be obtained by finishing the work crosswise of the grain than in a line with it, because any inequality in the texture of the metal will usually run with the grain, and the file teeth will cut the softer parts more readily when following in their length than when merely crossing them.

EMERY PAPER.

In applying the emery paper, use at first No. 1 paper both along and across the work, and repeat the process with No. 0, No. 00, No. 000, or No. 0000, according to the fineness of the polish required, bearing in mind that, the more the emery cloth or paper has been used, the finer is the polish it will give, the reason being that it becomes coated with a glazed surface, composed of particles of the metal it has been rubbing; and all metals polish finer and brighter with such a surface than with any other. If the finer grades of emery cloth or paper cannot be readily obtained, take the finest grade at hand, and wear it down by using it on a rod or piece of metal in a lathe at a high speed, wiping the rod once during the latter part of the operation with a piece of rag or waste slightly oiled, which will cause the oil to pass to the emery paper, and the latter to retain the particles of metal upon its surface. If this method of polishing be carefully executed, the work may be kept very true and even, and possess a finer finish and polish than by applying oil stone or by any other known method.

Before commencing any piece of work, measure it all over; and if it has a rectangular part, apply the square to it so as to be assured, before any work has been done to it, that it will clean up to the required dimensions.

MANUFACTURE OF LAMP BLACK.—J. H. Bottenberg, Ravens, O., provides a revolving cylinder, which is kept cool. Within is a series of gas jets, which deposit carbon on the interior of the cylinder, which carbon is removed by scrapers by the turning of the cylinder.

THE BLACKSTONE AND ELMER WATER WHEEL.

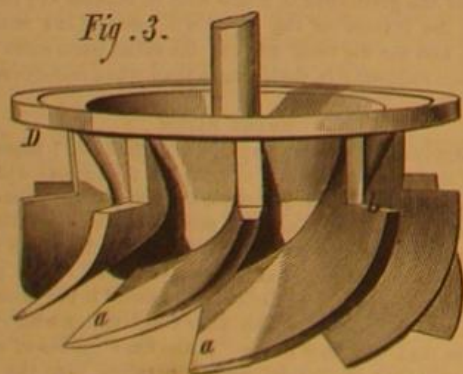
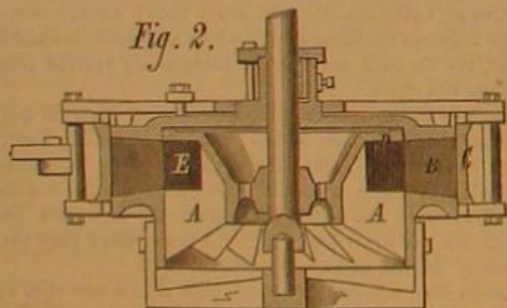
The principal advantages claimed for the improved water wheel, represented in our illustrations, consist in the utilization of the full force of the water, the construction which prevents breakage of the wheel through the entrance of obstructions, the relation of the size of the chutes to that of the issues, so that the water leaves the wheel with the same velocity with which the latter runs, and the arrangement of the buckets to reduce friction to a minimum. Other points of merit will be noted in the course of the description.

Fig. 1 is a perspective view. Fig. 2 shows the apparatus in section, and Fig. 3 the wheel separate from its attachments.

At A are the buckets, B the chutes, and C the gates. D, Figs. 2 and 3, is a horizontal extension of the top of the wheel hub, which is calculated to receive a lifting action of the water entering below, and will largely counteract the downward pressure of the water on the buckets. The projection of the rim of the wheel prevents the water rising up over the extension so as to neutralize the lifting action. The buckets, as shown in Fig. 3, are made to terminate above at the bottom of the chutes, with the exception of narrow extensions left for their more permanent connection with the hub. By this means a clear annular chamber, E, Fig. 2, is formed in front of the chutes, into which the water flows in solid volume, and in better condition for entering the buckets than were it broken by the action of the latter revolving immediately against the chutes.

The construction of the chutes is such that they are tangent to the rim of the wheel or very nearly so; thus, it is claimed, allowing of the employment of the full force of the water instead of only a component of the same. The buckets are made with a radial termination, *a*, and have dimensions between the lines, *a* *b*, decreasing from the rim of the wheel to the hub, as the radii of circles from the rim to the hub decrease. The curve of the bucket, in brief, is the curve of the quickest descent for a body acted upon by gravity.

The gates, C, which close the mouths of the chutes, are hollowed out on the inner side, leaving only a bearing surface around the edge. They are provided with stems which pass through the gate operating frame, F, and have ample play on their seats. The exterior water pressure holds the gates firmly against the chutes; but should an obstacle be carried into an aperture, the gate thereon will yield, swinging partially open and will not be broken. While the gates are entirely independent of each other, all are operated to open or shut at once, unless one or more be obstructed, in which case it, or they, alone will remain open.



The rack and pinion, G, for governing the gates, are placed at a distance from the wheel, to avoid wearing or clogging by sand and debris, and also that the gate rod may not come in contact with any of the pulleys or gears that may be on the wheel shaft. These arrangements do not have to be removed in case a wheel is taken up. The spider is placed on the outside of the case, thus preventing the wheel from being broken in case the step should chance to wear down.

Two wheels are made for each size, No. 1, it is claimed, utilizing ninety per cent of the effect of the passing water, and No. 2, eighty-six per cent.

The patents under which the device is constructed are dated April 8, 1873, and March 24, 1874. For further particulars, address the manufacturer, Mr. C. C. Paige, Eagle Iron Works, Oshkosh, Wis.

SCIENCE is the trunk of a mighty tree, the roots of which penetrate into the unknown, and the branches flourish in the useful arts.

Rat Science vs. Alligator Strength.

"A wholesale drug store on Magazine street is the happy possessor of a young and domesticated alligator. This little crocodile has become quite the pet and plaything of the establishment; he is of an amiable disposition, fond of music and dinner, and quite submissive, shedding tears and showing repentance whenever it is found necessary to correct him. It was resolved by the clerks in the establishment—as the alligator had reached his third birthday and increased to three feet in length—to utilize him, to put him to some other employment than that of a mere pet. It was concluded to make

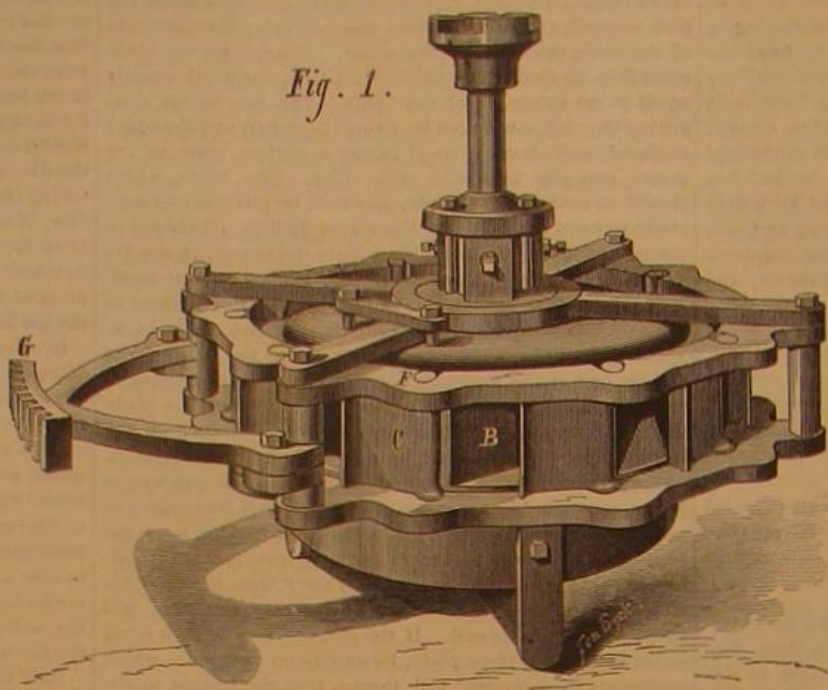
themselves from almost certain death. The branches that thus suddenly snap are as verdurous as any of the others, and there seems to be no other defence than to avoid "the elm tree's shade" as much as possible. It was from just such an accident that the Queen was saved by the promptitude of her attendant; and there have been several very narrow escapes recorded, from a similar danger.

IMPROVED HAND CRANK DRILL.

Many a superintendent or foreman of a shop has, doubtless, wondered at the extreme slowness with which his hand drills penetrate metal when operated by certain workmen. The metal does not appear unusually hard, the tool seems in excellent order, and the man even, when the boss is at the other end of the shop, turns away at the handle with exemplary rapidity, and yet the hole is an astonishingly long time in getting through. The trouble lies in the simple fact that while it is a very easy matter to keep turning a drill around and around in the same hole, it takes considerably more labor to rotate the instrument and, at the same time, force it down into the metal. This truth once through the cranium of a lazy workman, he utilizes it to his advantage, by neglecting to screw down his feed whenever the foreman's back is turned. Further explanation as to why the hole progresses slowly is unnecessary, but we may, instead, proceed to describe an invention which is excellently calculated to disgust lazy individuals who practice such systems of shirking.

The device, as represented in the annexed engraving, is a patent crank drill which is provided with an automatic feed, that is, whenever the handle is turned, feeding must take place. At the upper extremity of the feed screw is a horizontal hollow wheel, the inner periphery of which is suitably notched. On the drill spindle which passes down through the screw is an eccentric block, not shown in the engraving. This is so arranged that at each turn of the handle a projection, to which it imparts a to-and-fro motion, enters a notch in the wheel and carries the latter and, consequently, the screw around for a certain distance, thus feeding the drill downward. It is impossible to rotate the handle without causing the above described action, and hence a continuous and regular feed is kept up, independent of the workman.

The remainder of the apparatus is readily understood from the engraving. It is constructed entirely of cast steel, with the exception of the handle and the castings to receive the standard. Two of these castings are furnished, one with its foot at right angles to the drill, the other parallel.



THE BLACKSTONE AND ELMER WATER WHEEL.

use of Crocky, the alligator, as a cat, and it is well known that alligators have a special and inestimable hatred toward rats. A rat to practice on was caught the other day.

Rat and alligator were put together in a box, and a numerous audience crowded around to get the front place. The two enemies soon awoke to an appreciation of the case. The rat safely and snugly ensconced himself in a corner. The alligator hesitated a second, scratched his head (metaphorically), and, having made up his mind as to the mode of attack, advanced slowly towards the rat with wide open jaws. The rat trembled; there was no escape, nothing but the wide open mouth of the alligator before him. Without hesitation, like Curtius, he jumped straight into the yawning gulf, and getting a good hold on the lower lip of the alligator, swung himself to the ground. The 'saurian' gave a squeak and swung himself around, the rat finally letting go, victor in the first round.

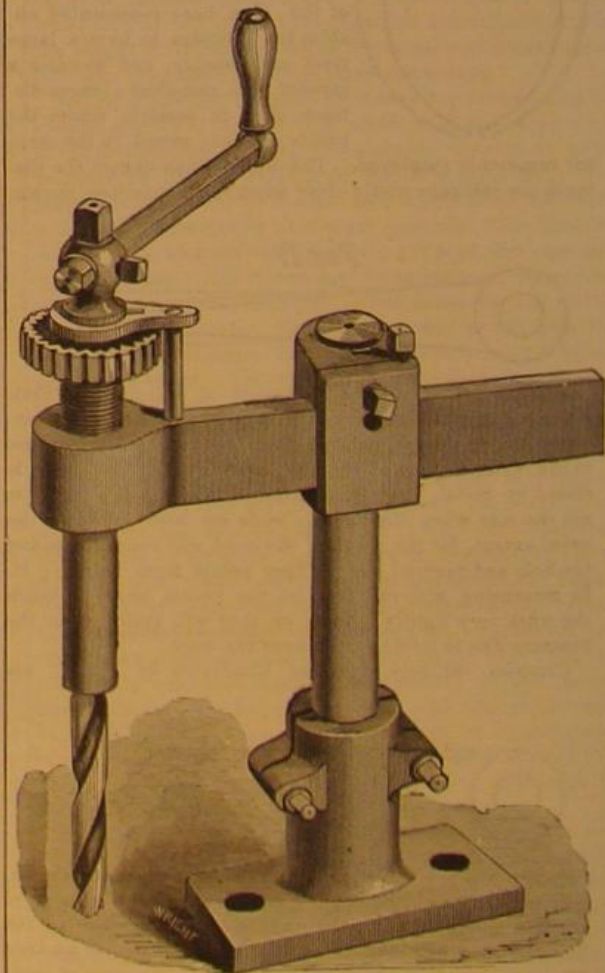
The alligator, however, was not daunted, and advanced with the same tactics. The rat this time, by a most agile movement, leaped entirely over the alligator. Getting behind him, he now proceeded to chew and gnaw away. The unwieldy animal could not get around to defend his hind legs. By a good use of his tail, the alligator again got free and advanced desperately, though with flagging courage, at the daring rodent. With equal success the rat again sprang into the air, alighting on the alligator's back. The fight was over then. The alligator could not shake his enemy off, could not dislodge him; and finally gave up the fight, laying himself down on his belly in a submissive attitude. The rat was set at liberty and given the run of all the drugs and medicines, while the poor alligator was doomed to disgrace and ridicule."

A Squirrel's Leap.

Recently, says the *Bangor (Me.) Whig*, a little red squirrel, having been pestered considerably by the lads above the saw mill of Eben Webster & Co., on Marsh Point, Orono, took refuge for life by running up the large brick chimney near the mill. By clinging to the corner, he kept foothold so well that he succeeded in reaching the very top. Here he found himself upon the iron cap, 105½ feet from the ground. As more and more of the waste stuff from the mill was added to the furnace, the chimney grew hotter and his situation became more and more disagreeable. He tried to descend upon the side of the chimney, but after getting down a few feet gave it up, turned about and went back. By this time the chimney top had become so hot that he must leave it; so after looking about carefully for a few minutes, he evidently made up his mind that he must leap to save his life, and this he did, spreading out his legs and balancing himself so that he struck the ground about fifty feet from the base, uninjured, and immediately scampered off and secreted himself under a pile of boards a little distance away.

Dangers of Elm Trees.

It is a character of some trees, of the species of elm in particular, to drop large branches during the hot months, without any external warning beyond, perhaps, a preliminary crack or two. An accident of this nature lately occurred in Kensington Gardens, London, when an immense branch, about twenty yards long, fell with a crash like thunder, and more than a score of children had a narrow escape for their lives. Three, who were sitting below the bough, alarmed by the second crack, ran away, and thus saved



A change of spindle can be made almost instantly to suit drills of different shanks, and if desired a hand feed can be used. The arrangement for holding the standards is such that, with any reasonable degree of care, it will not be marred.

The instrument works easily and efficiently, and is, in general construction, a thorough and substantial tool. It is manufactured by the New York Steam Engine Company, of No. 98 Chambers street, New York city.

BOUQUETS FROM FIELD AND GARDEN.

Our contemporary *The Garden*, in discussing the arrangement of bouquets, states that the excessive formality of the present orthodox form of presentation or ballroom bouquets exhibits a kind of close packing, in which the delicate graces of flower form are entirely submerged in consequence of this close, even tight, juxtaposition. The end sought in this kind of grouping appears to be a method of packing together (according to price) an abundance of rare and, consequently, expensive flowers, all of which must be got into the same lump. This system, of course, necessitates the use of such flowers as are more or less rare, and there is, perhaps, no other way of making up a bouquet that shall be fairly worth, in intrinsic value, from \$1 to \$25. The cut flowers of which the bouquet is composed are, probably, worth all the money, at their respective market prices; and for certain occasions, bouquets so manufactured may be deemed appropriate, even necessary; but as works of art they are utterly valueless. A few elegant grasses from the meadow, combined with a selection, at any season, of flowering branchlets from the shrubbery or common garden border, and a freehanded and tasteful grouping, without crowding, and with a well balanced proportion of natural foliage, may be made to form a composition such as a painter might desire to transfer to his canvas, while he assuredly could never wish to dip brush in color for one of the expensive bouquets of the cauliflower shape. Such has long been a favorite theory of the writer in the matter of flower grouping; and the other day he found it gracefully exemplified on the drawing room table of a friend, by a graceful half wild bouquet from field and garden, formed with the free grace and uncrowded arrangement which, as nearly as may be, illustrated his views. It is needless to state that a lady's fingers and a lady's taste were the joint authors of the composition. In the arrangement, each flower and grass of the gathering had been made to find its seemingly proper place, unjostled by its neighbor, and so freely and easily located in its basket work receptacle, supported on three slender canes of bamboo, that even its foliage had room to display its graces and modes of growth. With the permission of the lady flower grouper herself, a drawing was at once made, a reproduction of which, in the form of a careful wood engraving, and for which we are indebted to our valuable contemporary, will be found on this page.

The central object was a small spray of guelder rose, with two or three of its spherical masses of snowy flowers, surrounded and supported by their own leaves. There was also a rose, perhaps one of the first of the season in the garden where it was gathered; and there were some smaller Scotch roses, accompanied by sprays of their miniature foliage. There was also, it will be seen, a flower of white pink, with buds, and with leaves which have room to display their delicately slender forms and the pale glaucous hue of their dainty green. A common corn flag towered in the center; and on the left was a single iris, backed by its blade-like leaves. Grasses of several kinds shot upward, crowned by their feather-like inflorescence, which added a pleasing lightness and careless grace to the composition. The effect was lightened as regards color by two sprays, not more, of pelargonium flowers, gathered with their leaves, and by two or three kinds of fern, one gracefully weeping frond being allowed to droop negligently to the table, the slender extremity of which curled itself fantastically, as with a set declaration against primness, trimness, or any kind of slavish formality.

The value of grasses for arrangements of this kind is well shown in this case. Ferns themselves cannot show so airy a grace or such delicacy of form. Many graceful wild grasses may be gathered in the fields, and many beautiful hardy grasses are as easily grown in any cottage garden as the hardy flowers of which this charming bouquet was composed.

Magnets.

M. Jamin describes experiments which support these three propositions: (1) The number of elementary magnetic threads, and so the quantity of magnetism a magnet may contain, depend only on the middle section. (2) The opening (*épanouissement*) of the poles of these threads, or the distribution of intensities, is regulated by the form and extent of the exterior surfaces of the magnet. (3) If the surfaces diminish, the tension increases till they become insufficient to allow of the elementary poles opening out, and a portion of the two contrary magnetisms disappears, reproducing the neutral state.

On combining 22 magnetized plates (each 0.04 inch long, 0.04 inch thick, and 2 inches broad) in a bundle, with pasteboard 0.032 inch thick between adjacent plates, each plate lost magnetism, and so the bundle, the loss of the latter being 50 per cent, which is less than in the case (first experimented on) of superposition without intervals; the loss was then 66 per cent. In this first mode all the magnetism retained was carried to the exterior; there was none, or almost none, between the plates. In the other mode the quantity remaining (151.1) was divided into two portions:—(1), 85.5, which was expanded on the exterior; and (2), 65.6, which remained

in the intervals. With wider intervals the exterior magnetism is diminished, the interior increased; and gradually the plates act as if they were independent.

Carbon in Cast Iron and Steel.

M. Bousisingault contends that in cast iron, and in certain steels, the carbon is in two states—(1) combined with the iron and therefore invisible; (2) disseminated in the metal, either as an amorphous black powder or in brilliant crystalline laminae, constituting the graphite of mineralogists. There is reason to believe that when cast iron is in fusion all the carbon is combined and is invisible, but that a portion becomes free on cooling. On acting upon a carburetted iron with acids, the state of the carbon is at once made known. The free carbon remains mixed with the insoluble residue. If no graphite is present, but merely combined carbon, there is no carbonaceous residue. The carbon is eliminated during solution, imparting a characteristic fetid odor to the hydrogen gas given off, due to volatile oily matters. This oily matter was



A JUNE BOUQUET OF GRASSES AND HARDY FLOWERS.

noticed by Proust in 1799. M. Chevreul remarked that in this case chemical forces give rise to compounds analogous to those formed by vegetable organisms. More recent researches have established that these compounds are not merely analogous but identical. The author does not believe that a steel exists absolutely free from carbon.

Ex-Commissioner of Patents S. S. Fisher.

With the deepest regret we record the death, by drowning, on August 15, of Samuel S. Fisher, Esq., of Cincinnati, O., formerly Commissioner of Patents, the duties of which important post he performed with the most distinguished ability till the end of the year 1870, when he resigned. The accident which terminated this useful life was truly calamitous, as Mr. Fisher's son was drowned at the same time. They left Elmira, N. Y., on a summer boating excursion, intending to float down the Susquehanna to Havre de Grace, and enjoy the wonderful scenery which that river presents. The boat was unfortunately capsized in the Conewago Rapids, fourteen miles below Harrisburg.

The record of Commissioner Fisher will long survive him. His learning and practical good sense, accompanied by great force of character, gave him more than customary authority over the important department in which he presided, and enabled him to carry out many salutary reforms in the administration of the Patent Office. As a patent lawyer, he was widely renowned, and many of the most important litigations were entrusted to him, and some very heavy cases were in his office at the time of his death.

Commissioner Fisher served his country in the late war, as Colonel of an Ohio regiment, was President of the Board of Education in Cincinnati, and has filled many other important public positions.

RECENTLY, at New Haven, Conn., and vicinity, there was continuous rain for nearly forty hours, during which period eleven inches of water fell—one third of the annual fall.

Sword Manufacture in Birmingham.

The manufacture of swords is one requiring great skill in all its departments. Success in this work depends upon the acquired skill, the long experience, the educated eye, and the manipulative power which seem to require many generations of workmen before they are attained in their higher excellence. The slightest mistake in working would make a sword blade useless, and this applies to each of the three great processes through which it has to pass—forging, tempering, and grinding. From the necessity of all the work being skilled work, each part of a sword—the blade, the grip, the hilt, the scabbard—is made by hand, and the witnessing of the manufacture is thereby rendered especially interesting. For the excellence of his swords, and for the skill displayed in every part of the work, no name in the history of the trade surpasses, and few if any rival, that of Mr. C. Reeves, of Birmingham, Eng., over whose works, with such efficient guides as Mr. Reeves and his son, says *Iron*, we shall now conduct our readers, in order that they may witness the making of a sword under the most favorable circumstances.

FORGING THE BLADE.

The first process is the forging of the blade. The steel comes from Sheffield in double molds, (the length of two blades), as it is called, and is the best steel, and is in strips, each strip being the length of two swords. The workman takes the strip and first breaks or cuts it across the middle. The handle end of the blade is of iron, as this metal bears more knocking about and can be used in a manner that would be fatal to steel. The iron end is then put in the fire, and the tang, or part to fit into the hilt, is forged. The blade is then passed through the fire a large number of times, and beaten out on the anvil in order to distribute the metal equally in every part. At the same time the furrow is worked up the center of the blade, wide or narrow according to the pattern and size required. In those known as Scotch blades two furrows are beaten. This is a work requiring great care and skill. The future worth of the blade depends upon the skill of the forger. The slightest defect or inequality in the distribution of the metal makes the blade to that extent imperfect. With a skillful workman this is, of course, of rare occurrence. He knows precisely the amount of hammering required. It may be noted here that every blade passes through the fire no fewer than twenty-five times before it is completely forged.

TEMPERING THE SWORD BLADES.

After forging follows the most delicate and important part in making a sword blade—tempering. On this process depends the perfection of the weapon, and it is quite pleasant to listen to Mr. Reeves while he descants on this part of the work. The object of tempering being, of course, to give the steel the required elasticity, it must not be too hard or it will break, and it must not be too soft or it will bend; but must be so equally tempered that, when its point is pressed on the ground, the blade will, when free, at once take its natural shape without hurt or detriment in the slightest degree. The mode by which this

great, this necessary quality, is secured is as simple as it is effective. Before the blade can be tempered it must be made extremely hard; this is done by first passing it through the fire, and then, while hot, it is plunged into water. The first plunge hardens the blade to such an extreme hardness that it is as brittle as glass, and if thrown down would break into pieces. Again it is passed through the fire and then beaten straight, for the effect of the action of the water on the hot metal is to make it of all shapes. Just at the point at which the blade takes a particular color, known at once to the practiced eye, it is again plunged into the water which, in technical language, "prevents it going down lower," and is tempered. It can now be bent backwards and forwards without any fear of its breaking, and is ready for the grinder.

GRINDING THE SWORDS.

The grinding is done on the best Leeds stones, the blade being placed in a frame of wood, and its surface pressed on the stone until the work is done. This also depends upon the skill and the eye of the workman. In grinding the furrows, a stone of a peculiar construction is used. The face is cut into raised flutings of the size and shape of the furrows of different swords, and on these the blade is pressed, and the furrow effectually ground. This is called the hollowing stone. Each blade takes from an hour and a half to two or three hours grinding, according to its quality. We saw one blade ground, and also some matchets, a kind of scimitar knife used for cutting down sugar canes, etc., in India.

SWORD POLISHING.

The blade is now ready for polishing. This is done on lathes worked by steam. Different sized wheels are fitted on the spindle, and lard oil and double washed emery are used in the operation. The blade is often put into lime dust during the process; and on the lathe brush used, a crocus dust, of deep purple tint and ground very fine, is thrown over the brush, and a most brilliant polish is the result. Scab-

bards and hilts, and other ornamental parts of the sword, are also polished in much the same manner. In the case of scabbards, a larger wheel is used instead of the ordinary lathe brushes. When polished, the blade is ready for the hilt and scabbard; so we will now see how these are made. And first for the scabbard.

MAKING THE SWORD SCABBARDS.

In making a scabbard, the workman takes a piece of flat steel cut to the required size. He first places it on the top of an open vise, and beats it with a wedge-shaped wooden mallet, bringing the two edges closer together each time it passes along the vise. It is then beaten on both sides until they almost meet; a mandrel is then put down it, and the steel beaten close round the mandrel, both edges being hammered over. The edges are then soldered. It is next beaten on an anvil all round, the mandrel is withdrawn, and the scabbard is ready for the drag, which is a piece of iron fitted to, and fastened on, the bottom of the scabbard. The bands are then put on, and the scabbard, after being filed and smoothed, is ready to be polished.

MAKING THE SWORD GRIPS.

The making of the grips is also a very interesting bit of work. These are the handles by which the sword is gripped, hence the name. A grip at first is a bit of walnut, oblong in shape, but narrower at the end than the top. The back, which is made of metal, is placed on it, and the wood is worked into the required shape by files. A large number of different shapes, sizes, and cutting powers are used in this work. When the top has been cut, the grip shaped, and the tenon for the ferrule made, it is then "balled." For this purpose it is fastened in a vise, a three-angled file cuts a deep indentation at regular intervals, each division is rounded or balled by a file, and the indentations connected by slanting interstices cut by a hand saw. The grip is then drilled through in a lathe, for the purpose of receiving the tang. When this has been done, a piece of the skin of a dog fish, which has been a long time soaked in water, is cut off. Every bit of flesh on the inside of the skin is then carefully cut off, and a piece of pure skin is left. This is put round the grip, a piece of string or wire is fixed by a loop to a piece of steel fastened in the vise, and the workman binds the skin tightly round the grip by winding the string or wire round the space between each ball. It is then filed and the back fitted on again. In making a grip, it passes through the workman's hands no fewer than thirteen times.

DRESSING THE HILTS.

A hilt is at first a flat bit of metal of a peculiar shape, and may be cut to any pattern. A large number of these are used, which are all made to a regulation size. The pattern used is placed on the metal, which is then marked. They are then filed and cut by hand, beaten on blocks and knobs into the shape of the hand, and afterwards polished, and made ready to be fixed to the sword.

This is called mounting. In the cheaper swords, the blade is bought from one person, the hilt from another, the scabbard from a third, and so on. But in this manufactory every part is made in the works, and each piece is prepared to suit and fit the other parts, so that when fitted together the sword is firm and sound; and the parts never give way or become loose, as they do when stuck on to the tang of a blade without any reference to their weight or suitability for each other and the blade to which they are attached. In such cases the parts with little wear become loose and rickety, and depend only upon the small rivet at the top for their security. In ordinary swords the blades and hilts, after having been ground, filed, and polished, are taken into the mounting shop. There the tang is placed in the grip. The hilt is fastened on by passing a rivet into the top of the grip, and fastening it to the tang. The hilt is drawn over this rivet, which passes through a hole at the top. It is then filed and broken off at a short distance from the hilt. The rivet is then welded by being filed, and smoothed until it has the appearance of an ornamental knob, forming an integral part of the hilt. These swords are now complete. In the mounting of best work, great care and skill are required. In the mounting shop, a very ingenious tool is used, called a float. It is a long bit of steel, shaped almost like a tang, with a series of blades along its surface. The grip is worked to and fro on the float until it is cut to the exact size and shape of the tang on which it is to be fixed. Great skill is required in this delicate operation. In this mounting room the swords are proved. This is done by placing the point of the blade on the floor, and bending it backwards and forwards. After it has stood this test, it is subject to another. The workman strikes the blade strongly on a wooden block, both on the edge and back, and can tell by the ring whether it is of true and perfect quality. By these tests the slightest fault or flaw would be detected, for a very small fault, indeed, would cause the blade to break.

The scabbards are lined. In the ordinary sword, two thin strips of wood of the shape of the scabbard are placed on either side, and they must fit so accurately that neither in drawing nor in sheathing the sword must the slightest obstruction be perceptible. In the better swords, leather is used in lining.

In the mounting and ornamenting of swords, any amount of artistic work can be employed either on the blade, the hilt, or the scabbard. The rank of the officer is indicated in this manner, and naval swords are ornamented differently to military. The work put on presentation swords is often most elaborate and expensive.

A NEW PAVEMENT, by Charles Pennington, of London, consists of a bed of concrete covered with an elastic layer, such as tar and tan bark. On this layer the blocks of stone are set, the crevices being filled with concrete.

A NEW SCIENTIFIC MUSEUM.

Operations have begun for the erection of the Peabody Museum in New Haven, which, when completed, will contain some of the largest and richest zoological, geological, and mineralogical collections in the world. The institution is founded under a bequest of \$150,000 from the late George Peabody, and is designed to bear the same relation to Yale College as the present Museum of Comparative Zoology does to Harvard.

The building will consist of a central edifice and two wings. For the present, only one of the latter is to be erected, with a frontage of 115 feet on one street and 100 feet on another. It will cost \$160,000, be built of brick with stone trimmings, fireproof, and contain, including basement, four available stories.

The fourth story is assigned to archaeology and ethnology, the third to zoology, the second to geology, the first to lecture rooms and mineralogical collections, and the basement to working apartments and a large class of heavy specimens, showing fossils, foot prints, etc.

The Brazilian Telegraph.

The great ocean cable between Lisbon, Portugal, *via* the Azores, and Rio Janeiro, Brazil, is now complete and open for business. The charges from New York to Rio Janeiro are about \$2.50 per word. The message goes *via* England, and through some eight thousand miles of submerged cables. Complimentary messages have been exchanged between President Grant, the Emperor of Brazil, the President of the Argentine Republic, and the President of Uruguay.

Last year the section of the above cable between Lisbon and Madeira was broken, and so remained until the present summer, when the two ends were fished up, joined, and relaid. The depth of water at the place of fracture was 2,500 fathoms, or about 2½ miles deep, and the successful finding, raising, and joining of the broken ends at sea, shows the great perfection of mechanism and skill that has been acquired in ocean telegraph engineering.

Fast Trotting.

At the Buffalo, N. Y., races, August 7, the famous horse "Goldsmith Maid" trotted the mile in 2m. 15½s. After the race, the Maid was stripped and led in front of the judges' stand, when the immense crowd arose and greeted her with deafening cheers. Her driver, Budd Doble, was ordered on the judges' stand, where he received a becoming ovation. In 1867, the racer "Ethan Allen" trotted a mile in 2m. 15s. But both these performances were surpassed by one of "Goldsmith Maid's" three one mile heats at Rochester, N. Y., on August 12, which was trotted in 2m. 14½s.

Running horses make much quicker time than trotters. In 1850, the English horse "Black Doctor" is reported to have run the mile in 1m. 40s.

The Chassepot as Altered.

Two years ago, the French government decided to adopt the metallic cartridge in its military equipments, and an official commission was appointed to ascertain the best plan for altering the Chassepot rifles, one million or more in number, so as to receive the new ammunition. The commission has just decided to adopt the plan of alteration proposed by M. Gras, Captain of Artillery. The altered Chassepots will have a range of from one and a half to two miles. At a range of one and a half miles, the bullet has force enough to flatten against an iron plate. The accuracy of fire is very satisfactory.

The August Meteoric Shower.

In the vicinity of New York, clouds obscured the heavens on the evening of August 10, and few observations of meteors were made. But we learn from a correspondent at Martha's Vineyard, Mass., that, near Edgartown, many beautiful meteors were seen.

DECISIONS OF THE COURTS.

United States Circuit Court.—District of Massachusetts.

BOTTLE FASTENER.—PATENT OF H. W. PUTNAM. GRANTED MARCH 15, 1869 AND EXTENDED FOR SEVEN YEARS, FROM MARCH 15, 1873.—HENRY W. PUTNAM vs. EPHRAIM D. WEATHERS, *et al.*

[Heard at Portland, Me., July 10, 1874.]

Shepley, Judge:

In the view which I take of the first claim of this patent, which is "forming the fastener at the part that comes over the cork of a piece of wire of U form, with the ends returned and connected to the bottle, in order that the pressure on the cork or stopper may cause the fastener to hold more securely," considering it in connection with the specification in the patent, it is not necessary that the wire which forms the U should be returned upon itself in a direction directly the reverse of that in which it is before the turn; but it is a sufficient compliance with the first claim of that patent if the wire, instead of being returned in a reverse direction from that which it had before, is returned at right angles, or approximately so, so as to be connected with the wire which encircles the neck of the bottle in the manner specified in the patent. In the construction which I give to this first claim there can be no question that the defendant's contrivance is an infringement. The only question, therefore, for consideration is whether the first claim of this patent be or be not a valid claim, and that question is one of significance, principally in its relation to the defendant's contrivance. The defendant's contrivance was considered by the Commissioner of Patents when this patent was granted. The disclaimer of the patentee clearly has reference to a contrivance like the defendant's contrivance; and, taking that into consideration, the Patent Office granted the patent. It has since been sustained by the adjudications of several of the federal courts. It has been in existence a long time, and it has been renewed by the Patent Office after the expiration of the original term. Under these circumstances I think this is a clear case, in which the patentee is entitled to the presumption, *prima facie*, which his patent gives, aided as it is by the long enjoyment and by the adjudications of the courts, and is entitled to protection by a preliminary injunction.

In the construction which I give of the claim, the only defence which could be maintained would be to destroy the validity of the plaintiff's patent; and I think, when the patent has been in existence so long, has been renewed after a contest, and has been adjudicated in favor of the patentee by the courts, he is entitled to the benefit of it until the adjudication of some tribunal shall decide that his patent is invalid.

This case is pending in the Massachusetts district, and when the court is in session there, the order for a preliminary injunction will be issued. I do not express any opinion as to the question which has been presented in the hearing on this case as to the validity of the issue of this patent, with reference to the existence of the defendant's contrivance; but, as I have before said, I think the position in which the patent stands entitles the patentee, upon well established principles, to the benefit of the legal presumption in his favor until that question is decided.

[W. H. Clifford and Thomas H. Dodge, for complainant.
Benjamin F. Thurston, for defendant.]

United States Circuit Court, Southern District of Ohio.

PATENT BOILER FURNACE.—GIDEON BANTS vs. JACOB ELIAS *et al.*
[In equity.—Before Swing, J.—Decided June, 1874.]

Swing, Judge.

The bill in this case alleges that the complainant was the original and first inventor of an "improvement in boiler furnaces for burning waste fuel," for which he received a patent, June 22, 1869; that he surrendered said patent February 8, 1872, and obtained new letters patent therefor, which were afterward extended for seven years from June 22, 1872. The bill then prays that defendants may be compelled to account for and pay over the profits of the infringement, and may be enjoined from making, vending, or in anywise using the patented improvement.

It is claimed, by respondents, that there is no infringement, because the combustion chamber or reservoir of the complainant is one having a cylindrical bottom, with narrow throat, whereas the combustion chamber or reservoir of the respondents has not the cylindrical bottom, but has one which is flat and set inclined, and has a wide throat instead of a narrow one.

I think, however, that the leading idea of the complainant is found in a combustion chamber or reservoir arranged in its relations with the fire chamber and boiler, for a particular purpose, rather than in the particular form of the back or throat of such chamber or reservoir.

Decree for complainant.

[John E. Hatch and Fisher & Duncan, for complainant.
Jacob Schroder, for defendants.]

United States Circuit Court.—District of Massachusetts.
PATENT TABLE TRAY.—LUCY A. DOHERTY, ADMINISTRATRIX, vs. JAMES G. HAYNES.

[In equity.—Before Clifford, Judge.—Decided May 29, 1874.]

Clifford, Judge.

Letters patent were granted to Nathaniel Waterman, on May 12, 1863, for an invention consisting of an improved table tray or waiter, as fully described in the specification, and the record shows that the original letters patent were subsequently surrendered and reassigned, as alleged in the bill of complaint, and that the complainant is the sole owner of the described invention, as secured in the reassigned patent on which the suit is founded.

Various defenses are set up in the answer, of which the following are the only ones which require to be noticed:

- First. That the invention is not patentable.
- Second. That the person named in the original patent, as the patentee, was not the original and first inventor of the improvement.
- Third. That the reassigned letters patent were fraudulently obtained in violation of the rights of the respondent, and that the patent as reassigned "covers more than was contained" in the original patent.

Decree for complainant.

[A. A. Ranney, for complainant.
C. D. Wright, for defendant.]

NEW BOOKS AND PUBLICATIONS.

AN ILLUMINATED HISTORY OF THE WORLD.

We have lately received an educational novelty, which, after examination, we can recommend to the notice of teachers and students as a valuable and useful aid to study. It is a chart, handsomely mounted and printed in colors, and in dimensions twenty-two feet long by thirty inches wide. Its aim is to teach the history of the world, biblical, ancient, medieval, and modern, ranging over the entire period of human knowledge, from 4004 B.C. to 1874 A.D., or 5,778 years of historic time. The plan adopted, which is a very ingenious one, is to represent the progress of time by a continuous black line, which is divided into centuries, decades, and years. Parallel with this are other lines, or streams, representing nations, and the division or flowing together of these indicates conquests, foundations of new States, and similar events. The arrangement of the map is such that the student sees at a glance exactly the condition of the world at any given date; and by the aid of colors, pictures, and similar helps, he is given an idea of the progress of arts, names and succession of rulers, and similar facts important to be remembered. We need not point out the obvious utility of this remarkable production, since it is well known that, while a person may readily master the history of one people, he frequently, in taking up that of another nation, is at a loss to connect contemporaneous events, and hence the various records remain detached in his mind, instead of uniting to form a single and detailed history of mankind. With the chart under review, such a difficulty need not be encountered, since the student, while at work upon the history of a single nation, need only glance at the map to be informed at once as to what the rest of the world was doing during the periods passed over. The execution of the work is excellent, and indicates an immense amount of labor and research on the part of the author, which should not go unrewarded. The length of the map necessitates its mounting upon rollers and arrangement in a neat frame, in which it is hung against the wall so as not to occupy more than three feet of space, suitable cranks on the ends of the rollers allowing the chart to be unrolled like a panorama. The author is Mr. S. C. Adams, of Cincinnati, Ohio. The price is \$15.

MANUAL OF PATENT LAW, with an Appendix upon the Sale of Patents. By William Edgar Simonds, Counsellor in Patent Cases. Hartford, Conn.: Published by the Author.

A concise and useful little book, explanatory of the patent law and practice.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 22 to July 30, 1874, inclusive.

CORSET CLAMP.—J. P. McLean, Brooklyn, N. Y.
ELECTRIC TELEGRAPH.—R. K. Boyle, New York city.
ELECTRO-MAGNETIC GOVERNOR.—J. M. Bradford, Portland, Me.
FASTENING SEAMS.—J. W. Davis *et al.*, San Francisco, Cal.
FAUCET.—F. Roach, Boston, Mass.
MATRESS.—G. N. Torrance (of Philadelphia, Pa.), London, England.
NEEDLE-THREADING HOOK.—H. Wells, Woburn, Mass.
OIL FROM PETROLEUM.—H. W. C. Twiddle (of N. Y. city), London, Eng.
PACKING FOR BOTTLES, ETC.—O. Long, Boston, Mass.
REAPING MACHINE.—W. A. Wood Company, Housick Falls, N. Y.
SAFETY LAMP.—B. Tappan, Steubenville, Ohio.
SOLAR COMPASS.—C. T. Pierson, Ramapo, N. Y.
SPECULUM.—E. D. Pape, New York city.
STEAM PUMP.—W. Atkinson, Gardner, Ill.
STEEL MANUFACTURE.—T. S. Blair, Pittsburgh, Pa.
TAPE WEAVING MACHINE.—F. F. Burlock, Birmingham, Conn.
TRANSMITTING MUSIC BY ELECTRICITY.—E. Gray, Chicago, Ill.

Recent American and Foreign Patents.

Improved Fireproof Roof.

Frederic J. Hoyt, Batavia, N. Y.—The object of this invention is to render the roofs of buildings in blocks, or where built close to one another, not only waterproof but fireproof. The ordinary flat roof is built on an incline from front to rear, and is covered with a waterproof composition. The front wall is extended a foot or more above the roof. The side walls and rear wall are brought to a level with the front wall, leaving spaces in the side walls near the top, for fitting in joists three feet apart, on which, from front to rear, strips of wood are fastened on edgewise, one fourth inch apart. This is covered with a waterproof composition, on top of which is placed two to three inches of loose gravel, screened so that none will pass through the openings into the lower roof. The water passing through this upper roof falls on the lower roof, and runs off by conductors arranged through the wall and into the lower roof in the ordinary manner, which also serve as air holes to ventilate the space between the two roofs.

Improved Lantern.

Daniel Lordon, Fremont Center, Mich.—The bottom of the lantern is made double, with a series of holes connecting with a hollow space for purposes of ventilation, a chamber beneath the wick chamber, and a tube, connected therewith, which passes upward through the globe. An oil tube on the globe connects the oil chamber with the wick chamber. A wick in the end of the oil tube may be adjusted to allow the oil to flow to the wick chamber fast or slow. There is an inverted funnel over an opening through the oil chamber connected with the tube by which heat is conducted down beneath the wick chamber. A strong current of heated air passes up through the opening, and is caught by the inverted funnel. The oil in the wick chamber is thus soon heated, and the burners consequently afford a clear and bright flame.

Improved Expandable Wedge.

Robert Nesbitt, Franklin, Pa., assignor to himself and J. E. Tiktob, same place.—This wedge is composed of two tapering pieces, triangular in cross section, having the outer edge of each piece serrated to prevent withdrawal. A tapering screw engages with a tapering female screw, cut between the two parts of the wedge, and, when driven down, expands the parts.

Improved Machine for Perforating Paper.

Lyman A. Upson, Enfield, Conn.—This invention consists of a serial punching machine, for perforating duplicate sets of pattern cards for Jacquard or figured weaving, and for perforating figures or designs for other purposes, in which the punches are arranged so that, for making different patterns, some of them may be permitted to rise and not perforate, while others are held so as to perforate, the material to be perforated being moved against the punches. A perforated hexagon beam, termed a card cylinder, working the pattern cards of the pattern to be perforated, is combined with the punching machine, and is so contrived that the pattern cards of the pattern to be perforated or duplicated move keys (which act as stops to punches) from over the punches which are not to act, and allow them to rise and allow other keys to remain over those punches which are to act, and retain those in their working position; or the operation may be the reverse of this, moving keys over punches which are to act, and allowing the keys for punches which are not to act to remain stationary. After each operation, there is a plate so combined with the working of the perforated cylinder, and keys which act as stops to the punches, as to return all the keys to their first position for the selection from the whole by the next pattern card, and thus cause the perforation to be made in accordance with the pattern to be duplicated or perforated, whatever it may be.

Improved Sand Iron.

Charles R. Rathbun and Henry Shaw, Worcester, Mass.—The iron has two holes bored in it close together, near the center of the top, in its longitudinal axis, said holes being slightly inclined from each other from the top downward. The standards are jointed together, and below the joint have the vertical portion fitted to enter the holes. Above the joint they branch apart wide enough to receive a wood handle, which has a rod extending through it, with a screw-threaded projection at one end screwing into one standard, and a square and round projection at the other end passing through a square hole in the standard, and having the cam pivoted to its end. The cam is arranged to press the standards toward the handle when turned downward, so as to cause the parts to bind in the holes, and thus make the handle fast to the iron. By releasing the cam, and shifting the round part of the rod into the hole of the standard, the rod may be turned to adjust the handle for holes, more or less distant from each other, or of different sizes, and to regulate the binding pressure.

Improved Earth Auger.

Dexter Page, Monticello, Iowa.—The sand auger is provided with valves, which take up the loose substances fed by the cutters of the auger. A cylindrical bucket fits tightly to a rim of the auger, and slides by means of its conical top part on the auger shaft, to which it is firmly applied by a set screw. The conical top prevents the bucket from catching under the curb when working inside or under it. The load of the bucket is readily discharged at the top of the well by loosening the set screw and raising the bucket, the sand flowing instantly out between the auger and the lower end of the bucket. When the bucket is filled with muddy water, the sediment closes every crevice in the bottom and makes the bucket therefore watertight.

Device for Keeping Steam Boilers Clear of Scale and Sediment.

William O'Brien, Mattoon, Ill.—The scraping frame is composed of longitudinal bars, having cross bars firmly riveted or bolted to them. The two cross bars at the ends of the frame are provided with eyes. Stationary rods are attached to the sides of the boiler, which support the frame by means of these eyes. The frame, as a whole, is an arc of a circle of a diameter corresponding with the boiler. Scrapers are attached to the bottom of each cross bar, which, as the frame is moved back and forth, are placed so as to just clear the bottom of the boiler and scrape therefrom any sediment or scale which may settle on the bottom. This frame is operated from the front of the boiler by means of a rod, which passes through the head.

Improved Riding Plow.

John H. Payton, Rantoul, Ill.—This is an improved riding or sulky plow, so constructed that it may be readily adjusted to plow deep or shallow, or to turn a wide or a narrow furrow, and may be easily raised from and lowered into the ground. The cutter is rigidly connected with the axle, so as to be entirely independent of the plow, and so as to be held firmly to its work.

Improved Gang Plow.

Finley R. Crothers, Sparta, Ill.—This improved gang plow is so constructed that the plows may be readily adjusted to cut wide or narrower furrows. The tongue may be moved toward either side, to adjust it for three horses while keeping it parallel with the line of draft, and without moving the line of draft from the center of the machine.

Improved Car Coupling.

Theo. T. Shotwell, Osage, Iowa.—This invention relates to means whereby great simplicity, efficiency, and economy are imparted to the ordinary car coupling, by dispensing entirely with the complication of parts now in use and combining a coupling pin and crank shaft so that the former is held up by a weight or spring, yields to the pressure of an incoming link, and rises to lock the link as soon as the latter has ceased to bear upon it.

Improved Bolt Heading Machine.

James and John Kennedy, Plainville, Conn.—This invention consists in several important changes in the ordinary machines for making square headed bolts, whereby the machinery is simplified and rendered less liable to accident, while much greater uniformity and excellence in the manufacture is attained.

Improved Car Coupling.

Dally S. Moore, Chicago, Ill.—This invention relates to that particular class of car couplings wherein each drawhead is provided with a horn over which the link is passed. The invention consists in novel means for automatically coupling with such a device, and also in means whereby the drawhead may be better adapted to this mode of coupling.

Improved Churn.

Nathaniel Ewing, Houston, Texas.—This invention relates to means whereby the dashers of plunge churns may be speedily, conveniently, and accurately adjusted to the quantity of milk which constitutes the churning at any one time, and also whereby a detachable churn itself may be easily and securely fastened to a frame just previous to the commencement of the churning operation.

Surfacing Sheet Iron to Resemble Russia Iron.

John Stackhouse, Allegheny, Pa.—The sheets of ordinary iron of good quality are placed in packs of four sheets, and immersed in a solution of oxalic acid and water. When the iron is heated, the water evaporates, leaving a slight film on the surface of each sheet of iron, which is converted into carbonic acid gas. This gas combines with the iron, and hardens the surface. The surface of the iron is, consequently, left clean, and takes a high polish when sheets are rolled, the iron resembling the best quality of Russia sheet iron.

Improved Water Wheel.

John W. Ross, Delphos, Ohio.—This invention relates to a turbine wheel in which the buckets are arranged to admit the water at an angle of ninety degrees, between a horizontal and a vertical line. The buckets are formed at the upper end on the inner curve of this dome-shaped chute rim, and they are concaved in cross section on a radius a little smaller than their breadth at the top. From the top they widen downward, so that from the quarter circle of the top they increase to nearly three quarters at the lower end, where, by their spiral curve, they come to the form of an inverted trough, from which they discharge the water directly downward. By this curved or dome-shaped form of the chute rim and the upper end of the buckets, combined with the concave shape of the body of the buckets, the water is delivered to the wheel, flowing direct and in solid columns, in which it is most effective.

Improved Corn Dropper.

Richard Peter Montague, Whitley's Point, Ill.—The frame of the device consists of two side bars and two cross bars framed to each other. To the axle is attached a cylinder, in which is formed a zigzag groove, the sides of which are concaved to receive the ball pivot, which revolves upon a bolt attached to the end of a lever, so that the said lever may be oscillated by the advance of the machine. The lever oscillates upon a long bolt, upon which is placed a coiled spring, which holds the said lever down to its place, and the elasticity of which allows the lever to move up and down upon the bolt as the device changes its position in passing over uneven ground. The forward end of the lever is pivoted to the dropping slide of the planter.

Improved Harrow and Cultivator Teeth.

Stephen J. Nason, South Berwick Junction, Me.—This invention consists in a double harrow tooth, pivoted so as to be self-adjusting and self-sharpening. The teeth are made double, and the working parts are made in the shape of right angled triangles, placed with their inclined sides forward. The triangular parts are parallel with each other, and are connected at their upper edges by a plate, which is pivoted at its forward part to the harrow frame.

Improved Damper.

Matthew Howles, Hamilton, Canada.—This invention consists of a damper which is weighted at one side, and provided, at the outside of the pipe, with a notched disk keyed to the projecting end of the shaft. A sliding bar is guided in a case above the disk, and engages the notches of the same, so that the damper is retained securely in any desired position thereby.

Improved Seal Dip.

Benjamin F. Reinmund, Lancaster, Ohio.—This invention relates to and consists in means by which gas may be transferred from the retorts to the condenser or gas main, with great facility, dispatch, and convenience.

Improved Washing Machine.

George A. Newell, Wilmington, and John N. Stallings, Kenansville, N. C.—As the water boils, it is forced up the sides of the boiler and clothes holder, and through holes upon the clothes, which will soon become saturated. The squeezer, as it vibrates, expresses this water, which serves as a vehicle for carrying dirt into the bottom of the chamber, from whence it will flow back, through covered holes, to the boiler. This is continued until all impurities are eliminated from the clothes.

Improved Sewing Machine.

Silas H. Hall, Ottawa, Kan.—The needle has its shank flattened on one side, the socket being of corresponding form; and a notch, in the side, receives a slide to hold it from dropping out when the set screw is loosened. The detachable head holds the needle so as to oscillate it a little, to adjust and line the eye properly. A set screw, for fastening the needle in the head, passes through a slot in a spring, hanging down from the needle bar, and prevents the head from turning too far. There is a clamp and a thumb screw, for fastening the presser to the presser bar by securing a stud on the presser in the eye of the bar, so that the presser may be changed without the use of a screw driver. There is a horizontal slide in a groove, in the side of the stationary arm, with a stud pin, which enters a curved cam slot and operates the needle arm. The slide is worked by a crank on the top of a vertical shaft, which is to be turned by a disk running against the driving wheel, to be turned by friction.

Improved Center Piece and Cover for Cooking Stoves.

Mary L. Melville and John S. Kidd, Brooklyn, N. Y.—It is proposed to construct pot holes in the top plate in clusters with one or more straight sides, according to the number of pots to be clustered together, and thus adjust them so that the whole of the middle portion over the hottest part of the fire will be covered by the pots, having flat sides and standing close together, and all of the available portion of the heat thereof will be utilized. The invention also relates to hinging covers to the stove, so that they may be turned up and rest on the edge by the side of the pot, and thus save the labor of lifting them off and on the stove. The joints or hinges will be on the straight side; and where two or more holes are used, the covers will be jointed to the cross pieces, so as to swing up between the pots.

Improved Wheel and Axle for Vehicles.

Sylvester H. Dailey, Olcott, N. Y.—The wheels which revolve upon the axle are made with wide rims projecting upon the outer sides, and having gear teeth formed upon their inner surfaces. The journals of the axle project upon the outer sides of the wheels, and are squared off close to the body of the said wheels, to fit into square holes in the center of bars, which are placed in vertical positions, and to the arms of which are attached gudgeons, upon which revolve gear wheels of a diameter equal to about one third the diameter of the wheels. The teeth of the lower wheel mesh into a gear wheel which runs upon the journal of the axle, and is formed with a sleeve which extends out nearly to the end of the journal of the axle. Upon the sleeve, close to the wheel, is placed a gear wheel, the teeth of which mesh into the teeth of the upper gear wheel. A spring is coiled around the outer part of the sleeve. By this construction, as the vehicle is drawn forward, the draft applied to the axle will act upon the upper part of the wheels, so that less power will be required to draw the machine; than would be necessary were the wheels constructed in the usual way.

Improved Feed Gage for Printing Presses.

John H. Pinks, Woodstock, Vt.—This invention consists of a pair of registering pages for receiving and holding the paper sheets to be printed, mounted on jointed arms which are pivoted to the tympan clamp, and so contrived that they can be shifted to hold paper of any size that can be printed in the press.

Improved Clothes Dryer.

Dennis L. Huff, Bay City, Mich.—There is a disk to which the arms are attached so as to radiate from the center, and by which they are mounted on the top of the post, to revolve horizontally. The said disk is provided with a spindle. This disk covers the socket in the post, and prevents it from filling with snow and water, by which the spindle would otherwise freeze fast in cold weather. To secure the arms to this disk, the ears on the upper side at the edge and the boss at the center are provided, and a hole is made through the ears and others through the boss, coinciding with them radially, descending from the ears to the center of the boss. On the under side of the disk are strengthening ribs, which unite in the spindle at the center. The post has strengthening ribs and a strengthening collar around it at the bottom of the socket, where it is subject to the greatest strain by the spindle.

Improved Cotton Press.

John Gramelspacher, Jasper, Ind.—The follower is attached to the cross head, and both are worked by rods. The latter are operated by levers and cramping pawls. There are also gripping pawls for holding the rods while the gripping pawls let go. The cramping pawls are connected to the levers by a yoke, and they have a spring under them for throwing them up, so as to release the grip on the rod; also to raise them for taking hold again as soon as the levers let go. The pawls are coupled to the frame by the link, and held by a spring, so as to grip the rods and hold them against going back. A yoke is provided with each gripping pawl to hold it down against its spring and prevent it from gripping when it is desired to raise the follower. Bars are attached to the two sides of the press case, with holes at the slots in the sides of the case, to introduce rods above a quantity of pressed material, not enough for a complete bale, to prevent it from springing up while the follower is raised to press in another portion.

Improved Barrel Head.

Owen Judge, Carbondale, Pa.—The head of this barrel consists of four pieces: two principal pieces which are so much less than semicircles that they may be crowded from the middle to the right and left into the cross, and two short pieces of sufficient width to complete the head, but connecting and lapping at the center. The inner edges of the principal parts are beveled. The smaller pieces are beveled to fit this space, so that when their outer ends are placed in the cross, and they are forced down by the central bolt, they act like a wedge to press the parts laterally, while making tight joints with them in the middle of the head. A nut plate is firmly attached to the center of an anchor piece. Into this a lock is screwed which forces down the pieces to a level and forms a tight head.

Improved Gas Regulator.

Jules Anselme Crété, Corbell, near Paris, France.—This is a regulator for gas and other fluids, in which a ball is confined in a tube, through which the fluid passes, and rises or falls as the pressure is greater or less, thus obstructing the delivery. The apparatus consists of a chamber fitted on the gas burner, the water pipe, etc., and formed at its upper part with a central channel of definite section, on the inner surface of which grooves or recesses are formed, which increase the sectional surface thereof. The number and section of these grooves or recesses is so calculated that, supposing the central channel to be obstructed, there will pass through the grooves (which constitute so many distinct passages leading to the burner proper, or to the water outlet) only a desired quantity of gas or water; or, in other words, the regular delivery. The lower part of the central channel is conical, and the body of the regulator is so set that when the delivery of gas or water is shut up, a small sphere rests on a seat at a certain distance beneath the cylindrical portion of the channel or passage. The seat consists of two or three pins, which retain the sphere above the center of the inlet pipe without closing it completely, leaving around the same free passages, while the space between said seat and the grooved channel forms a case or chamber, into which the sphere can rise. The operation is as follows: The delivery cock being shut, the sphere stands resting on its seat. If, now, the cock is opened, and the pressure is superior to two fifths of an inch, the sphere then will rise, and, getting near to the conical part of the central channel, will give access to the burner of only the quantity of gas passing through the grooves in said channel and the annular section existing between said sphere and the channel surface. Should the pressure increase, then the sphere will narrow more and more the annular space, so far as to completely annul it, and the gas will then escape only through the grooves, which are adapted for delivery of a volume of gas sufficient for the normal consumption of the burner. When the pressure subsides, the inverse effect will be produced, the sphere lowering and thus increasing the escape section. When the pressure gets beneath two fifths of an inch, the sphere will drop again to its seat, and the gas will escape through the entire channel and its grooves.

Improved Pocket Book.

Daniel M. Read, New York city.—This invention consists in an improved fastening for pocket books, etc., in which a part of the main plate is movable, and has teeth formed upon its inner edge to take hold of the catch attached to the flap of the pocket book. The sliding part has an arm, the ends of which overlap the plate to keep the said part in place. The sliding part is moved back by a knob to unfasten the catch, and is connected with the end of the arm by a pin which passes through a slot in the plate. The sliding part is held forward by a spring.

Improved Artificial Stone.

Ernest L. Ransome, San Francisco, Cal.—This is an improved process for indurating and removing the excess of moisture from artificial stones by the aid of heat and moisture. If the stone contains soluble silica, it is first immersed in a solution of any of the compound silicates. The maximum temperature of the solution should be about 212° Fah. When the stone has been subjected a sufficient length of time to the action of this bath, the stones are removed and placed in a separate vessel. The stones are next surrounded with an atmosphere of about their own temperature, which is moistened by steam, the object being to obtain a greater quantity of moisture in the atmosphere surrounding the stone than would result from the conversion of the moisture in the stone to steam. After maintaining this moist atmosphere at a temperature long enough to convert the moisture in the stone to steam, the amount of moisture is gradually reduced, while carefully regulating the temperature. Artificial stone which does not contain soluble silica need not be subjected to the hot bath, but will be seasoned and indurated by being subjected to the moist atmosphere and subsequent dry heat. By the above described process the surface of the stone is speedily indurated, while heat and moisture are conveniently conveyed to the mass, and by the use of the atmospheric treatment the obnoxious surface cracks, consequent upon variable shrinkage of the mass, and so frequently met with in artificial cement stones, are prevented.

Transparent Fluid Compound for Engraving Purposes.

Frederick Diffany, Newark, N. J.—This compound is used for engraving with the sand blast when a large surface is required to be cut away, such as in bracelets, watch cases, etc., for example. When it is desired to ornament a bracelet, the pattern is drawn with the compound, and such portions covered as may require to be left untouched by the action of acids or the sand blast. The piece of metal thus prepared is set aside for a few hours until the compound stiffens, when it is ready to be treated with the sand blast, which will rapidly cut away all such parts left uncovered. The compound is composed of benzine, ether, spirits of turpentine, India rubber shellac, dragon's blood, mastic gum, and alkanet.

Improved Medical Compound or Salve.

James W. Miller, Leesburg, Tenn.—This invention consists of a compound composed of slippery elm bark, the plant known as life everlasting, mullein tops, and pure spring water. These ingredients are boiled down, then beef tallow, mutton tallow, English rosin, beeswax, and neat's foot oil are added. By this method a healing salve is produced, which is a remedy for all descriptions of sores, wounds, bruises, etc.

Improved Piano Stool.

George A. Ramseyer, New York city.—The stand dard, which is supported at the ends in the cross bars of the stand, has the nut fitted on it. The nut is provided with the branching arms, which extend above the upper cross bar and support the seat sufficiently above it to allow the necessary play for it to be adjusted to vary the height. A friction pawl holds the seat, by binding the nut on the standard, and is so arranged that the downward pressure on it by the standard causes it to grip the standard and bind it fast. By lifting the seat up, the grip of the pawl is destroyed, and the seat may be raised without manipulating the pawl, but to lower the seat the pawl has to be held away from the standard. The seat may thus be adjusted much quicker than with a screw, and without revolving it.

Improved Manufacture of Friction Matches.

José J. Machado, Havana, Cuba.—This invention consists of the preparation of the matches with a composition not liable to ignition, except on a prepared surface of amorphous phosphorus, in such a manner that part of the match is covered with a slower burning composition, while the point or end is prepared with greater affinity to the surface for more rapid ignition. The combustible composition is made entirely waterproof by dipping it into a solution of alcohol and tannic acid.

Improved Driving Reins.

Stillman E. Mathews, Chaska, Minn.—This invention consists of reins or a cord connected to them, arranged through the bit ring, around the bit and under the under jaw, from one side to the other, so that the strain tends to grip the jaw very firmly between the bit and the part passing under the jaw. By this means a powerful effect is produced on the horse, greatly interfering with his running. It is also proposed to connect the reins to the bit ring by other safety straps, to come into action in case the aforesaid cord breaks.

Improved Grain Separator.

Frank Johnson, Fredericksburg, Mo.—To the upper forward part of the shoe is attached a board upon which the straw and grain are received from the thrasher. The upper part of the receiving board is stationary, and the lower part may be hinged to said upper part. The lower edge of the lower part is secured adjustably to the shoe. To the adjustable board are attached fingers about three inches apart, and two feet in length, along which the straw slides while the grain drops through. To the shoe below the fingers, is attached a frame, to which are attached short tongues, which enter grooves in the side boards of the shoe, so that the forward end of said frame may be adjusted higher or lower by shifting it from one to another of said grooves. The rear end of the frame is supported by bolts, which pass through the shoe. To the side bars of the frame are attached cross slats, which are arranged one inch apart, and the forward edge of each rear slat one half an inch below the rear edge of the next forward slat. To their rear edges are attached wires about one quarter of an inch apart, and which project about four inches. The forward edges of the slats are made thicker and are beveled off, so as to allow the grain to pass through, and also to give the blast of air a proper direction to blow off the chaff.

Business and Personal.

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

Annealer Wanted—To take charge of the furnaces in a malleable iron foundry; must be able to give reference, and state where and how long he has been engaged in the business. Address John H. Thomas & Co., Dayton, Ohio.

Wanted Address—Maker of coal conveyer. Saml' M. Van Chief, 37 Rose St., New York.

Old Battery Zinc Bought—7c. per pound paid for old zinc battery plates. Parties out of town will please send the above stock C. O. D., and it will receive prompt attention. Thos. Huns, 341 Leonard St., Williamsburgh, New York.

Manufacturers of Scroll Saws, send circulars to J. A. Field, P. O. Box 902, Racine, Wis.

Compound Propeller Pumps, for Mines, Quarries, Canals, and Irrigating purposes. Circulars on application to Hydrostatic and Hydraulic Company, 215 Ridge Avenue, Philadelphia, Pa.

To Manufacturers and Amateurs—Solutions for covering all kinds of metals with different metal, either by Electro Plating or chemical process, always on hand, with reliable direction for use. Address Alb. Loyie, 222 N. 4th St., Philadelphia, Pa.

The Taper-Sleeve Belt Pulley cannot be thrown out of balance—has no keys or key seats to mar hubs or injure shafting—no set-screws to catch clothing or belting, or, in slipping, to ring shafting. One Pulley sent on trial to any part of the U. S. A. B. Cook & Co., Erie, Pa.

A cheap and efficient receipt, and plain directions for removing scale from Boilers, and keeping them free, will be sent for 25 cents, by H. F. Henry, Box 223, Pittsburgh, Pa.

A Stationary Engineer wants a Situation; will take charge of one or more Engines. Can give the best of reference. Address E. F. Shaw, 117 South Second St., Philadelphia, Pa.

Wanted—Agents to sell territory for Hoyt's Fire and Water Proof Roof, noticed in this week's List of Patents. Address, with stamp, F. J. Hoyt, Batavia, N. Y.

Architects and Builders, send to Charles K. Bell, 725 Broadway, for Catalogue of Photographs of New York City and Central Park.

For Sale, Cheap—Second hand Machinist's Tools. D. Frisbie & Co., New Haven, Conn.

Pattern Letters and Figures, to put on patterns of castings, all sizes. H. W. Knight, Seneca Falls, N. Y.

We make to Order Iron and Steel Drop Forgings of every description. B. A. Belden & Co., Danbury, Conn.

Wanted Agents Asbestos Felting Co., 316 Front St., New York.

A machine that actually pays its cost in 30 days. Made by Humphrey Machine Co., Keene, N. H.

S. H. P. Baxter Engine, Allen's variable Cut-off, 11x14, Todd & Raftery 12x12, 45 others, new and 2d hand, with Upright and Horizontal Boilers, Steam Pumps, &c., each fully warranted. Wilson & Roake, Water and Dover Sts., N. Y.

A few copies of the Manual of Power for sale. Price \$1. Address Saml' Webber, Manchester, N. H.

For Sale—Lathes, Drills, lot of Machine and Boiler Tools. W. McCollum, 333 Pearl St., N. Y.

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

Steam Air Pump Wanted—A good Second-Hand Steam Air Pump, capable of a pressure of at least 40 pounds. Address J. Barnard, 21 So. 3d St., Camden, N. J.

Button-Hole Worker—Patent for Sale—Sample worker sent for \$5. A. W. Webster, Ansonia, Ct.

Wanted—Circulars and Price Lists from Makers of small Water Motors, suitable for running light machinery. Address Porter Blanchard's Sons Concord, N. H.

Safe Investment—For Sale—Big Muddy Coal, Timber, and Farm Lands. The whole or one interest in 144 Acres of the Big Muddy Smelting Coal Lands, in Jackson County, Illinois. Vein 3 and 6 feet in 80 feet from surface; five improved Farms, with 246 acres under fences; Timber, such as White and Burr Oak, Walnut, Poplar, Ash; being 500 acres. The Timber alone will pay for the land. The St. Louis and Cairo Railroad runs through said lands, two miles from Murphyboro, the county seat of Jackson County, Ill. Will sell the whole for \$75 per acre, and take half or one third interest. Address Dobschütz & Abend, Owners of three Mines in St. Clair Co., Illinois, Belleville, St. Clair Co., Ill.

Deane's Patent Steam Pump—for all purposes—Strictly first class and reliable. Send for circular. W. L. Chase & Co., 95 & 97 Liberty St., New York.

Spinning Rings of a Superior Quality—Whittemore Spinning Ring Co., Whittemore, Mass. Send for sample and price list.

Wanted—The Manufacture of "Specialties" made mostly of Wood. Beyer & Co., Meadville, Pa.

The Pickering Governor, Portland, Conn.

Portable Engines 2d hand, thoroughly overhauled at 1/4 Cost. J. H. Shearman, 45 Cortlandt St., N. Y.

The Improved Hoadley Cut-off Engine—The Cheapest, Best, and Most Economical steam-power in the United States. Send for circular. W. L. Chase & Co., 95 & 97 Liberty St., New York.

Mechanical Expert in Patent Cases. T. D. Stearns, 23 Murray St., New York.

Gas and Water Pipe, Wrought Iron. Send for price list to Bailey, Farrell & Co., Pittsburgh, Pa.

Forges—(Fan Blast), Portable and Stationary. Keystone Portable Forge Co., Philadelphia, Pa.

Boilers and Engines, Second Hand. Egbert P. Watson, 41 Cliff St., 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 \$5. F. C. Beach & Co., 268 Broadway, New York, Makers. Send for free Illustrated Catalogue.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

Brown's Coal-yard Quarry & Contractor's Apparatus for holding and conveying materials by iron cable. W. D. Andrews & Bro., 41 Water St., New York.

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

Lathes, Planers, Drills, Milling and Index Machines. Geo. B. Lincoln & Co., Hartford, Conn.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 479 Grand Street, New York.

Electric Bells for Dwellings, Hotels, &c.—Most reliable and cheapest Hotel Annunciator. Cheap telegraph outfits for learners. In's for Private Lines, Gas Lighting Apparatus, etc. J. H. Heald, 26 Cleveland St.,

Engines, Boilers, Pumps, Portable Engines
Machinists Tools, J. H. Shearman, 45 Cortlandt St., N. Y.

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

Price only three dollars—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., 268 Broadway, New York.

Rue's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 95 & 97 Liberty Street, New York.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels; also Glaziers' Diamonds, J. Dickinson, 54 Nassau St., N. Y.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 25 Cornhill, Boston, Ms.

The French Files of Limet & Co. are pronounced superior to all other brands by all who use them. Decided excellence and moderate cost have made these goods popular. Homer Foot & Co., Sole Agents for America, 30 Platt Street, New York.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement. Andrew's Patent, inside page.

Automatic Wire Rope R.R. conveys Coal Ore, &c., without Trestle Work. No. 31 Dey street, N. Y.

A. F. Havens Lights Towns, Factories, Hotels, and Dwellings with Gas. 34 Dey street, New York.

Best Philadelphia Oak Belting and Monitor Stitches. G. W. Arny, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for circular.

Temples & Oilcans. Draper, Hopedale, Mass.

Buy Boulton's Paneling, Moulding, and Dovetailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 227.

Answers to Correspondents

G. X. D. will find directions for removing stains from cloth on p. 171, vol. 30.—C. N. F. will find directions for preparing sumach on p. 71, vol. 30.—G. F. will find a recipe for printer's ink on p. 154, vol. 30, and directions for galvanizing sheet iron on p. 59, vol. 24.—M. W. C. will find a recipe for gelatin (isinglass) cement on p. 71, vol. 30, and for cleaning brass on p. 102, vol. 25.

J. S. asks: How small a circle can a small locomotive turn on without causing friction enough to overcome the power of 2 one inch cylinders? The driving wheels are 4 inches in diameter and 6 inches between each driver from center to center, and 14 inches from the back driver to the forward truck wheel. The truck wheels are 4 inches from center to center. A. It will depend upon the play of the wheels on the track. You can strike area with different radii, and determine the question after a few trials. By making the intermediate wheels without flanges, you can turn the locomotive in a very sharp curve.

R. M. says: The present method for sawing marble is with sand and water, acted upon by a soft iron blade. 1. Can the teeth of a steel blade be hardened enough to saw marble and stand the wear for any time? A. It has not been found practicable. 2. If this would not answer, how would it do to use the steel blade instead of the iron, as we could put a great deal more pressure on it, and naturally do more sawing? A. There would not be any advantage, in our opinion. We believe the diamonds are the only cutters that are practicable.

J. B. F. R. asks: How long do you suppose a vacuum could be maintained if formed in an airtight cylinder with a rubber leather piston? A. For ever, if the cylinder were perfectly airtight.

J. H. A. asks: What is the rule for calculating the blow of a steam hammer? We have a 900 lbs. steam hammer with a 5 inch cylinder and 12 inches stroke, working at a pressure of 100 lbs. to the square inch. What is the weight of the blow with the hammer working at full stroke? A. We do not know of any rule by which you can calculate this.

R. G. R. asks: Can you inform me of a cheap method of consuming the smoke, or part of it, from soft coal, in a furnace under two tubular boilers 42 inches by 12 feet each? A. A common plan, which is frequently successful, is to admit air to the products of combustion, after they leave the furnace. Others admit air to the furnace, above the fire. You will find a great deal of interest, in this connection, in Mr. Charles Wye Williams' works.

V. A. says: I have lately had an argument with a friend on the subject of the ball dropped down a hole through the earth's diameter. The subject, being conjectural, cannot of course be submitted to experimental research; but inasmuch as some of the well known principles of matter may be involved, we have agreed to abide by your opinion. He asserts that the ball, on arriving at the earth's center and losing its weight, also loses its momentum, and will come to rest without passing the earth's center. I am inclined to disagree with him on the ground that his assertion is at variance with the theory of conservation of force, and am of the opinion that the ball will oscillate for ever from end to end of the diameter, provided that frictional or retarding media, such as air, etc., be excluded. Your opinion is respectfully sought on the question. A. We incline to your opinion.

W. S. B. asks: 1. Is the use of tobacco by smoking injurious to the teeth? A. Yes. 2. If so, what part of the tooth does it first affect? A. It affects the upper part of the teeth, near the gums. 3. What effect does it have on the brain, if any? A. There is no doubt that the use of tobacco has an injurious effect upon the brain. "Tobacco smoking excites an abundant secretion of saliva; hence some persons maintain that tobacco smoking aids digestion. Smoking acts on the intestines as a slight purgative, and no doubt a pipe or cigar smoked after breakfast is beneficial to some persons. Smoking to excess is no doubt a very harmful habit; it disorders digestion, greatly lessens the appetite, produces much restlessness at night, and weakens both mind and body. Chronic pharyngitis, and chronic dyspepsia in some instances, may be clearly traced to smoking in excess. Even amaurosis is said to be sometimes produced by excessive smoking. Kolliker teaches that nicotine quickly paralyzes the brain and destroys voluntary movement."—(Ringer.)

L. C. T. asks: With what tasteless composition can I coat the inside of a keg to make it air and gas tight? I have tried rosin 3 parts to 3 of beeswax, melted and poured in, but without any good effect. I think that the heat from the composition causes shrinking of the staves, which cannot be tightened after the composition sets or cools. A. Take an aqueous solution of gelatin, about 1 quart of gelatin to 3 quarts of water. Heat the barrel and pour in the gelatin solution boiling hot. Revolve the casks several times until you are satisfied that the gelatin has reached every part of the cask. Draw off the remainder. Allow the cask to become cold. Then pour a solution of tannin in water into the cask, in the same manner as the gelatin, except that during this process everything must be cool. Draw off the tannin solution and allow the cask to remain undisturbed for two or three hours, when you have a solid coating, upon the inside of the cask, of tannate of gelatin.

How can I make root beer? To make root beer, take 3 gallons of molasses, add 10 gallons of water at 60° Fah. Let this stand 2 hours, then pour into a barrel, and add powdered or bruised sassafras and wintergreen bark, each 1/2 lb., bruised sassafras root 1/2 lb., yeast 1 pint, water enough to fill the barrel, say 25 gallons. Ferment for 12 hours and bottle.

J. T. P. asks: 1. How much greater would be the heat in a box, filled with steam through a perforated pipe, with the pressure in the boiler at 40 lbs., than at 20? A. Temperature at 40 lbs. would be 257° Fah.; at 20 lbs., 229° Fah. 2. Is there any instrument for measuring the heat in such a box? A. The temperature can be measured with a thermometer.

J. B. R. asks: What is the best method of extracting tannic acid from new white oak wine casks, so as to make them perfectly wine clean? A. Ether is the best solvent, but being expensive you can use alcohol in its place. The alcohol can be used again, if purified by distillation.

L. G. D. asks: How can I prevent the bodies of butterflies and moths from becoming oily, and secure those that are already oily from becoming more so? I do not wish to cut out the intestines, as that makes the body look unnatural. A. Soak the insect in benzine by dropping the liquid upon its thorax, continuing this until the insect is thoroughly impregnated even to the tips of its wings; then dry in the wind. Pin the insect under a window raised a few inches, or any other place where a sufficient draft of air can be obtained. The moth should be placed with its head pointing inside, so that the rushing air may blow up the feathers of the insect and prevent them from becoming plastered or stuck to each other.

S. L. asks: Can you give me a simple process for making bone black or animal charcoal, used in the manufacture of blacking? A. Put clean bones in a crucible, close, and expose to strong heat till calcined. Cool the crucible, remove and powder the contents, wash them in warm water, and dry.

G. H. asks: What is the process of staining glass, such as is used for church windows, etc.? A. The different compounds for painting on glass are glasses of easy fusion, colored with ground metallic oxides and laid on the glass with spirits of turpentine.

Will light, in passing through such glass, assume its color and transmit it to any object upon which it may be reflected? Will liquids so transmit their colors? A. Yes, in both cases.

G. K. asks: How can I mix a cement that will harden under fresh or salt water, in 24 hours or less, and be of a hard and durable nature? A. You do not state what use you want to make of the cement. There are several hydraulic cements; the following is one: Powdered clay 3 lbs., oxide of iron 1 lb., boiled oil to form a stiff paste.

P. J. K. asks: I do not quite understand how it is proved that the earth is round, by viewing a ship on the ocean. The geography books say that the first part of a ship that is seen is the tip of the mast. How can this be, as water cannot be round, as it always seeks its level? A. Your idea as to water "finding its level" is erroneous. Water, by gravity, assumes the spherical form on the earth's surface; and the roundness of the earth can be demonstrated by the means you describe as well at sea as on land.

R. S.—The phosphorus light you mention is well known, and has been described in our columns.

C. W. says: On August 3 a brilliant star was seen in the west, immediately after sunset; it was as bright as the sun, and gradually faded away till nothing could be seen of it. What was it? A. Probably one of the meteors which are so very numerous during this month.

J. C. S. says: I wish to make some marine glue; in your excellent book of "Instructions for Obtaining Patents" you give directions for making the same, namely: Gum shellac 3 parts, caoutchouc 1 part; dissolve in separate vessels in ether free from alcohol, applying a gentle heat. An encyclopedia says, respecting ether: "Its odor is peculiarly powerful and penetrating if inhaled, producing insensibility to pain, etc. Great care should be taken not to pour it out with a flame below it, otherwise an explosion of a dangerous character might ensue. Mixed with certain proportions of air, it forms a highly explosive compound." I must confess that, in the face of the above, I should be afraid to use ether for making glue until I hear further about it. A. If proper care be taken, the danger is small. Keep in airtight vessels in a cool place. We cannot see the necessity of pouring the ether out with a flame beneath it.

W. A. P. says: Please give me a recipe for glue that will be tough and strong, to fasten emery to leather. A. Marine glue, made of shellac and India rubber dissolved in naphtha, will probably answer well. It is recommended by some to add a little milk to ordinary glue, in securing emery to leather.

H. W. N. asks: Which goes the fastest, a shell boat pulled by two persons, using two oars apiece 10 feet long, or one pulled by two persons using one oar apiece, 12 feet long, weights being equal? A. This is scarcely a matter of theory, but is one of those questions which should be decided by direct experiment.

G. E. H. asks: Can a belt be laced so that the lacing will not be crossed on either side, and at the same time be strong enough to hold from pulling out on a belt that has to be so tight as to be stretched on to the pulley by clamps? A. We think it is better for the lacing to cross.

C. M. P. asks: How can I keep metal boxes from getting loose? Is there anything you can put on the iron before you run the metal that will make the latter stick? A. The iron should be recessed or provided with holes to retain the Babbitt metal in position.

C. H. H. asks: What is wire drawing in a steam engine? A. It is a reduction of the pressure of steam by contracting the opening through which it passes.

How is the hammer test applied to steam boilers? A. By tapping the boiler gently with a light hammer, and judging by the sound whether the iron has deteriorated.

B. asks: Is not an asymptote a line which, approaching a circle, continues to infinity without touching it? A. An asymptote is a straight line which continually approaches nearer to a curve, but never meets it. The straight line is continually dividing the distance between itself and the curve, so that, between two successive equal lengths of the straight line, the distance between the curve and the straight line is only a fraction as great as it was before; but as there will always be some distance to divide, the two lines will never meet.

Can two bodies approach each other from opposite directions in the same line, without meeting? A. The possibility of the two balls continually approaching, and never meeting, might be conceived. Imagine them to be subject to a law by which the space through which they moved in one second was always half the distance between them at the commencement of that second. Then if the distance between them at any given point were 2 feet, it would be after 1 second, 1 foot; after 2 seconds, 1/2 foot; after 3 seconds, 1/4 foot; after 4 seconds, 1/8 foot, and so on; and if the law were unchanged the balls would never meet.

L. B. asks: Will a common cotton boat, usually called in South Carolina a mountain boat, propelled by an engine instead of poles, be subjected to United States inspection, and be required to have a licensed engineer aboard? A. Yes.

A. W. S. asks: Having run an engine for two years, I want to learn to be an engineer. Can you tell me where to go to learn more of the business? A. You need shop experience and education. Cornell University furnishes both. You could enter a machine shop and employ your spare time in study.

J. H. N. asks: What horse power steam engine is necessary to perform work on a farm, such as grinding, sawing, etc.? A. From 3 to 5 horse power.

What is the capacity, in the indicated horse power of a steam engine, of a two horse tread power, elevated and driven by horses, in the manner usually done by threshers? The horses are to be of medium size and capacity. A. From 3 to 4 horse power.

I. asks: A friend of mine affirmed that the revolutions of a wheel could be indefinitely increased by the use of a number of multiplying wheels, without increasing the motor power. I averred that this could not be done without increasing the motor power, for the weight of the wheels would counterbalance the rapidity of the motion; and that finally the mechanism would become so heavy that the number of revolutions would no longer be increased. Who is right? A. Every additional connection would require some power to drive it, and therefore your friend is in error.

J. R. S. asks: Is it a fact that ice houses take fire by spontaneous combustion? If so, I would like a scientific explanation of the matter. I have noticed that there have been quite a number of ice houses burned this season, and that the cause was attributed to spontaneous combustion. One was burned in Massachusetts on the night of July 31. The building was 40x30 feet, with 20 foot posts made of light as possible, with no means of ventilation; it was filled to the plates with ice packed in fine sawdust. The parties owning the ice had a quantity in another building packed in small hay; after using the ice that was packed in hay, they dried the hay and spread it upon the ice in the ice house. Four days after the building was discovered on fire, the fire bursting from the roof. A. We are not aware of any other case in which the origin of a fire in an ice house has been attributed to spontaneous combustion, although the burning of ice houses is a somewhat frequent event. Workmen so commonly smoke pipes about their work that we would be inclined to attribute the origin of these unfortunate disasters more to this cause than to any other. We would be pleased, however, to receive from our correspondents any additional facts bearing upon the subject. As to providing special means of ventilation for ice houses, we understand that it is considered by many essential to the proper preservation of the ice to do so.

S. E. J. says: If we have a plane surface containing a square foot or yard, how much more pressure will there be on it when it is placed so that the wind can blow square against it, than when it is placed at an angle of 20°, 30° or 45° to the wind? A. Experiments have not been sufficiently extended to enable this question to be answered exactly. Robins and Borda's experiments, however, seem to show that the pressure on oblique surfaces varies nearly as the sine of the angle of incidence.

C. D. says: Please give me the number of figures that it requires to make a billion. A friend says that 8,750,340,240 stand for three billion, seven hundred and fifty million, three hundred and forty thousand, two hundred and forty; and by consulting the arithmetic I find that he is right; but when I go to Webster, I find that it requires a million of millions to make a billion, which would be 1,000,000,000,000, or 13 figures. A. In French numeration, commonly employed in this country, a billion is a thousand millions. In the English numeration, as given by Webster, a billion is a million millions; and the first example, read by the English numeration, would be three thousand seven hundred and fifty millions, three hundred and forty thousand, two hundred and forty.

A. J. K. asks: What are the three and five cent pieces (now in use) composed of? A. Three fourths copper and one fourth nickel. The five cent piece weighs 77.16 grains; and the three cent, 30 grains.

G. A. says: J. S. S. says that he runs one pair of burrs (or rocks, as he calls them) on 40 lbs. of steam. I should like to know the size of his boiler and engine, also the size of stones, and kind and quality of work done. I have a tubular boiler, 10 feet long and 4 feet in diameter, with 72 two inch tubes, with a grate surface of 16 square feet. The engine has two cylinders, 5 1/2 inches bore x 12 inches stroke, running 105 revolutions per minute, cutting off at 1/4 stroke. We cannot run with 40 lbs. of steam; with 60 lbs., we cannot grind over 300 bushels of corn in 10 hours into feed meal. I think we have a good boiler. The engine will not give us the amount of power we want. Will you give us your opinion, and will J. S. S. further explain his case? A. It might be well to run your engine faster. A good engineer could readily ascertain whether the machinery is doing as well as it should. We should be glad to hear again from J. S. S., in answer to the present correspondent's inquiries.

C. J. W. asks: 1. Given a set of four boilers, placed side by side; the steam is taken from each through a 1-inch pipe which is carried directly to the front and connected with a 6-inch pipe running parallel with the fronts. From about midway between the ends of this last, a 6-inch pipe is taken to the engine. The total distance from the boilers to the engine is about 75 feet, and in this distance there are four right angles. The steam drums and pipe are all exposed to the air. Is there greater condensation on account of the right angles? If so, is it appreciably greater? A. Yes, to both queries. 2. Is the condensation probably much greater on account of exposed condition of drums and pipe? A. Yes.

M. C. H. asks: As to the relative properties of air and steam, which is the most compressible, that is, the most elastic? If two boilers were charged, one with steam and the other with air, each compressed to a pressure of 100 lbs. to the square inch, and one of two engines of the same size be attached to each boiler, which would give the greater number of revolutions, everything else being equal? A. If utilized to the best advantage, the steam would give the greatest number of revolutions, since it can be condensed, while air is a permanent gas.

O. S. asks: Suppose a bottle, weighted with shot and so adjusted as to submerge it one inch below the surface of the water, be made perfectly tight, would the bottle continue to sink, until it reached the bottom; regardless of the depth, or would it find its equilibrium, and remain suspended between the bottom and surface? A. The bottle would continue to sink as long as its weight was greater than that of an equal volume of water; when the two became equal, then the bottle would come to rest.

S. S. says: I have two wells, 436 feet apart. Which is the cheapest way to arrange a windmill to pump the water of both wells with one pump? One well is 20, the other 25 feet deep. A. About midway between the two wells, but far enough away from the center, towards the deepest well, to compensate for the greater lift.

R. H. F. says: On p. 101 of your current volume, the following passage occurs, in reference to making screw dies: "Make an allowance for shrinkage in hardening, for all holes shrink in hardening." This I believe to be erroneous. Let some of your young readers test it; it may help to teach them methods of careful investigation. Take good steel, soft, and drill a hole accurately in it; take the same steel in the same condition (not having heated it meantime) and fit closely and very accurately the hole thus made, harden the steel with the hole in it, and apply the round steel in the hole; if it will not enter at all, it is clear that the metal containing it has expanded inwardly; if it enters as before, otherwise. Now harden the steel that has been fitted in the hole, and it will be found not to enter the hole, whether the metal of the latter be hard or soft. Suppose that steel of proper dimensions be given an even and finished surface, and a true and delicate circle be drawn thereon; then let the steel be hardened, and the diameter of the circle be remeasured. The result, no doubt, would be an enlarged diameter, and that in consequence of the tension of the metal within the circle. I believe that, if no metal were there, the circle would be unchanged; otherwise, if the circle were diminished, it would be contraction of the metal about the margin of the hole, not expansion in hardening. A. If an inch hole be bored in a piece of soft iron or steel, and the iron or steel be then hardened, the hole will be less than an inch. If a piece of round iron or steel, an inch in diameter and 8 inches long when soft, is hardened, it becomes more than an inch in diameter and more than 8 inches long. A circle described on a solid face would enlarge from hardening; but if the metal were cut away round the inside of the circle, it will then become smaller. It is obvious that in the one case the metal inside the circle expands and forces the circle outwards, therefore enlarging it; while in the other case, there being no obstacle to the metal finding room to expand inwards, it does so.

E. H. M. says: I have in daily use twelve tanks (or, more properly, casks), holding about six hundred gallons each. They are built of best Michigan two inch oak, and are used for receiving spirits, about proof in strength. They sometimes leak. What is your opinion of an application of paraffin outside, and what method would you suggest for an inside application, to be put on without taking end or head out? Would a satisfactory result be reached by placing sufficient paraffin at the bung and rolling the cask about till the materials be wholly taken up? If any remain in the cask, would the paraffin combine with the spirit or give it any flavor? Is it solid or liquid? If the former, how shall I manage for the purpose named? A. Paraffin at ordinary temperature is a solid. It melts at 45° to 66°. We think it would be best for you to try an outside coating of paraffin on the parts which leak. It would be difficult to line the inside without taking out the head. To apply the paraffin, melt it in an iron vessel and pour on the parts to be treated; then use a hot piece of iron to rub the cooled paraffin down smooth.

E. L. S. asks: Why does the German student lamp flicker, even with a new wick? A. You do not use the best of kerosene. These lamps absolutely require it.

J. C. E. asks: Is it beneficial to a heavy rubber belt to keep it well coated with paint? A. It will be decidedly injurious, causing the belt to crack and eventually to tear.

G. B. S. asks: What is the principle of the lactometer? Is it anything like the hydrometer? If not, in what respect does it differ? A. Hydrometers are of two classes. 1. of constant volume but variable weights; 2. of constant weights but variable volume. Hydrometers of the first class are used to determine specific gravity. Hydrometers of the second class (of which the lactometer is one) do not determine the specific gravity, but merely show whether a liquid is more or less concentrated. Pure milk is liable to great changes in strength (owing to change of food, wet, damp weather, etc.), so that the lactometer is not to be relied upon to detect adulterations.

J. M. T. asks: 1. Are resonators made as an article of trade? A. No, not in this country; they can be obtained at Munich. 2. Have they any definite form? A. They generally have a globular shape, resembling in their external form a small mortar. 3. Should they be constructed of any particular substance? A. Helmholtz' resonators, one of which may be seen at the Stevens Institute, Hoboken, are made of plaster of Paris. 4. Is it the mass of air contained or the column that causes resonance? A. The enclosed air is the sonorous body and the substance of the globe has scarcely any influence on the tone. It is the volume of air which causes resonance. 5. Should the opening be of any specific size? A. The opening should have a definite size.

M. A. W. says: There are several marks on my face, the result of scratching while having the smallpox at the age of 7. My age now is 19. I have outgrown many of the marks, but the remaining ones give my face a somewhat rough appearance. Is there any possible way of removing them? A. Age is the only remedy.

R. H. P. says: If I dissolve 1 lb. of Malacca tin in muriatic acid, and then precipitate the tin with zinc, how can I recover or bring back the precipitant to metallic tin? Can it be done in a lead crucible, and at what temperature? A. Precipitated tin can be reduced in a graphite crucible by mixing it with cyanide of potassium and a little carbonate of soda, and covering the charge with a layer of common salt. The fire should be a bright red, and the crucible should be left in 30 to 60 minutes. The sample sent is not precipitated tin. Two assays of the sample were made, and failed to obtain tin; but instead, obtained iron. Are you sure about its being Malacca tin?

W. H. K. Jr. asks: What ought to be the thickness at top and bottom of two square brick stacks respectively 100 feet and 140 feet high, each having an 8 feet square flue for the entire height? A. For the 100 feet stack, make the walls 3 feet thick at bottom and 16 inches thick at top; and for the 140 feet stack 3 feet 8 inches thick at bottom and 16 inches thick at top, the brickwork being of hard brick and cement mortar. (This answer was incorrectly given in our last issue. —Eds.)

J. W. M. asks: How can I fasten ornamental center pieces, made of plaster of Paris, on to plastering? A. Stucco center pieces and ornaments of all kinds are put up after the second or brown coat of plastering—and sometimes the finishing coat—is put on. Make a number of holes in the plastering down to the lath, and then fill them with white mortar, gaged or tempered with plaster of Paris; wet the ceiling well, and ornaments, at bottom; you can then stick them on with the gaged mortar as you please; and if well bedded into it, they will adhere. Clean off all loose mortar with a plasterer's brush and plenty of clean water, after they are set.

How can I polish plastering, when the last or white coat is of lime and plaster of Paris? A. In hard finishing walls, plasterers use an oleaginous substance called "elbow grease," by which they imply that the polish is put on mainly by much and hard troweling. Use clean washed white beach sand in your finishing coat of lime and plaster; take your brush in one hand and your trowel in the other; first apply clean water and then follow it with the trowel, and repeat until the plaster sets and shows a polish.

J. P. asks: Has a common underground cistern, well secured with the best of hydraulic cement, ever been tried as a receptacle for wine? When the cement is well set, would it be detrimental to the wine or the wine to the cement? A. We are not aware of any instance of the kind, and would not advise you to try it. The value of wine depending so much upon a certain delicacy of flavor, it would not be safe to subject it to the action of the crude materials of which such a receptacle would be made.

W. G. R. asks: How can I test the effect of frost upon samples of artificial stone? Can I do it with sulphate of soda? A. Experiments of the kind referred to have been made by Professor C. F. Chandler, of the School of Mines, whom you may address at East 19th street, corner Fourth avenue, in this city.

C. M. M. asks: 1. How much power will it take to run a 24 inch planer? A. It depends a great deal on the speed at which you wish to run the machinery, and the depth of cut. It would be well to allow at least 10 horse power. 2. How much power is required to run a common wood lathe for turning table and bedstead turnings of walnut and maple? A. Allow 3 horse power. 3. How much power is required for running a 16 inch circular saw for ripping 2 inch white oak plank? A. Allow 15 horse power. Of course, you can use a great deal more or less, as you desire, in each case.

W. P. asks: What size and power of boiler would it take to heat with steam 4 rooms of 7,000 cubic feet each? Are 2½ feet radiating surface sufficient per hundred cubic feet of room? A. Under ordinary circumstances, a boiler that will evaporate from 1½ to 1½ cubic feet of water per hour ought to be large enough.

F. H. asks: 1. On a tramway, 1,400 feet long, with a full wagon, weighing 10,000 lbs., have sufficient tractive force to pull up the empty one, weighing 2,000 lbs., if the incline is only 1 in 100? A. Yes, if properly arranged. 2. What power of engine would be required to convey (by means of endless wire ropes) these full wagons, bringing them on the return, empty? A. About 10 horse power. Your other questions are of purely personal interest, and you should apply for answers to manufacturers and dealers.

H. B. asks: How many cubic feet gas would be required to lift one pound weight? A. Taking it for granted that hydrogen gas is meant, it will require about 14 feet of nearly pure gas, as from the action of zinc upon acidulated water. Of common street gas (carburetted hydrogen), it would require about 30 feet to lift one pound weight.

What would have to be the size of a vessel to contain 30 cubic feet? A. A spherical vessel (balloon) about 3 feet 4 inches in diameter will hold about 30 feet.

F. Y. asks: What will remove tan from the face, hands, and other portions of the body without injury to the skin? A. Take of corrosive sublimate 3 grains, muriatic acid 30 drops, lump sugar 1 oz., alcohol 7 oz., rose water 7 oz.; agitate together till all is dissolved. Apply night and morning.

M. S. H. asks: In boiling (or in keeping in hot water below boiling point) tinned articles in lye water to remove rosin, etc., the tinning sometimes becomes colored or stained dark, like lead. Can this be prevented by anything in solution in the lye water (that will not stain silver), or is there any simple way of brightening up the tinning, otherwise than by polishing? Could the darkened parts be varnished by some bright colored lacquer that would give it a nice appearance? A. We have tried the experiment of boiling the tin with rosin in lye water; but the tin was not discolored. We cannot say, without having suitable specimens of the discolored tin, what would remove the stains in the way you desire.

J. F. asks: Is there any agent except peroxide of hydrogen (which I cannot obtain) by the application of which the whites of paintings (particularly water colors) which have been blackened by sulphuretted hydrogen gas may be restored without injury to the material on which they are painted, or to those pigments with which the white lead is associated? A. Peroxide of hydrogen is the only thing we have seen recommended for the purpose.

C. G. B. says: Please give me a full description of Robinson's anemometer, the size of wheels and number of teeth and pinions, also the size of cups, as used in the United States signal service. A. Robinson's anemometer consists of 4 metallic cups in the form of hemispheres, on 4 arms at right angles. They are supported so as to turn freely about a vertical axis. The plane of the base of each cup is perpendicular. The action on the convex surface is less than on the concave surface, hence motion is produced. Making no allowance for friction, the center of each hemisphere moves with ½ of the velocity of the wind. An endless screw on the vertical axis gives motion to a series of wheels which can register the wind's progress to 1,000 miles. The anemometer used by the United States signal service is essentially Robinson's, but the special arrangement of the wheels, etc., is a patented improvement.

C. F. C. asks: 1. What are the proportions used to sensitize the collodion for taking photographs by the new method, without using the silver bath, and also the best developer and fixing solution? A. The following are the proportions of the materials as given by Colonel Stuart Wortley in his new dry plate process, wherein the usual bath is dispensed with: Plate collodion 1 oz., pure anhydrous bromide of cadmium 7 grains, nitrate of uranium 30 grains, nitrate of silver 15 grains. To purify the nitrate of uranium: Dissolve one part in two parts of ether, and let stand for some hours. The water of crystallization in the uranium will fall to the bottom, leaving a top layer of pure uranium, and it is this top layer which is used for the preparation of the emulsion. It is desirable that this purified uranium should have an acid reaction; and if it has not, add to it a minimum or two of acid per ounce. Nitric acid is to be preferred, taking great care not to use too much. A strong alkaline developer is to be preferred. If very sensitive negatives are required, or very rapid development, use bromide in the developer in minimum quantity; if, on the contrary, you wish to be slow and sure, use plenty of bromide and take time for development. The light in the room must be as orange as possible, more so than for the wet process. The following is the composition of the developer: Carbonate of ammonium solution (ninety-six to the ounce) forty drops; bromide of potassium (same strength) ten drops; pyrogallol acid solution, alcohol (same strength) twenty drops; water, one ounce. 2. I am at a loss to produce good sensitive paper; please to tell me how it is albumenized and how to fume it. A. To albumenize paper: Take chloride of ammonium 100 grains, water 5 fluid ozs., albumen 15 fluid ozs. Take the albumen from nearly fresh eggs, taking care not to break the yolk. Mix the ingredients and beat into a froth. Skim off the froth as it forms and place in a flat dish to subside. When the froth has partially subsided, transfer it to a tall and narrow jar, and allow to stand for several hours, that the membranous shreds may settle to the bottom. Then pour off the upper clear portion, which will be fit for use. To apply albumen, pour a portion of the solution into a flat dish to the depth of ¼ inch. Then take a sheet of paper by the two corners, bend it into a curved form, convexity downwards, and lay it upon the albumen, lowering the corners. The upper side remains dry. Allow the sheet to remain one minute and a half, then raise it and pin up to dry. To render the paper sensitive: Take nitrate of silver 90 grains, distilled water 1 oz. Lay the sheet upon the solution in the same way as described for albumen; 3 minutes is sufficient contact for this paper, and 4 to 5 minutes for thick. Finally hang up to dry. 3. Can positive pictures be taken on the glass with the same process as negatives? I would not trouble you with these questions, but, living in the Sandwich Islands, I am so far removed from civilization that it is difficult to obtain books, and the SCIENTIFIC AMERICAN is my constant companion. A. Collodion positives, taken directly, need an image which is feeble though distinct. Iodide of silver is substituted for chloride, and a developing agent is employed. The surface of the reduced metal must be whitened as much as possible. The developer should consist of sulphate of iron. To produce a dead white tint, use with acetic acid. The addition of nitric acid to sulphate of iron modifies the development, making it more slow and gradual. Too much acid must not be used. It is best that the nitrate bath should be acidified by nitric acid instead of acetic acid. It should be tolerably concentrated. In regard to the collodion, if it is the ordinary iodized collodion, it should have some bromide added to it. The operator must be guided by the aspect of the developed image as to the necessary quantity of bromide to be added. If the high lights appear too dense, more bromide must be added. If, however, the positive is gray and feeble, and this is not due to over exposure, the proportion of bromide may be reduced.

A correspondent sends us the following recipe: "Blackening consists of a black coloring matter, generally bone black, and substances which acquire a gloss by friction, such as sugar and oil. The usual way is to mix the bone black with sperm oil, sugar, and molasses; a little vinegar is then well stirred in, and strong sulphuric acid is gradually added. The acid, acting on the salts of lime in the bone black, produces sulphate of lime and a soluble acid phosphate; the sulphate forms a tenacious paste with the other ingredients, which can be spread very smoothly; the oil serves to render the leather pliable. This forms a liquid blacking; paste blacking contains less vinegar. According to Liebig, in Germany blacking is made as follows: The bone black is mixed with one half its weight of molasses, and one eighth its weight of good olive oil; to which are afterwards added one half its weight of hydrochloric acid and one fourth its weight of strong sulphuric acid, mixed up with water to an unctuous paste." He asks: Is not the acid bad for the leather? A. Bone black consists of carbon 10 parts, phosphate of lime 81 parts, carbonate of lime 6 parts. Assuming the bone black to equal 100 parts, the hydrochloric acid 50 parts, the sulphuric acid 25 parts; there will remain 5 parts of acid not taken up by the bone black. These 5 parts will be held in solution by 50 parts of molasses, and 12½ parts of olive oil, and water enough to make an unctuous paste. By this great dilution, the acid loses all power to damage the leather.

W. H. S. asks: 1. How can I make white linen or cotton waterproof without discoloring the fabric or covering the texture? A. Pass the linen through a hot solution of weak glue and alum (1 oz. of alum to 2 qts.) with a few pieces of soap added. 2. How can I make an adhesive substance that will not discolor white linen? A. Use white glue. 3. What kind of varnish or other transparent substance will give linen a durable and finishing polish? A. A little paraffin added to starch will give it a brilliant gloss.

M. S. says: I have a 12 inch belt (double thickness) connecting shafts 40 feet from center to center, with an idler 1 foot 5 inches from the driven shaft. What amount of power will I gain by putting the idler half way between the two shafts? A. Unless the belt is very stiff and unyielding, we do not imagine that there will be any appreciable gain.

H. P. asks: Do you think the moon has anything to do with rain? A. We have no conclusive evidence that the moon has anything to do with rain or in any way affects the weather except perhaps in tending to cause the disappearance of clouds under a full moon.

Is there any danger in testing a boiler by filling it full of water and then slowly heating it? A. This is a method that we have frequently recommended.

What is the best color for painting the cylinder and steam chest of an engine? A. There is a black varnish made from mineral oil that seems to answer very well.

L. B. asks: Which way will a moving railroad car be brought to a standstill the quickest, by applying the brake tight, allowing the wheels to revolve or by applying the brake so that the wheels will stop revolving and slide along on the rails? A. The former way.

G. P. S. asks: Are there any self-switching engines in use? A. Not that we know of.

Is water compressible by freezing? A. It expands. What is the velocity of a gale at an elevation of 100 feet above the surrounding country, and what is the pressure per square foot? A. Velocity about 50 miles an hour, and force more than 12 lbs. per square foot.

Are there any self-running solar cameras in use? A. Yes.

C. A. asks: What is the highest speed ever attained by any locomotive or train in the United States? A. Probably not much more than 60 miles an hour, though there are accounts of much greater speed. Is the dummy engine used to a great extent throughout the State of Pennsylvania, and what is the usual speed? A. It is not very extensively used. The speed is from 15 to 15 miles per hour.

Is there any difference in the speed of the locomotives of this country and Europe? A. The average speed of express trains in England is, we believe, greater than in the United States.

J. R. F. asks: In conversing about the Catline process for making wrought iron, practiced in Northern New York, I was told that the workmen believed that the iron necessarily contained silver; and that if the silver were extracted by means of a loadstone, the iron was thereby rendered worthless. What is the origin for such a belief? A. We never heard of this theory before.

S. L. W. asks: I was once operating a piston slide valve engine, with pendulum governors. I would sometimes check up the speed, which then would run so slow that the governor would not have any effect on the engine. Having one cylinder cock open, the steam would rush out of it at intervals and the speed would increase as if the governor valve were in motion. Was this caused by the eccentric valve not being set correctly? A. This is very common with many governors which are not sensitive enough to provide for great and sudden variations in work. There does not seem, from your account, to be anything wrong in the setting of the slide valve.

Is there any such thing as a Chinese sensitive leaf or plant? A. There is a sensitive plant, occurring principally in the tropics of America. Any flower raiser could doubtless procure one for you.

How many miles per hour will a 10 horse power portable engine propel a flat boat, 60 feet long, 25 feet wide, with side wheel and breakwater? The boiler is to carry 100 lbs. steam, and the paddle wheels are to be driven with a belt from the engine. What would be the tonnage of such a boat, and how much water would she draw when loaded? A. Probably about two miles per hour. You can readily calculate the tonnage and draft by allowing 35 cubic feet displacement for each ton weight of the vessel and cargo. 2. This boat being my own property and carrying freight for the public, would the steamboat law compel me to have licensed officers, and also to have my boat inspected? A. Yes.

F. H. L. asks: What is the process by which brass is tempered? A. It is done by hammering or rolling.

C. M. B. says: I made me an engine last winter with a cylinder 2½ inches, which I am using to run a small wood-turning lathe; the boiler is 1½ inches and 1-16 of an inch thick. I am working steam at 30 lbs., and a friend tells me that my boiler will explode, for the iron should be as thick for a boiler 1 foot in diameter as for one 4 feet in diameter, the steam pressure being the same in both cases. Is he right, and am I working my boiler at an unsafe pressure? It is strongly made with doubly riveted joints. A. Your friend is in error. A boiler four feet in diameter would only safely sustain one fourth of the pressure that could be maintained in one similarly constructed but only one foot in diameter. The pressure of 30 lbs. is not excessive, if the material and construction of your boiler are first class.

Would it not be advisable to galvanize the sheets for boilers to prevent rusting, and why is it not done, especially in small boilers that are only used occasionally? A. Small house boilers are frequently galvanized. It would probably be difficult to do the work thoroughly enough, in the case of stationary and marine boilers, to ensure protection.

In looking over some back volumes of the SCIENTIFIC AMERICAN, I find (on p. 110, vol. 6) an answer to F. N. B. Is the 250 lbs. correct? A. Yes.

G. T. P. says: How do you find the length of the chord of an arc when the radius and the length of the arc are given, being 15 and 11.781 inches respectively? A. First find the circumference of the circle. It will be radius $\times 2 \times 3.1416 = 94.2478$ inches. Then the angle at the center of the circle, subtended by the given arc, will be $\frac{11.781}{94.2478} \times 360 = 45^\circ$. And the required chord will be $\sqrt{2 \times (15)^2 - 2 \times (15)^2 \times \cos 45^\circ} = 11.45$ inches, nearly. To generalize this method: Let R = radius of circle, a = length of arc, C = length of chord, A = angle at center, $A = \frac{a \times 360^\circ}{2 \times R \times \pi}$, $C = \sqrt{2R^2 - 2R^2 \times \cos A}$.

J. S. asks: What metals are used to make white metal and what are the proportions of each? A. Tin 2 lbs., copper 94 lb., antimony 1½ lb. 2. What will make a suitable metal for handles and mountings? A. Tin 14 lbs., copper 94 lb., antimony 0.5 lb. 3. What are the proportions of type metal? A. Lead 9 lbs., antimony 1 lb.

H. P. M. says, in reply to H. B., who asks for a solution to remove the sand or scale from castings: The following will do it and is more simple than the one you gave: One part vitriol to four of water. The castings need only be wetted either by dipping them in or pouring it on. In 12 hours, the scale will thoroughly removed. They should then be washed clean.

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

A. K.—It is a sample of apatite. It is a valuable product, produced by smelting, in a blast furnace with charcoal, a spathic iron ore containing a large percentage of manganese.—W. H. R.—Your supposed animalized horsehair is a species of the genus *gordius*, frequently found in still water; it is not thicker than a horsehair, and is popularly considered to be a hair of that description in the act of being transformed into an eel. Linnaeus calls it *gordius aquaticus*.—J. P.—It is calcareous, an ore of lead.—A. B. C.—It is a sample of a fine quality of clay. Shale has the property (which clays have) of capability of being kneaded up with water and fashioned like paste by the hand; but it is much stronger and firmer clay than the sample sent.—A. H.—It is magnesite, enclosing granules of apatite or phosphate of lime. All minerals are reported upon in the week in which they are received, except such few as require a longer period for analysis. The last have not altogether exceeded a dozen in number.

W. J. B. says: I have constructed two large sliding doors 10 feet high 45 feet wide, and 2½ inches thick. They run on a round track on the bottom, with small pulleys on the top. I have weighted them so that they will open themselves as soon as unlocked, and I want a device that will shut them after they have been open 2 or 3 minutes. Can any of your readers inform me of one?—D. W. asks: 1. How can I make a cheap sealing wax of a violet color? 2. How can I make a good indelible ink, to be used with a stencil plate, for marking clothing?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

- On Popular Fallacies. By A. D. F. H.
- On the Cardiff Giant. By E. X.
- On the Movements of a Gum Ball. By R. L. S.
- On the Philosophy of Thunderstorms. By J. H. G.
- On Swimming with the Clothes On. By W. A. H.
- On a Remarkable Prescription. By Z. T. D.
- On Strained Honey. By H. W. S.
- On a Family killed by Lightning. By P. D. R.

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 enquiries analogous to the following are sent: "Please to inform me where I can buy sheet lead, and the price? Where can I purchase a good brick machine? Whose steam engine and boiler would you recommend? Which churn is considered the best? Who makes the best mangle? Where can I buy the best style of windmills?" All such personal enquiries 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

July 28, 1874,

AND EACH BEARING THAT DATE.

(Those marked (P) are released patents.)

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

30,538.—GAS FITTING FINISHING MACHINE.—J. W. Lyon.

October 14.

30,567.—OILING SPINDLES.—E. N. Steere. December 2.

EXTENSIONS GRANTED.

29,374.—THRASHING AND CLEANING MACHINE.—I. Hart.

29,409.—RAILWAY CATTLE CARS.—G. W. Chambers.

DISCLAIMER.

153,376.—GLOVE.—J. F. Mason.

DESIGNS PATENTED.

7,389 to 7,390.—CARPETS.—R. Allan, Yorkers, N. Y.

7,396.—PEN KACE.—B. Brower, New York city.

7,397.—INKSTAND BASE.—B. Brower, New York city.

7,398.—BADGE.—R. D. Green, Lowndes county, Miss.

7,399.—URN AND PEDISTAL.—H. E. Wesch, Phila., Pa.

7,400.—GLASS BOTTLES.—C. C. Woodworth, Rochester, N. Y.

7,401.—CHILD'S CARRIAGE.—A. Shoeninger, Chicago, Ill.

TRADE MARKS REGISTERED.

1,809.—MEDICAL COMPOUND.—E. A. Butts, Wash'ton, D. C.

1,900.—MILK PANS.—C. A. Douglas, Franklin, N. Y.

1,901.—PICKLES, ETC.—Du Vivier & Co., New York city.

1,902.—COFFEE EXTRACT.—G. W. Karhart, Columbus, O.

1,903.—THERMOMETERS, ETC.—J. S. F. Haddleton, Boston, Mass.

1,904.—GIN.—Wellington & Co., New York city.

1,905.—WINE.—Wellington & Co., New York city.

1,906.—MEDICAL COMPOUND.—E. K. Al Burtis, Ridgefield, N. J.

1,907.—SAUCE.—Lea & Perrins, Worcester, England.

1,908.—COTTON GINS.—Sanborn Machine Company, Mystic River, Conn.

1,909 & 1910.—KNIT GOODS.—American Hosiery Company, New Britain, 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 Extension of Patent	\$30
On granting the Extension	\$50
On filing a Disclaimer	\$10
On an application for Design (5 years)	\$10
On application for Design (7 years)	\$15
On application for Design (14 years)	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA

JULY 31, 1874.

3,891.—E. M. Davis, Allegheny, Allegheny county, Pa., U. S., and F. J. Rebeck, Pittsburgh, Allegheny county, Pa., U. S.

ty, Pa., U. S. Improvements on curtain fixtures, called "The Davies & Rebeck Curtain Fixtures," July 31, 1874.

3,895.—P. Griffin, Cork, Cork county, Ireland. Improvement on the manufacture of spirits, called "Griffin's Purified Spirits," July 31, 1874.

3,896.—D. Forbes, Cambridge, Middlesex county, Mass., U. S., assignee of H. Wells, Woburn, Middlesex county, Mass., U. S. Improvements on needle threading hooks, called "The Magic Needle Threading," July 31, 1874.

3,897.—N. E. Wheeler, London, Ont., assignee of C. D. Blinn, Port Huron, St. Clair county, Mich., U. S. Improvements on window blinds or shades, called "A Lap Window shade," July 31, 1874.

3,898.—A. Lorrain, Bord-Prouffe, Laval county, P. Q. Improvement on wheel horse powers, called "Lorrain's Horse Power Wheel," July 31, 1874.

3,899.—F. M. Salvay, Bellaire, Belmont county, O., U. S. Improvement on trace fastenings, called "Salvay's Improved Trace Fastening," July 31, 1874.

3,900.—H. Ing, Hamilton, Wentworth county, Ont. A gas regulator, called "Ing's Improved Gas Regulator," July 31, 1874.

3,901.—C. H. White, White's Station, Calhoun county, Mich., U. S. Improvements on railway switches and frogs, called "White's Safety Railway Switch," July 31, 1874.

3,902.—W. Vahey, Forest Village, Lambton county, Ont. Improvement on machines for blocking horse collars, called "Vahey's Collar Blocking Machine," July 31, 1874.

3,903.—W. Murphy, Pettitodiac, New Brunswick. Improvements on organ blow pedals, called "Murphy's Reversible Organ Blow Pedals," July 31, 1874.

3,904.—G. Webster and J. F. Webster, Hamilton, Wentworth county, Ont. Improvements in sewing machines, called "The Webster Hand Shuttle Machine," July 31, 1874.

3,905.—J. Dwyer and J. V. Carter, Detroit, Wayne county, Mich., U. S. Improvements in base-binding heating stoves, called "The Crown Jewel Stove," July 31, 1874.

3,906.—W. Craig, Nunda, Livingston county, N. Y., U. S., assignee of H. C. Grover, same place. Improvements on washing machines, called "Grover's Improved Washing Machine," July 31, 1874.

3,907.—D. N. B. Coffin, Jr., Newton, Middlesex county, U. S. Improvements on capstans and windlasses, called "Coffin's Capstans and Windlasses," July 31, 1874.

3,908.—L. O. F. Meyer, Newtown, Fairfield, Conn., U. S. A certain india-rubber compound presenting a surface against which what are known as safety matches can be ignited, called "Meyer's Igniting Rubber," July 31, 1874.

3,909.—D. C. Kellam, Pontiac, Oakland county, Mich., U. S., and R. and A. Hayes, Detroit, Wayne county, Mich., U. S. Improvement on window screen frames, called "Kellam's Adjustable Window Screen," July 31, 1874.

3,910.—B. Tappan, Steubenville, Jefferson county, O., U. S. Improvement in miners' lanterns, called "Tappan's Miner's Lantern," July 31, 1874.

3,911.—H. Whiteside, Jr., Ottawa, Carleton county, Ont. Improvements on spring slats for beds, called "Whiteside's Improved Spring Slat," July 31, 1874.

3,912.—H. Behning, New York city, U. S., and J. Diehl, same place. Improvements in pianofortes, called "Behning & Diehl's Improved Agraffe for Pianofortes," July 31, 1874.

3,913.—E. S. Waterman, Hamilton, Wentworth county, Ont. Improvement in bed bottoms, called "Waterman's superior Strap Steel Spring Bed Bottom," July 31, 1874.

3,914.—W. T. Redding, New York city, U. S. Improvements on metallic or other boxes for bisecting or analogous uses, called "The Redding Improved Box," July 31, 1874.

3,915.—W. Morehouse, Buffalo, Erie county, N. Y., U. S. Improvements on ship knees, called "Morehouse's Improved Ship Knee," July 31, 1874.

3,916.—W. B. Hall, Lancaster, Lancaster county, Pa., U. S. Improvements in cartridge-creating and loading implements for breech-loading firearms, called "W. B. Hall's Cartridge Creator," July 31, 1874.

3,917.—W. H. Becke, t. Chelmsford, Essex county, Eng. Improvements in valve apparatus for controlling the flow or passage of fluids, called "Dennis & Co.'s Patent H. P. Valve," July 31, 1874.

3,918.—W. M. Watson, Tonica, La Salle county, Ill. U. S. Improvements on nut locks, called "Watson's Improved Nut Lock," July 31, 1874.

3,919.—C. Comstock, New Canaan, Fairfield county, Conn., U. S. Combined hot air and hot water furnace, called "Comstock's Ventilating Steam Heater," July 31, 1874.

Advertisements.

Back Page - - - - - \$1.00 a line.

Inside Page - - - - - 75 cents a line.

Engraving 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.

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10 Cash Gifts, 14.000 each.....	140.000
15 Cash Gifts, 10.000 each.....	150.000
20 Cash Gifts, 5.000 each.....	100.000
25 Cash Gifts, 4.000 each.....	100.000
30 Cash Gifts, 3.000 each.....	90.000
50 Cash Gifts, 2.000 each.....	100.000
100 Cash Gifts, 1.000 each.....	100.000
240 Cash Gifts, 500 each.....	120.000
500 Cash Gifts, 100 each.....	50.000
19,000 Cash Gifts, 50 each.....	950.000
Grand Total, 20,000 Gifts, all cash, 2,500,000	

PRICE OF TICKETS.

Whole Tickets.....	\$50 00
Halves.....	25 00
Tenths, or each Coupon.....	5 00
11 Whole Tickets for.....	500 00
22 1-2 Tickets for.....	1,000 00

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Public Library Building, Louisville, Ky.
or **THOMAS H. HAYS & CO.,** EASTERN AGENTS,
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From 1/2 to 1 inch.....	\$17.50
" 1 to 2 ".....	3 00
Iron, from 1/2 to 1 inch.....	6.50
" 1 to 2 ".....	15.00
1 Set of Steel Clamps.....	12.50
" " Iron.....	10.00

Expanding Mandrels taking anything from 1/2 to 4 inches, &c.
Send to C. W. LE COUNT, South Norwalk, Conn. for Circular.

THE CHAMPION SILVER-STEEL SPRING MATTRESS.

has been before the public for several years, and continues to occupy its unrivalled position in the trade, as the BEST BED ever produced. It presents the rich and elegant appearance of silver, and is the softest, easiest, cheapest, and most durable Spring Bed in the market. Wholly composed of tenacious tempered steel springs, so united that the pressure is equally distributed. Easily lifted, turned, or rolled up. Both sides alike. No frame, no wooden slats, no low stuffing, no straps. May be used on floor without bedstead. No under bed required. Needs only half the thickness of hair mattresses. More springs for your money in this bed than in any other. Unequalled for hotels. Any sizes made to order. Send for pictorial circular. Retail price of double bed, \$15. Shipped by single bed or quantity, to all parts of the world. Liberal discount to the trade. Sold by leading dealers in all parts of the country. Refer to Phelps, Doremus & Corbett, J. T. Allen & Co., New York, Gould & Co., Philadelphia, Pa., Gilbert & Sons, Norwich, Conn., Bowditch & Co., New Haven, Conn., and many others. **CHAMPION SPRING MATTRESS CO.,** Makers, 24 Canal St., near Broadway, New York.

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The Chilean Exposition

Packages for this Exposition can be shipped at the Pacific Mail S. S. Co's Office, foot of Canal St., New York, and from the Pacific ports touched at by the Steamers of this Company. One dollar, gold, for each package weighing not more than 200 pounds, or measuring not more than 20 cubic feet, is the only cost of ocean transportation to Chile. Heavier or larger packages may be shipped per same line at low rates under special contract. Applications for room at the Exposition must reach Chile by January 1, 1875. Particulars may be obtained by addressing anyone of the United States Commissioners for the Exposition, any Chilean Consul in the United States, or **A. VILLARROEL,** Corresponding Agent, 51 Pine St., New York.

\$475 A MONTH TO AGENTS. Address C. M. LAMINGTON & BRO., New York or Chicago



MAHOGANY,

WALNUT, ROSE, SATIN, HOLLY, SPANISH & RED CEDAR, and all kinds of HARD-WOODS, in Logs, Plank, Boards and Siding.

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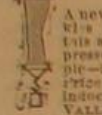
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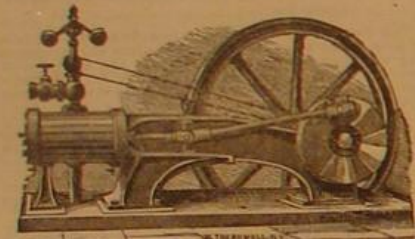


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to John

SCIENTIFIC AMERICAN

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Vol. XXXI.—No. 10.
[NEW SERIES.]

NEW YORK, SEPTEMBER 5, 1874.

\$3 per Annum.
IN ADVANCE.

SIR WILLIAM FAIRBAIRN.

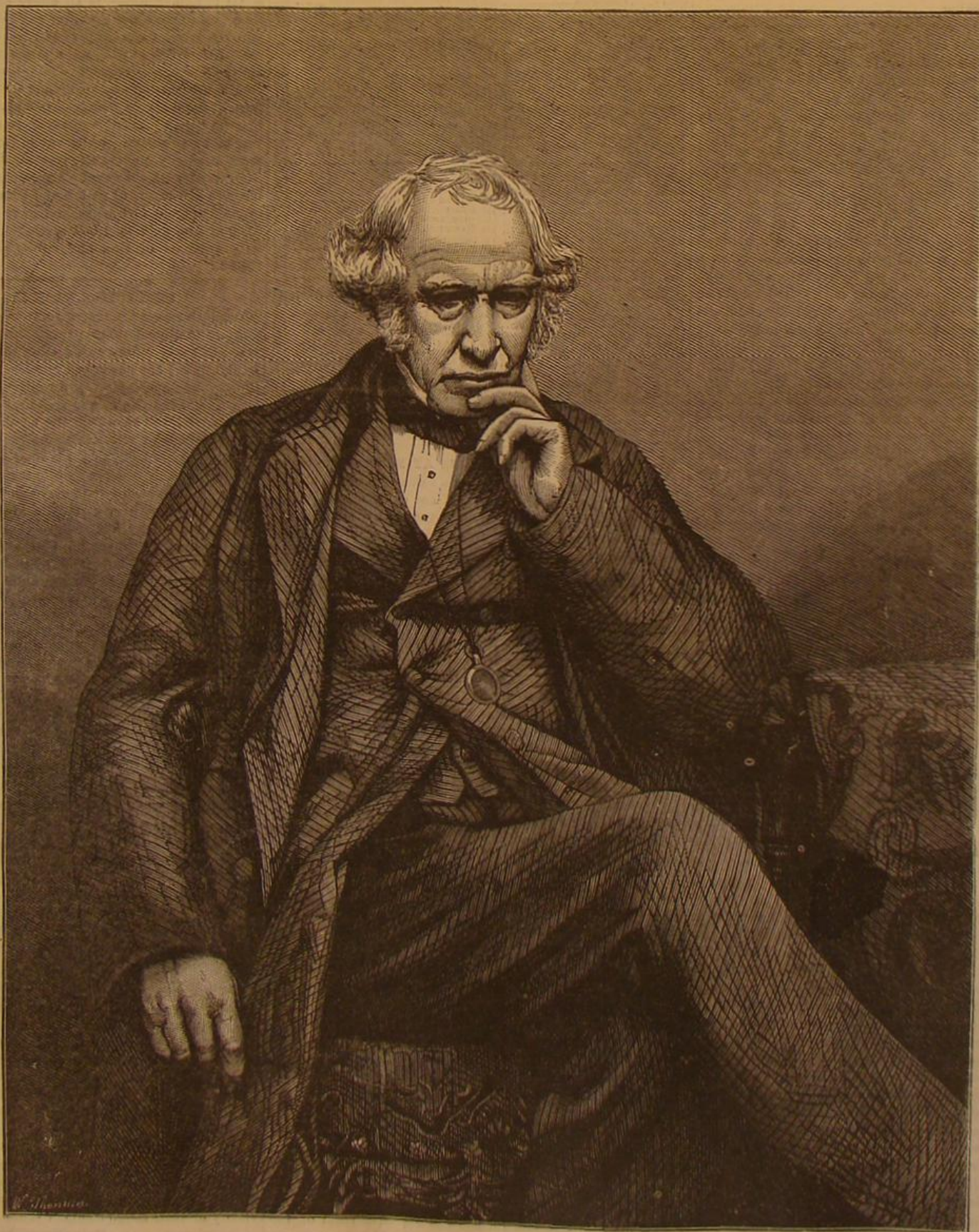
Sir William Fairbairn, the distinguished English engineer, whose portrait we give herewith, died on the 18th of August last, at the advanced age of 85 years. One of the first to undertake the construction of iron vessels in England, thus aiding in founding a manufacture in which that country has, until lately, maintained an unrivaled supremacy, the first to substitute iron for wood as shafting for cotton mills, the inventor of the riveting machine, the author of experiments and works which have changed the whole practice of iron construction: to few men do the engineering profession and the great metal industries of the world owe so large a debt.

The record of the long and useful life, now closed, shows, during early years, that persevering struggle against limited means and humble birth, which has characterized the initial

efforts of many of the most famous men. Born in the year 1789, at Kelso, on the Tweed, his sole education consisted of such rudiments as were taught at the parish school. With a knowledge of writing and arithmetic which is described as "imperfect," he entered upon an apprenticeship as an engine wright, in the Percy Main Colliery, and when his time had expired worked for two years in London as a journeyman. Travel in those days was a necessary part of every workman's education, and Fairbairn availed himself of opportunities to visit various portions of the kingdom, working a short time at every place, and, while not neglecting his books, posting himself thoroughly in every particular of the practical portion of his trade.

About the year 1817, we find him settled in Manchester in partnership with Mr. Lillie, founding a firm which steadily

progressed and became known as the leading machine makers of the city. From this period, it appears, date the investigations and inventions which eventually rendered their author one of the greatest of modern engineers. With the limited space at our disposal, it is impossible to review all these works in detail, nor is it necessary, since the published reports of the English scientific societies of the period and Fairbairn's own volumes contain the full descriptions. One of his earliest inventions was that, already alluded to, of substituting iron for wood as shafting in cotton mills, and the introduction of lighter and improved machinery in factories, more simple than the contrivances then in use. These modifications resulted not only in the reduction of the cost of machinery, but allowed of speeding the same from 40 to 160 revolutions per minute. Then followed the introduction of



Yours faithfully,
W. Fairbairn

Univ. of Michigan

a double lined boiler for alternate firing, productive of economy of fuel and consumption of smoke, improvements of feeding apparatus in millstones, the adoption of a better principle of suspension and the use of ventilated buckets in water wheels, the invention of the riveting machine, and, finally, in 1836, the introduction of improved architecture for factories.

Experiments upon canal boats engaged Fairbairn's attention in about the year 1831, and through these researches he was led to examine the advantages of iron for the construction of vessels. One of his earliest attempts was the building of a small iron ship, which was set up at his works and carted through the streets of Manchester to the water. His experiments thus begun resulted, five years later, in his development of iron construction in ships of the largest class, at Millwall, London, on the premises afterward occupied by Mr. Scott Russell. Here more than one hundred vessels were built by Fairbairn's firm, ranging from frigates to small boats. It is to Fairbairn that we owe the repeated enforcement of the fact that a ship is, in many respects, to be regarded as a huge beam or girder.

In conjunction with Mr. E. Hodgkinson, the subject of our sketch conducted a series of experiments, resulting in the determination of the comparative strengths of hot and cold blast iron, of the tenacity of boiler plates of various thicknesses, of the best form of section of cast iron beams, of the resistance of hollow tubes to outside pressure, and also in the general use of wrought iron plate girders in ordinary building operations. One of the first edifices ever constructed of iron was a corn mill, manufactured in 1838 by Fairbairn, the castings, etc., of which were sent to Constantinople, where it is still standing.

Mr. Fairbairn's experiments on tubes were conducted during the erection of the celebrated tubular bridge over Menai Straits; and although considerable controversy was engendered at the time, the original plans of Robert Stephenson were modified in accordance with the results. Stephenson suggested a circular tube supported by chains, but Fairbairn found that a rectangular structure, strengthened by a series of cells at the top and the bottom, and suspended, without supports, from pier to pier, was best adapted to the stipulated conditions.

Subsequently to this period, Mr. Fairbairn made researches into the strength of wrought iron plates and rivets for shipbuilding, and also into boiler explosions. He believed that steam could be worked with greater economy at a pressure of from 150 to 200 lbs. per square inch, and that at a high rate of expansion, with two or more cylinders. With this view he first constructed the Lancashire boiler, and subsequently, in 1872, a fire tube boiler, which was tested safely to 400 lbs. per square inch, and found to stand uniformly the first mentioned high pressure.

Mr. Fairbairn was one of the founders and afterwards President of the British Association. His published works, besides a large number of papers on special subjects, are: "Iron, Its History and Manufacture," "Mills and Mill Work," "Application of Iron to Building Purposes," "Iron Ship Building," and three series of "Useful Information for Engineers," all standard volumes of reference. He was a corresponding member of the Institute of France, a Chevalier of the Legion of Honor, and a Baronet, the last named honor being conferred upon him in 1869.

NEW INDUSTRIAL RESOURCES OF FRENCH COLONIES.

A French commission has recently carried on extensive investigations into the resources of the colonies of France, with a view of determining as to whether certain indigenous productions can be utilized for industrial purposes. From the results elicited, it appears that active measures will be taken for the introduction of some products and for the cultivation of others. Special attention is to be given in the Réunion Islands to the cultivation of vanilla. Plantations are established, which will be renewed every ten years, and are designed solely for the propagation of healthy slips for distribution, it being hoped that, by this means, the gradual disappearance of healthy plants may be checked.

The Tahiti Islands furnish the finest variety of mother of pearl now known; but commerce therein is at present carried on by English and German merchants. French government officials have been supplied with funds, and efforts will, through them, be made to establish a French trade, both in this substance and in tortoiseshell. Ramie is found in large quantities in Tahiti, but is too costly a production to figure in commerce. Another variety, also adapted to textile manufacture, has been recognized in the Antilles and in French Guiana. The crop averages about 3,420 pounds to the acre, the white fibers being some 6 feet in length, and worth 18 cents per pound. This yield per acre is superior to that of sugar. The sap of the *balata minusopa*, or Guiana gutta percha tree, was rejected, in 1867, as valueless, on account of the friable properties of the resulting product, and the resinous effervescence which appeared thereon. Some fragments of the plates employed in the tests have lately again been experimented upon, and the material is now found to possess all the qualities of good gutta percha. The former defects were due to bad preparation. Further investigations into this product will be inaugurated.

The commission has also found a large deposit of valuable fertilizer in the bones of the cod from the fisheries of St. Pierre and Miquelon. The remains are rich in phosphate of lime, and contain 21 per cent of ossein.

JUMPING OF GAS FLAME.—This is caused by water condensing in some low place in the fittings. Have the pipe cut, and a T piece put in, with a small tap, so that water may be let out before turning on the gas.

Scientific American.

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THE TORPEDO PRACTICE AT NEWPORT.

The torpedo practice during the recent fleet drill at Key West, it will be remembered, was not exactly of a nature calculated to impress the public mind with a sense of the tremendous destructive force of bags of powder poked out on the ends of sticks; and consequently, since that time, slurs upon our naval torpedo system have been more frequent than commendations for the efforts of the very zealous corps of officers, who, for several years past, have been quietly working and experimenting, at their station on the bleakest of the islands in Newport Harbor. With the publication of the excellent results of the recent trials at Newport, however, the cloud which has obscured the labors of the experimenters is dispersed; and we must admit that, in lieu of sticks and powder sacks, the torpedo officers, Professor Moses Farmer and Lieutenant John P. Merrell, have developed for us a means of warfare of terrible efficiency.

The recent trials took place on successive days, in the presence of a congressional committee, and a large concourse of spectators. The initial experiment was the explosion of a ground torpedo of fifty pounds of powder enclosed in an iron-cased shell. This was blown up by Professor Farmer's dynamo-electric machine. Two fifty pound torpedoes were then fired by the contact of a boat with the circuit closers; and the blowing up of apparatus improvised from ordinary water breakers followed, to show how easily these destructive weapons could be constructed from the simplest materials, and without special machinery.

The plane table was used in the explosion of a three hundred pound torpedo, the current being established at the instant the approaching vessel was seen through properly adjusted sights. A column of water, two hundred feet high, marked the tremendous violence of the escaping gases. An attempt was made to blow up an old hulk, by the aid of submarine torpedoes; but through some mal adjustment of the latter, the vessel, though badly damaged, was not destroyed. An excellent feature of the operation was, the firing of a torpedo through a mile of cable, the main object being to show that this means of offense or defense could be safely carried on beyond the range of the enemy's fire. An explosion of 500 igniters simultaneously, proving that several mines could readily be blown up at once, concluded the experiments of the first day.

An old coal schooner formed the objective point of the second day's operations, the interest of which was greatly heightened by the participation therein of the new ironclad torpedo boat Intrepid. This vessel is a small steamer, built expressly for torpedo manœuvring. She steams at a rate of about nine knots per hour. The hulk being stationed

out in the stream, the Intrepid backed astern for about a mile in order to get good way on, and then rushed ahead at full speed. The Harvey torpedo, which she towed on her starboard side, was brought in contact with the hulk and, at the instant of touching, fired by an electric fuse, smashing in a huge hole in the vessel's side. Immediately the Intrepid dashed up for a second trial, and this time exploded a spar torpedo, rigged out from her port side, directly under the bottom of the fated craft. A fearful explosion, followed by the hurling aloft of great fragments of wood and masses of water, showed that the weapon had done its work. The ship was literally torn to pieces, leaving but a few large portions drifting about. A second torpedo blew these out of existence, and the total disappearance of hulk marked the close of, probably, the most successful extended series of torpedo experiments conducted under naval auspices in this country.

RECENT METALLURGICAL RESEARCHES.

Some facts of interest to metallurgists, in gold and silver, are to be found in a recent memorandum of Mr. Chandler Roberts, chemist to the British Mint. We learn that the spectroscopic assays, begun last year, have been successfully prosecuted, giving results that prove that, for purposes of quantitative analysis, the spectroscopic must form an auxiliary of the highest value. It is stated that differences of composition amounting to less than $\frac{1}{10000}$ part may thus be determined.

Mr. Roberts quotes the interesting results obtained by M. Serol, of the Paris Mint. This chemist finds that, while a silver copper alloy containing 71.893 per cent of the former metal is homogeneous, in all alloys containing more silver than this amount the center of the solidified mass is richer than the interior. A mass of 112 ozs. of silver copper alloy, melted, carefully stirred, and allowed to solidify, was found not to be homogeneous. The silver accumulated at several points, not bearing any apparent relation to the geometrical form of the mass. A homogeneous plate was at last obtained by assaying all parts of a plate of standard silver and cutting off those portions which varied from the required standard. Perfectly pure gold was obtained by reducing the chloride of gold with oxalic acid and fusing in a clay crucible with bisulphate of potash and borax. The electrolysis of cyanide of gold and potassium gave a product containing 999.9 of fine gold in 1,000, while reduction of the chloride with sulphate of iron and subsequent fusion gave only 999.85.

PROTECTION FROM LIGHTNING.

During a recent thunderstorm in the village of Trumbull, Conn., a family of three persons, husband, wife and child, who had taken refuge on a feather bed, were instantly killed by lightning; the house had no rods. In the same village, during the same storm, a dwelling house, which had two lightning rods upon it, was seriously damaged. Several of our readers, who have seen the accounts of these disasters, and others who cite analogous examples, have had their faith in feather beds, as a place of safety during thunder storms, severely shaken; while some of them would fain believe that lightning rods serve to destroy rather than to preserve life and property. We are asked to print something upon the subject; and we cheerfully comply, premising, however, that there is little that is new to be said, and that the subjoined information has for the most part been heretofore reiterated in our columns.

ARE FEATHER BEDS A PROTECTION FROM LIGHTNING?

Feather beds are not a protection from lightning, and the popular belief that they are, doubtless results from a misapprehension of the laws that govern the passage of electricity. The human body is a better conductor of electricity than feather beds or other objects ordinarily contained in the apartments of dwellings, and therefore, *a priori*, when the lightning enters an apartment, the human body is likely to form one in a chain of inductions, determining the path of an electrical discharge, unless better conductors are in its vicinity to divert this action.

WHAT IS THE SAFEST PLACE DURING A THUNDERSTORM?

The only place of absolute security in a thunderstorm is an iron building; or next in safety is a building properly protected by lightning rods.

Houses constructed entirely of iron manifestly stand in no need of lightning rods at all, because the electric fluid, on striking so good a conductor, would rapidly diffuse itself in all directions and flow into the ground, provided, of course, that the construction of the building is such as to allow its free escape.

ARE LIGHTNING RODS OF ANY REAL VALUE?

Unquestionably they are. Examples are numberless where the lightning has been seen to fall upon the rods of buildings and descend harmlessly to the earth; while the fact is undisputed that the principal damages suffered from lightning are in connection with buildings that are not provided with conductors. Notwithstanding these facts, some people are apt to be indifferent whether their houses and stores are provided with lightning rods or not, and are always ready to give an example where some building so provided was struck in spite of its protection. Such cases are quoted by the old fashioned "practical men" with much satisfaction, because they hail in them what they are pleased to call the victory of their sound common sense and the discomfiture of the scientific man. This class is, however, rapidly diminishing in numbers under the influence of the extensive diffusion of scientific education among the people.

It may be well to assure unbelievers that the efficacy of the lightning rod is no longer an open question, and that any

failures are attributable to bungling or ignorant construction. It would be an easy matter to multiply statistics in proof of the assertion; but none would carry with them more force than the following statement obtained from the records of the British navy, by Sir Snow Harris, F. R. S.:

"Between 1810 and 1825, before rods were introduced, no less than thirty-five sail of the line and thirty-five frigates and smaller vessels were completely disabled; and in 200 cases recorded, 300 seamen were either killed or injured. When the lightning rod was introduced, every mast was furnished with a capacious conductor permanently fixed and connected with bands of copper passing through the sides of the ship under the deck beams, and with large bolts leading through the keel and keelson, and including, by other connections, all the principal metallic masses employed in the construction of the hull" (Harris). Since the adoption of this arrangement, "it appears that damage by lightning has positively vanished from the records of the navy."

In England, the various telegraph companies suffered serious damages by every thunderstorm, by the destruction by lightning of their poles. The poles are now provided with small lightning rods, and all damage has ceased.

In this country the Western Union Telegraph Company has suffered in the same manner, especially, says a recent number of the *Journal of the Telegraph*, "upon the plains and prairies, where every lightning storm formerly shattered and destroyed more or less of our poles, but which are now fully protected by a conductor (No. 8 wire) placed on every fifth pole. Wherever telegraph poles are provided with such lightning rods, all damage is prevented. Where the poles are not provided with rods, damage ensues."

WHAT IS THE PROPER SIZE AND MATERIAL FOR HOUSE LIGHTNING RODS?

According to the best authorities, a copper rod of one inch in diameter, or an equal quantity of copper under any other form, will resist the effect of any discharge of lightning hitherto experienced. The copper rod is therefore the safest and best material that can be used, but it is expensive. Iron rods of one inch in diameter are very commonly used, and, if pointed with solid copper and properly put up, are efficacious in the great majority of cases. The particular form of the rod makes no difference. It may be round or square, twisted or hollow, composed of one solid piece or made of wires twisted together. It is the quantity of metal contained in the cross section of the rod that is of value, not the form.

WHY SHOULD THE ROD BE POINTED?

The reason for terminating lightning rods in a point is as follows: When a thunder cloud highly charged with positive electricity comes up, it repels the positive electricity of all bodies on the surface of the earth coming within its influence, and causes negative electricity to accumulate in them. This is called induction, and it always takes place before a discharge. Now it has been discovered that, when electricity is accumulated in a body in this manner, it can most readily escape by sharp points because in them it meets with the least resistance. A lighted candle held near the prime conductor of an electrical machine furnished with a point will be nearly blown out by the current of air produced by the escape of the electricity. Lightning rods are therefore provided with sharp points to allow the accumulated negative fluid to pass off readily into the air and neutralize the positive fluid of the thunder cloud.

HOW SHOULD RODS BE MADE AND APPLIED?

The object being to make so good a passage for the lightning to the ground as to remove all danger of its leaping to some conductor in the house, the greatest care must be taken not to have any break in the conductivity. As it is inconvenient to manufacture or transport the rods in one piece, the different parts must be in intimate connection when they are put up; it is best to have them soldered and the joints protected from the air and moisture.

The point of the rod should be extended a little above the chimney or highest part of the building, and should be fastened in contact with the building by staples or cleats. Glass insulators should not be employed. It makes no difference in conductivity whether the rod is painted or not painted.

No building can be said to be properly rodded or protected against lightning, unless the lower part of the rod or terminal under the ground is made quite extensive. The extremity of the rod should connect with masses of good conducting materials, such as old iron, or iron ore, or coke, or charcoal, laid in trenches, or the rod itself should be elongated, sunk deep in the ground, and carried a considerable distance from the building, and put in connection with water or moist earth if possible. The golden rule for safety is: "Provide the largest possible area of conducting surface for the terminal of the rod."

LOOK TO YOUR TERMINALS.

A lightning rod which is not properly connected with the earth is quite dangerous. The very common method of merely sticking the lower end of the rod down into the dry earth near the surface of the ground is bad, and endangers the building, because dry earth is such a poor conductor, and the amount of rod surface in contact with the earth is so small. Under such conditions, a portion of the electric current will be likely to find an easier path to the earth, through the building than through the rod; and a part of the electricity will therefore leave the rod, strike into the building, and down in various directions into the earth, making havoc as it goes. As a measure of prudence, house owners should look to the terminals of their lightning rods, and place there a considerable amount of the conducting materials above named.

By adopting this simple expedient, many buildings, other-

wise unsafe, will be rendered comparatively secure from damage by lightning.

As an electrical conductor, well burnt charcoal ranks next to the metals. Metallic ores come next to charcoal. Water and moist earth, which are so frequently recommended as terminals for lightning rods, are among the poorest of conductors.

One of the best protected buildings that we have heard of is that of Mr. John Knox Smith, an intelligent English merchant residing at Singapore. His country house is built on a prominence, upon a bed of iron ore, with which the house lightning rods are made to communicate. The lower ends of the rods thus have a very extensive conducting surface, and the protection afforded is considered perfect. Thunder storms and lightning strokes are very frequent, but the house has never been injured.

PROTECTIVE AREA OF RODS.

It was supposed to have been established by Charles and Gay Lussac that a lightning rod protected an area whose radius was double the height of the rod extending above the building, but this rule is no longer reliable by reason of the extensive use of metals in the shape of pipes, etc., in the construction of the buildings of our day.

WATER AND GAS PIPES SHOULD BE CONNECTED WITH THE LIGHTNING ROD.

When electricity finds several paths to the ground, it will prefer the best, it is true; but some portion will also pass along the poorer conductors. If, therefore, any metallic substances lie within the area supposed to be protected, they are in danger of being struck. This is especially true where the lightning has a chance to jump to the gas and water pipes of a building. It is a good plan to connect these pipes with the lightning rod; if the rod is struck, the electricity will then have an excellent path into the ground and will be rapidly diffused over the vast underground network of pipes. The danger to the inmates of the house of being struck from these pipes is less than that of receiving a shock from the powerful induced currents, liable to be developed in them, if unconnected, during a thunderstorm.

IS MORE THAN ONE ROD USEFUL?

The more rods on a building the better, especially if all are connected with each other near their upper ends.

Multiple lightning conductors are useful because each one helps the others, and if the discharge is too great for one, they will be able to carry it between them, but what is more important is this: The less the total resistance of the conductor to earth, the more certain is it that no other, undesirable line will offer an approximately good path to the earth, and so get a part of the flash. Thus, suppose a single rod whose resistance is 1, and that a series of bolts, hinges, gutters, stove pipes, etc., offers another line (passing perhaps through the walls of the house or the body of its occupant) whose resistance is 2. Now, under these conditions, a flash would be likely to divide itself, and while $\frac{1}{3}$ would go safely down the rod, $\frac{2}{3}$ passing along the other line might burn the house or kill the man. But if two rods were connected, the resistance in this line would be but half, hence $\frac{2}{3}$ would take this road and but $\frac{1}{3}$ tend to go by the other. Again, the less the resistance of any line, the higher the opposite charge developed in it by induction, and hence the greater its attractive influence, leading the discharge to prefer it as a path. This bears upon the importance of connecting all accidental lines of conductors, such as gas and water pipes, with the lightning rods. Insulated, these are opposition lines, soliciting the lightning to come into house and traverse them; connected, they help the rod as we have seen to get and keep the lightning outside.

METAL ROOFS, GUTTERS, LEADERS, AND WATER TANKS SHOULD BE CONNECTED WITH THE LIGHTNING RODS.

Finally, in the way of general advice, we would say: Connect all your lightning rods together, and also to your iron tank, and water, gas, or other pipes, not by separate connections, but so that there is some connection between all, which connection should be as high up as possible. If you have a metal roof, connect all rods with it. If the roof is not of metal, then connect your rods together by means of a good sized conductor running along the ridge of the roof. Bear in mind that, to carry off the heaviest lightning flash known, a copper rod one inch in diameter is not considered too large; and though of course such flashes are of very rare occurrence, they may come. Hence the great value of uniting your different rods high up.

THE ELECTROMOTOGRAF--A NEW DISCOVERY IN TELEGRAPHY.

Within the past few days, we have had under examination, in practical operation in our office, a novel electric telegraph apparatus, which presents some very remarkable features, and promises to result in the creation of an entirely new and advantageous system of telegraphy. It is the discovery of Mr. Thomas A. Edison, of Newark, N. J., who is well known as a telegraph engineer of the highest ability, and the inventor of a larger number of electrical devices, probably, than any other person living. His improvements are employed upon all the various telegraph lines in this country.

The present discovery relates to that form of apparatus known as the automatic or chemical telegraph, in which signals are made and recorded by causing the electricity to pass through paper, the latter being saturated with a chemical substance, which changes in color when the current acts. Lines, dots, and dashes are thus produced with great facility. In the ordinary working of this form of telegraph, the electricity is sent over the line wire by a key, in the usual manner, and passes through a pen, stylus, or lever, which

has no movement, but simply rests upon the paper, the latter being moved by a weight or clockwork. No magnet and armature are used.

The salient feature in Mr. Edison's present discovery is the production of motion and of sound by the pen or stylus, without the intervention of a magnet and armature. By the motion thus produced, he works any of the ordinary forms of telegraph printing or sounding instruments or relays, and is enabled to send messages, by direct transmission over thousands of miles of wire, at the highest speed, without re-writing, delay, or difficulty of any kind. More than this, his apparatus operates in a highly effective manner, under the weakest electric currents, and he is able to receive and transmit messages by currents so weak that the ordinary magnetic instruments fail to operate or even give an indication of the passage of electricity. Thus, when the common instruments stand still, owing to weakness of current, the Edison telegraph will be at work up to its fullest capacity.

The author has baptized his discovery the Electromotograph, which is, perhaps, as good a title as could be adopted.

We subjoin the following original notes by the author, which explain the peculiar principle that lies at the base of his discovery. These notes, we are confident, will be read with very general interest.

To the Editor of the Scientific American:

In my new system of telegraphy, it would seem that power was obtained or that electricity had been passed into a new mode of motion, as with magnetism; but this is only apparent, not real, if I understand it right.

The electricity, acting by electrolysis, changes the nature of the surface of the paper, either by depriving it of some constituent, or the hydrogen, in conjunction with the metal and paper, form substitution compounds, the surfaces of which are smoother than the paper in its natural state, in the manner that the surface of rough paper is made smooth by dipping it into sulphuric acid. The strangest thing connected with this phenomenon, however, is this:

In trying to ascertain what caused the lever to move, whether it was by reducing the lead by hydrogen to a finely divided powder that acted as a lubricant, or whether the nature of the surface of the lead were changed by the absorption of hydrogen, like palladium, or whether the effect were due to the effort of the gases to escape from under the lever: I was led away from these notions by finding that platinum, with sulphate of quinine, will likewise show the movement. It then struck me that the nature of the paper was changed by the electrolysis. To test this, I had a long message received over the Automatic Telegraph wire from Washington (this wire runs in my laboratory at Newark), and recording the same on ordinary chemically prepared paper. The speed with which the message was sent from Washington was about 800 words per minute, and the colorations forming the dots and dashes were rather faint. I then passed the strip into the electromotograph (I use this name for the want of a better one), the colorations being in a direct line with the lead point. On rotation of the drum, and when no coloration was under the lead point, the lever was carried forward by the normal friction of the paper. But the moment a coloration passed under it, the lead point slid upon the paper as upon ice, the friction was greatly reduced, and the lever moved in an opposite direction to the rotating drum.

In this experiment, no battery was connected to the instrument. This proves that electrolysis produces a change in the nature of the paper.

I afterwards found that, if a tin pen were used to receive the message from Washington, although no marks were seen, the paper appearing unchanged, yet, on passing the paper through the instrument, the movement of the lever was more marked than before. Receiving the message with a lead pen did not give so good results, although lead is the best when used, standing at the head of the twelve metals tried. The next is thallium. On paper moistened with aqueous solution of pyrogallol acid, tin is as good as thallium. Of all the solutions yet tested, potassic hydrate has been found to give the most marked results. The second best is sulphate of quinine. Third, rosaniline oxidized and discolored by nitrous acid.

A peculiarity of the quinine solution is that platinum shows an action, and shows it when either oxygen or hydrogen is evolved on its surface. With hydrogen the friction is lessened, as with all other metals; but with oxygen the friction is increased. This is so with all the metals subject to oxidation; but it appeared strange, at first, that it would show with a metal upon which the nascent gases had no effect.

With a lead point and a solution of the disinfectant known as bromo-chloralum, the evolution of hydrogen increases the friction of the paper enormously.

Silver seldom shows a movement with any solution; and when it does, it is very weak.

Sulphuric acid shows least movement with any metal.

It appears to be a matter of indifference as to the character of the metal used for the drum, which acts as one of the decomposing electrodes. Considering that the lever will close a secondary circuit under the great pressure used upon the lever, its sensitiveness to electricity is wonderful. With a delicately constructed machine, moved by clockwork, which I have nearly finished, I have succeeded in obtaining a movement of the lever, sufficient to close the local circuit with a current (through one million ohms, equal to 100,000 miles of telegraph wire), which was insufficient to discolor paper moistened with potassic iodide, or move an ordinary galvanometer needle. Messages may be read from the sound of the lever, when the most delicate telegraph magnet shows no current.

The uses of this instrument are many; in fact, it gives an entire new system of telegraphy.

As no secondary currents are generated, as with an electromagnet, to prevent the instant magnetization or demagnetization of the iron cores, and electrolysis being instantaneous, it is obvious that the lever will respond to signals transmitted with great rapidity. I have succeeded in transferring signals from one circuit to another at the rate of 850 words per minute; hence it may be used to repeat the rapid signals of the automatic telegraph into secondary circuits.

By attaching an ink wheel to the extremity of the lever, opposite a continuous strip of paper moved by clockwork, messages transmitted at a speed of several hundred words per minute may be recorded in ink. By attaching a local circuit to the repeating points, and adding thereto a sounder, it may be used as a Morse relay to work long lines of telegraph.

T. A. EDISON.

Newark, N. J., August, 1874.

THE TRANSFUSION OF BLOOD.

The idea of returning to an animal blood which has been lost, or, rather, of replacing the vital fluid which has disappeared through the effects of increasing age or the ravages of illness, by transfusion from the veins of another animal in full health, was known to the ancients. It is described in the "Metamorphoses" of Ovid, and repeatedly alluded to in the works of the old alchemists, who believed that, by such means, perpetual regeneration of the body might be accomplished. Toward the middle of the seventeenth century, the subject appears to have enlisted the attention of French physicians and philosophers; and in the month of June, 1667, experiments, which previously had been frequently practised successfully upon the lower animals, were for the first time tried upon man. Eight ounces of the arterial blood of a lamb were injected, by Denis, into the veins of a child. Subsequently calf's blood was transfused into the blood vessels of a maniac, who shortly thereafter regained his reason. While, starting from these attempts, the operation was again and again repeated, sometimes successful, sometimes the reverse, until it became common in the practice of almost every French physician. Too common, however,—whether through the rude means employed for forcing the fluid into the veins of the patients, or whether from the lack of skill on the part of the operators, or, more probably, a lack of caution on the part of the latter, due to supposed familiarity with all the consequences of the operation—for accidents soon became more frequent than successes. In the course of a few months, failures became the rule and cures the exception; the people became alarmed, and finally, in the beginning of 1668, the Parliament of Paris proscribed the practice, and the fulminations of Rome, closely following, effectually arrested any further investigation and experiment. The physicians, however, carefully preserved and printed their records; and from an old treatise, called the *Clymatologia Nova*, printed in Brandenburg in 1667, we reproduce an engraving showing how, in those days, the operation was performed. Opening a vein and inserting the end of a common syringe constituted the whole process, in marked contrast to the delicately adjusted instruments and careful measurements now employed.

For a century the subject was abandoned, to be taken up again, however, at the lapse of that period, by Harwood, whose researches showed that blood could not be transfused from one animal to another of different families without killing the latter within a few days after the operation. From this discovery date the modern investigations, which have culminated in the acquisition of knowledge sufficient to admit of the safe practice of transfusion of blood from man to man.

The early experiments of Denis, and of others subsequently, would seem to negative the above mentioned truth, but the details of the operations, as handed down, are very defective, and in some instances it is known that individuals, at first benefitted by the transfusion, subsequently died from its effects. There is certain evidence, however, that death was repeatedly caused by transfusion between widely differing animals. More modern experiments, especially those of Prevost and Dumas, prove that the blood of calves or sheep, injected into the veins of a cat or rabbit, is fatal, and mammals inoculated with the blood of birds rapidly succumb. On the other hand, Lower has shown that the fluid from the veins of one variety of dog acts beneficially upon another dog of different characteristics; and from the experiments of Milne-Edwards and Lafond, of still later date, it appears that it suffices for the two animals to be of the same natural group, although belonging to distinct species. An ass, for example, whose blood was nearly exhausted, was re-animated perfectly by the blood of a horse.

If it is true, then, as facts demonstrate, that, in the case of man or other animal whose life is almost extinct through abundant hemorrhage, revivification may be gained by transfusing a quantity of blood much less than that lost, it becomes an interesting matter to determine to what elements the liquid owes its reanimating properties. Prevost and Dumas show that an injection of serum—that is, blood deprived of fibrin and globules—is utterly without effect. On the other hand, blood containing the globules, but in which the fibrin has been destroyed by agitation, gives strong revivifying results, and hence, as extended investigation has abundantly shown, the perfect globule is absolutely indispensable.

In order to comprehend the hurtful effect of the blood of widely differing creatures, as above alluded to, it is necessary to take into consideration the greatly varying shape of the globules in the blood of various vertebrates. The annexed engraving, representing these globules very much magnified, will, in this regard, be of interest. No. 1 represents human globules imprisoned in the fibrin of coagulated blood. No. 2, the same in rolls. No. 3, globules detached, showing them as circular biconcave disks, diameter 0.00026 inch to 0.00017 inch, weight 0.000001 grain, surface 0.000004 inch. No. 4, globules of the camel, elliptical disks, diameter 0.00031 inch. No. 5, globules of pigeon, elliptical, biconvex, diameter 0.0006 inch. No. 6, globules of frog, elliptical, diameter 0.0008 inch. No. 7, globules of cobitis, round, diameter 0.0005 inch. No. 8, globules of water lizard,

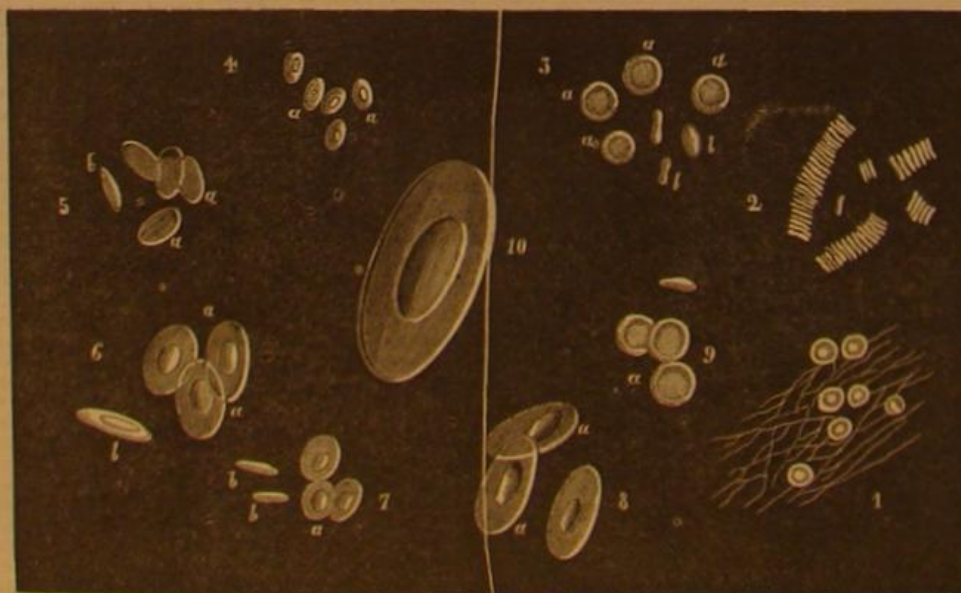
diameter 0.0015 inch. No. 9, globules of ammocoetes, diameter 0.0004. No. 10, globules of proteus (species of batrachian), diameter 0.0048. *a*, in all the figures, indicates front, and *b* side, views.

The results of later investigations prove that the blood of mammals may be injected into man without producing hurtful effects, so long as the red globules of the animal do not differ greatly in form and dimensions from those in human blood. If the globules become dissolved and soon disappear in the organism into which they are transmitted, they nevertheless produce advantageous though not permanent results. It would seem, then, that, when human blood is unattainable, that of animals may be used.



THE TRANSFUSION OF BLOOD, A. D. 1667.

The mode of performing the operation at the present time is graphically depicted in the large engraving on the opposite page, extracted from a French contemporary. The young woman represented as receiving the blood was a servant, twenty-two years of age, who had become extremely exhausted through hemorrhage and overwork. She was received into the Hospital de la Pitié, in Paris, and the transfusion was accomplished by Dr. Béhier from the arm of Dr. Strauss. The aspirator used was so arranged that by no possibility could any air enter with the blood. The latter



BLOOD GLOBULES. MAGNIFIED.

was sent into a cup from the veins of the donor and collected in the inferior part of the instrument, whence it was pumped by a small piston worked by a handle. It was then forced through a canula into the veins of the patient. The instrument, in order to prevent coagulation of the fluid, was first immersed in tepid water, and the tubes used were of gold. Before employment, the apparatus was filled with blood, so that considerable of that obtained from the healthy veins was lost. In all about one ounce, out of three, was administered, but this was sufficient to secure restoration to the patient, and to enable her, after a lapse of seven weeks, to resume her ordinary occupation.

The New York Medical Record, of recent date, contains an interesting paper on this subject, by Dr. J. W. Howe, visiting surgeon to a charity hospital in this city. He gives an

account of his treatment of an invalid woman, forty years of age, whose pulse was weak and irregular, and at times imperceptible. He says: "I abstracted, by means of the aspirator, four ounces of blood from the median basilic of a healthy man. The blood thus obtained was injected into the cephalic vein of the patient. In a few moments she expressed herself as feeling better. There was an immediate and marked improvement in the volume and force of the pulse. This was so perceptible as to be noticed by all present, and prevented me from transferring any more blood. The next morning I found her pulse still improving and her general condition excellent." The patient subsequently regained her strength and recovered.

Testing Colors for their Fastness.

For this purpose, Professor W. Stein gives the following schedule of directions:

Red.—A small sample of the yarn or fabric is boiled first in soap water, which should not affect the shade and become but slightly tinged itself; secondly, in lime water, which also should neither affect the shade nor extract it. These tests are sufficient to demonstrate the presence or absence of logwood, sanders, and aniline.

Yellow.—Boil samples successively in water, alcohol, and lime water. Shades which are not fast enough tinge the water and alcohol sensibly, and turn the lime water red. Annatto and turmeric are the most fugitive yellows; fustic is a little faster.

Blue.—1. Boiled in alcohol, a fast blue should not give a red, purple, or blue liquid. 2. Boiled in muriatic acid and water, or alcohol, the liquid should not turn red, nor should the shade on the yarn or fabric change to red or reddish brown.

Purple.—The only fast shades of this class are those derived from combining a vat blue or indigo carmine blue with cochineal, and the madder purple. Boiled with dilute alcohol (one half water), and left to stand ten or fifteen minutes, fast purples suffer no change; nor should they turn brown or reddish brown when boiled with dilute muriatic acid.

Orange.—Boil in water; if it becomes yellow, reddish yellow, or red, the dye is not fast. If the water remains unchanged, boil in alcohol, which should likewise leave a fast orange unaltered.

Green.—Boiled in dilute alcohol, it should not color it blue, green, or yellow; muriatic acid should not be colored red or blue.

Brown.—It is very difficult to test these for their fastness. Boiling water should not change them to red; when steeped in alcohol they should not become yellow.

Black.—Boiled in water and hydrochloric acid, they should not be yellow.

Prevention of Waste in Manufactures.

In the economy of trade and manufactures, there is nothing more interesting than the prevention of waste, or the discovery of a way by which waste material may be turned to a profitable use. A remarkable case in point has recently occurred. In the manufacture of the beautiful blue and violet dyes that make silken textures and the wearers thereof look so beautiful, there has always been produced a large quantity of dark colored substance, known among chemists as Hofmann's gum. In some aniline dye works the accumulation of this refuse amounts to hundreds of tons, and has long been a hideous burden. But recently Mr. J. Spiller, a member of the Chemical Society, has discovered that, by the process which chemists describe as destructive distillation

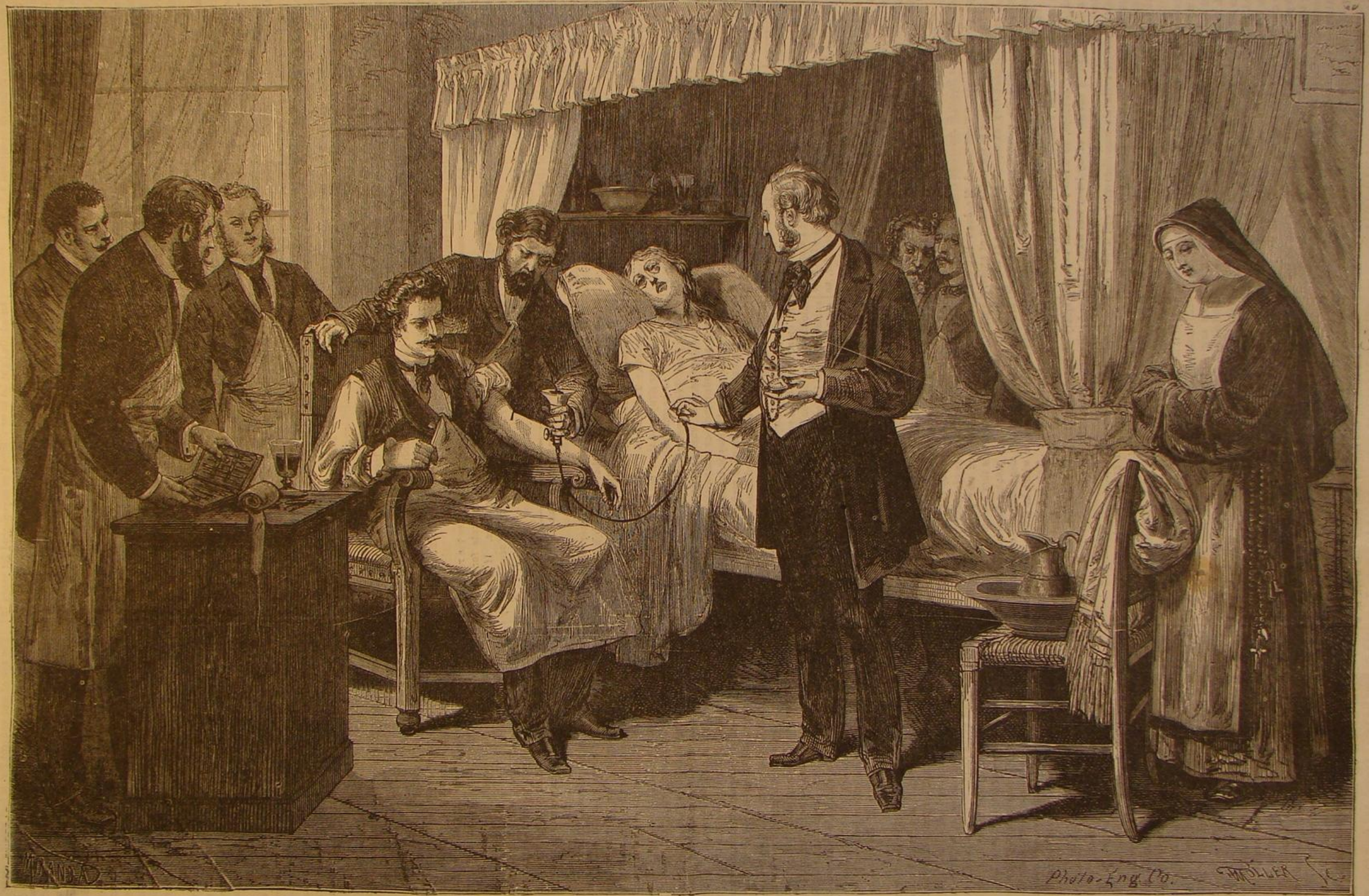
blue and violet dyes, quite as good as those extracted in the first instance, can be got out of this gum; and so, as if by magic, the hideous heaps, now lying on the outskirts of many chemical works in England and on the Continent, become as valuable as gold mines, and enterprising chemists reap the reward.

Another instance is reported from Cornwall. The drainage of certain mines there is discharged from a great pit, and flows into the sea. A few enterprising individuals rented a piece of waste land at the outfall, dug a few catch pits, into which the water poured and threw down a sediment ere it finally escaped. This sediment is ocher, useful for paint and many other purposes, and the quantity collected in this simple way, in one year, was about 2,000 tons, worth from \$2.75 to \$5 a ton. These economizers, however, have let some of their profit slip, for a keen contriver dug a pit to intercept their waste water, and in the same year got \$1,500 worth of ocher as the reward of

his ingenuity.

One more comes to us from Southern Italy, where the people press the oil from olives in common wooden presses, and burn the husks as fuel. A Frenchman from Marseilles went among them, and bought the husks at \$4 a ton, and shipped them to France, where, after treating them chemically, he squeezed them in a steam press, and extracted therefrom 20 per cent of oil.—*Chemical Review.*

WATERPROOF PAPER.—A nice article, transparent and impervious to grease, is obtained by soaking good paper in an aqueous solution of shellac in borax. It resembles parchment paper in some respects. If the aqueous solution is colored with aniline colors, very handsome paper for artificial flowers is procured.



PERFORMING THE OPERATION OF TRANSFUSION OF BLOOD AT THE HOSPITAL OF PITY PARIS FRANCE.

Correspondence.

Notes from Washington, D. C.

To the Editor of the Scientific American:

On Sunday morning, August 16, intelligence reached this city of the death by drowning of Ex Commissioner S. S. Fisher and his son, during a pleasure excursion (in the Rob Roy style) upon our inland waters. Last month, Mr. Fisher left Cincinnati, with his son Robbie (who was about twelve years of age), in a fine metallic boat, built at Cleveland, which was well stocked with provisions and camp equipment; and a few days afterward they arrived at the beautiful Canandaigua Lake, lying in Central New York, where they launched their boat and immediately proceeded to make a tour of the long chain of inland waters which grace the interior of the Empire State, and thence via the Erie canal to Elmira. From Elmira they went to Towanda, Pa., where the boat was again launched in the picturesque Sasquehanna, down which they were passing when the terrible accident occurred which deprived both of life. On Friday morning the little party left Harrisburg at 7 o'clock. At 11 o'clock the boat and occupants were seen just above the falls. At 1 o'clock the boat, with oars, papers, and baggage, was found floating down the stream; unguided and alone, below the rapids. The Colonel's body was found near York Haven late in the afternoon of the same day, about twenty miles below the rapids where the accident is supposed to have happened; but his son's remains were not recovered until the following Monday, some five miles further down the river. The bodies were embalmed and sent to Cincinnati for interment, which takes place to day.

As a curious incident in connection with his death, it is stated that, on the Sabbath before leaving home, he described to a Sunday School the supposed feelings of Pharaoh and his hosts when they were swallowed up in the Red Sea, drawing a vivid and terrible picture of the feelings of drowning men: little thinking that he would so soon experience that which he so graphically illustrated.

The following order was issued yesterday by Commissioner Leggett:

"UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., August 18, 1874."

The news of the sudden death of Hon. S. S. Fisher, late Commissioner of Patents, has cast a pall of sadness over all connected with the Patent Office. We remember him as an affable, genial, generous friend and companion—a kind, courteous, just, and laborious officer—a high-toned Christian gentleman, always commanding the love and respect of all who came in contact with him.

Colonel Fisher's administration of the Patent Office was the beginning of a new era in its history. He did more to adapt the organization to the increased business of the Office, more to establish uniformity in the practice and decisions of the Office, and more to make such decisions and practice attainable and intelligible to the public than had been done before. He ably discussed and satisfactorily settled many questions which had long vexed and harassed the Office. The impress of his clear head and strong will are discernible everywhere, and his administration will ever be regarded as an epoch in the history of our patent system.

In memory of his personal and official integrity, of his great ability as Commissioner, and of his eminent virtues as a good citizen and a Christian gentleman, the Office will be closed on August 20, the day of his funeral.

M. D. LEGGETT,
Commissioner of Patents."

The surviving family of the deceased consists of a wife and two children, who are probably well provided for, as his practice was very lucrative, his last year's income being estimated at \$45,000. In addition to this, his life was insured for \$10,000 in the Traveller's Accident Insurance Company of Hartford, and in the Connecticut Mutual for the same amount.

Washington, D. C.

OCCASIONAL.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

Your correspondents, "Tools" and Mr. Juan Pattison, seem to have great objections to the words "film of oxide," used by me, as though they expressed something of an occult nature and beyond the comprehension of the mechanic or artisan; and I judge from the tenor of their communications that they have somehow imbibed the idea that my original letter is the work of a mere theorist, without practical experience. It may, perhaps, be a relief to them to know that, notwithstanding the gist of my letter was taken from a lecture to the engineers at the Naval Academy, the principal points referred to therein were discovered and largely experimented upon by the writer during over fifteen years of shop experience of the very best kind, ten of which were passed in one of the first and largest establishments in this city, that of Messrs. R. Hoe & Co.

I have a more elevated opinion of the American mechanic, from my long association with him, than to believe, when he is told that the colors appearing upon the surface of a tool which he is tempering are caused by the union of the oxygen of the air with the metal, that if the time be unduly prolonged in producing it, or that, if in the operation he excludes the air from it, his results will be valueless unless these conditions are taken into account, that he will regard so simple, so plain, so very practical a proposition as something too deep for him, but rather that he will set himself at once to apply the test of a trial for himself.

If the mechanic of today is really so obtuse, he must have retrograded not a little in the past ten or fifteen years. I believe, however, that this is exactly the reverse of the truth, and I have long ago become convinced that the known superiority of the American mechanic over the average European is mostly due to the fact that he always seeks for the why and the wherefore; he wants a reason for the faith which is

in him; he is not satisfied to work, like his European brother, by the rule of thumb.

Already I am in receipt of communications thanking me for a little light let in on difficulties experienced for years in tempering tools, and for which the communicants could not, till now, account. Mr. Rose, Mr. Pattison, and "Tools" may as well think the matter over a little more carefully; if they will, I must believe that they will not be willing to ignore two of the most essential readings of what I have called "our color thermometer."

I have noticed frequently, in discussions of this kind, that on the part of many there appears to be an impression that there is some kind of a natural antagonism between what is called theory and practice; but there is no such antagonism. Correct theory makes good practice. Practice without theory is the rule of thumb; and but for theorists and their theories, the productions of our factories would be today what they were two hundred years ago.

The eminently and thoroughly practical man was very happily described in your issue of August 8, in him who borrowed your journal from his neighbor in the cars, and who "never learned nuthin' from books in his life." But I am glad to believe that there are, at this day, few such remaining, that the American mechanic is capable of reasoning and being reasoned with, and that he is always the better for a little good sound theory wherewith to improve his practice.

JOHN T. HAWKINS.

62 Cannon street, New York city.

To the Editor of the Scientific American.

Your correspondent, J. T. Hawkins, insists on the value of the fact that the color on steel is caused by a film of oxide. Is this true? The hardness and temper of a piece of steel vary as the carbon contained therein; and why an oxidized surface should be cited as an indication, I do not know.

Nobill asserts that these colored films are the results of a carbonizing treatment, and that this accounts for the non-rusting of steel covered with such coatings. If the fibers were oxidations, the rusting would be largely accelerated by them.

J. T. N.

New York city.

Honey, Strained or in the Comb.

To the Editor of the Scientific American:

The public are apt to believe that all honey which is out of the comb is impure, and that all comb honey is pure. There are several bee keepers in this neighborhood who produce a great deal of honey for market, and who extract it by a machine. There are a few about here who feed their bees with sugar sirup, and their bees put it into combs, and it is then sold to persons who believe that none but comb honey is pure. We, however, know that what we extract by our machines is just what the bees themselves bring in without any inducement or compulsion. By the use of the extractor, the yield of honey is increased perhaps five fold; but, on account of the unfounded prejudice in favor of comb honey, our producers of extracted honey have some difficulty in introducing it.

On account of the prejudice against extracted honey, and also on account of the ease of putting manufactured honey into the combs, the only way for producers of pure honey to succeed is to be honest, and gradually establish a reputation for honest dealing, which will sell their products at best rates. The idea that honey in the comb is, on that account, pure is totally wrong, and should be abandoned. Extracted honey (not strained, but extracted by a centrifugal machine), properly settled and drawn off into bottles, of which we have in this neighborhood not less than ten thousand pounds this season, is as pure as any in the comb, and purer than much of it. The purchaser gets it perfectly free from wax, and is not obliged to press it out by the use of his teeth.

I send you, with this, a bottle of honey from each of two of our producers, so that you may judge not only of its quality, but also of the means they are employing to introduce a pure article in such a manner as to inspire and confirm confidence. I send you also a communication received from one of our apiarists, in which he shows his product to be 70 + lbs. from each hive. This is a large yield, although this has not been a good season here. Last year, this same apiary produced about 150 lbs. per swarm, another 185 lbs., and still another about 150 lbs.

H. W. S.

Cincinnati, O.

Performance of Small Engines.

To the Editor of the Scientific American:

I have made a small engine, with a 4 inch cylinder, a 2 inch crank, and a 16 inch pulley, with a 5 inch face. The fly wheel is 26 inches in diameter, weighing 125 lbs. It runs at 240 turns per minute, with from 30 to 40 lbs. of steam. With this engine I am running 40 feet of 2 inch shafting, and 40 feet of 1 1/2 inch shafting, 2 engine lathes, 2 speed lathes (one for turning wood, and the other for drilling iron), 1 chucking lathe (sawing 30 inches), 2 grindstones, 1 upright drill, and a pump for pumping water into the boiler; and I have power to spare. I have made with this engine one of 16 horse power, and I am now making one of 25 horse power, besides doing other work.

My boiler is a six horse upright tubular, with thirty tubes 1 1/2 inches diameter. It is not covered in any way, but stands perfectly naked; and I am pumping cold water into the same. I am running this engine and doing this work at a cost for fuel of 50 to 60 cents per day of 10 hours. I cannot tell you the amount of water evaporated, as I have made no note of it.

J. HERBERT BULLARD.

Barre, Mass.

POPULAR FALLACIES.

The age of war and conflict is fast passing away, and the industrial and commercial age is taking its place. Progress is the world's watchword today; and it is the boast of the nineteenth century that, since its birth, the march of discovery and invention, in all the sciences and arts most conducive to man's comfort and civilization, has been greater than in any preceding half thousand years. Science is now the measure of a nation's standing: for general scientific knowledge means education, which means refinement and religion, which means death to superstition. And in this country especially, where education and true religion are so generally diffused, Science seems to have a stronghold upon the respect and admiration of all but the most ignorant and backward minds.

In view, then, of this general diffusion of scientific knowledge, which in this country, though not in itself astonishing, is yet great when compared with that in most other lands, it does seem remarkable oft-times that so many old and long exploded fallacies should still find credence among the majority of people, and even among the well educated. It is fairly astounding to see what outrageously absurd stories will circulate through the popular press, often published in the fullest good faith, and accepted as true by simple minded readers. The scientific hoaxes perpetrated in the United States are almost innumerable; and that they continue to be published, republished, revamped, and, strangest of all, believed, and solemnly discussed in journals that ought to know better, does not speak well for the thoroughness of this scientific knowledge, on whose diffusion we so often pride ourselves.

We remember a recent example in the story, lately published in a California paper (these hoaxes generally emanate from the fertile West), concerning a magnetic cave, said to have been just discovered, possessing such powerful attraction that hatchets were drawn from the hands of the explorers and flew to the roof, remaining glued there; while unfortunately in hobnailed shoes had to leave their foot encasements behind them. This story, though laughed at by one half the community, was received with open eyes and gaping mouths by the other half, who could not comprehend that the size of the attracted body might have something to do with the force of attraction.

But it is not merely of these ingenious hoaxes that we wish to speak, but of a far more injurious state of ignorance among the common people. We refer to popular fallacies concerning the sciences of everyday life, and to the general ignorance about the great forces of Nature, and the first principles of Science in all its departments. Some of these fallacies are simply ludicrous; others are worse. What absurd blunders are made in matters of hygiene! The prosperity of quack doctors, who have medicines, each one of which will cure all the ills that man is heir to, is a forcible example of the latter case. And where we see newspapers—secular and religious—advertising their poisonous wares, we can hardly tell whether to call them stupid or wicked.

"By looking into a looking glass inclined at 45°," Mr. ———, of Northampton, obtained last night a fine view of Jupiter's satellites," says a certain Springfield paper. How Professor Snell, of Amherst, must have chuckled to read it! Mr. ———'s wonderful glass would have conferred satellites upon every star in heaven. He should have known that plain looking glass has no telescopic power, and that his "satellites" were only repeated reflections, between the quicksilver and the front surface of the glass, of the planet he was gazing at.

"Mrs. ——— was recently saved from death from a lightning stroke by her son, who dashed a pailful of cold water upon her. It is supposed that the water carried off the electricity remaining in her body, and saved her!" Such is the Boston Journal's lucid explanation of a simple cure. The poor lady, almost killed by the terrible stroke, was saved by the sudden nervous shock caused by the cold water which her son with such presence of mind threw at her. It is not the presence of electricity in a human body that endangers, nor even the discharge of that electricity, since the body can hold but a small amount; it is the passage through the body of an immense discharge, between clouds and earth, that kills and destroys.

Old maids, and young ones too, throw themselves upon a feather bed for protection from "thunder," or descend to the cellar. An iron bedstead would be safer than either of these places, because it would keep the charge away from them by receiving it through itself. Timid ladies are terrified when a boiler discharges steam through a safety valve, for fear that it will burst; when the roar of escaping steam is proof positive that it will not burst. And to crown all, some misguided victims of an insane fever, forgetful that "action and re-action are equal," and that "gain in power is loss in time, when the force is given," still labor and strive to create force out of nothing, and make what Science has, time and again, declared impossible, a perpetual motion.

Such absurdities of course will never cease, until ignorance ceases. But they are altogether too common among those that should know better, and reveal a great lack of logical reasoning and definite knowledge. Superficiality is perhaps the great fault of our common education, especially in Science, where exactness is so essential. The natural and exact sciences are, we are happy to say, taking more nearly their deserved stand in our American educational courses; and we hope the time may come, and come soon, when such nonsense as we have discussed cannot possibly be found, much less believed in, among those who have been fairly educated.

A. H.

MEDICAL NOTES.

Copaiba in Croup.

If the following remedy should prove a universal one, the saving of young life would be enormously increased:

Drs. Miller and Lincoln, in the "Transactions of the Medical Society of the District of Columbia," vol. I., No. 1, relate several cases of croup cured by balsam copaiba, and refer to many others. Dr. M. had used copaiba extensively in croup for 30 years, and had before spoken of its efficacy, in the Society. He was in the habit of placing a vial of the balsam in possession of all his patients whose families were subject to croup, directing them to take doses of 20 or 30 drops before sending for medical aid. The result was that, while he was formerly frequently called out at night to attend croup cases, he was then but seldom annoyed by similar calls. So great was the faith of his patients in this remedy that he had often been applied to for his so-called croup medicine. It was especially valuable in the early stage. Dr. Lincoln had never seen copaiba fail if given in the first stage of the disease, and had derived great benefit from it in every period of the complaint. He thought the remedy of great use, even in the pseudo-membranous form of croup. His dose was one drachm which gave prompt relief.

Guarana in Chronic Rheumatism.

Dr. Edward A. Rawson, assistant surgeon to the Carlow Infirmary, says: "Suffering severely from lumbago, and finding all vaunted remedies fail, I tried guarana as an experiment. I took 15 grains in hot water, with cream and sugar. For 24 hours afterwards I had a delightful relief from pain. On the return of the lumbago, I took another dose in the same manner, and with a similar result. I gradually increased the dose to 40 grains, and took it regularly once a day for about a week. The lumbago disappeared. I gave up the guarana, and in a few days the pain in the back returned. A 40 grain dose removed it, and it did not return for several days. Whenever it does, I have my remedy at hand." Dr. Rawson goes on to say that he has tried guarana with a variety of patients, rich and poor; and if the pain is acute, coming on with sharp stings, guarana acts like magic; when it is of a dull, aching character, the drug is slower in its action, and several doses must be taken before any decided benefit can be perceived. He comes to the conclusion that, whenever the fibrous envelopes of nerves, the aponeurotic sheath of muscles, or the fasciæ or tendons are the parts affected, guarana gives either instantaneous or speedy relief, which will last from 12 to 24 hours; and he thinks that perseverance in the use of the drug, gradually increasing the dose to 40 grains, will finally entirely remove any of the above named kinds of rheumatism. Guarana was examined by Martius in 1829, and by Gravelle in 1840. They declare that it stimulates and at the same time soothes the gastric system of nerves, diminishes febrile action, and strengthens the stomach and intestines, particularly restraining any excessive mucous discharges; at the same time increasing the action of the heart and arteries, and promoting diaphoresis.

This medicine is a preparation of the seeds and juice of the *Paullinia sorbilis*, a Brazilian plant, of which wonderful stories have been told by travelers. Its effects appear to be various, some of them similar to those of tea and coffee in stimulating the nervous system. The Indians consider it a specific for bowel complaints. Dr. Gravelle found it advantageous in the diarrhoea of phthisis, sick headache, paralysis, tedious convalescence, and generally as a tonic. Dr. Ritchie recommends paullinia in irritation of the urinary passages. Dr. Herve never failed to derive benefit from it in the most obstinate cases of idiopathic diarrhoea. It cures both headache and neuralgia by restoring the tone of the gastric membrane, and removing all pains caused by irritation of the stomach. Though not an astringent, its peculiar action renders it a most valuable agent in all affections of the bowels, whether simple or chronic diarrhoea, dysentery, or choleraic discharges. In France it has cured attacks of cholera when the evacuations have been at the rate of 30 an hour. It is also said to be prompt and certain in dysentery, curing the very worst cases. From all appearances, no new medicine rivals it in value.

An Ingenious Substitute for the Hypodermic Syringe.

In the *Edinburgh Medical Journal*, Dr. John M. Crombie, states that many medical men are often deterred from using morphia hypodermically on account of the expense of the syringe, and the pain they cause the patients. To avoid these, he advises the use of small threads coated with morphia and passed through a fold of the skin by fine needles. The threads may vary in strength from one sixth to one grain of morphia.

Diabetes.

Dr. O. Schultzer claims great success in the treatment of diabetes under the free use of glycerin, internally, with citric acid, and abstinence from starchy food.—*New Remedies*.

Diatase as a Digestive Agent.

The substance here named, says Dr. Collins C. Hunt, in the *Physician's Monitor*, which is believed to be new as a remedial agent, was first employed by William Elmer, M. D., of New York, who has given it a fair trial for a year or two, with most gratifying results. It not only aids in the digestion of starchy food, but seems to impart vigor to the digestive functions generally, and through this action supplies energy to the brain and nervous system. For some of the worst forms of indigestion, the use of diatase has had the effect, in particular, of producing the most tranquil and refreshing sleep, and that where, previously, satisfactory sleep had been almost unknown. This result is attributed

to the digestive power of diatase more than to any other property it possesses. Diatase may be given in the form of a sirup or in lozenges. The dose is from 1 to 2 grains directly after each meal. The sirup should be prepared with glucose rather than with cane sugar; but any sirup has the great objection that it is required to be kept cold, or the diatase is liable to turn sour.

Iron Purifies Water.

Almost all large water pipes are of iron, as tax payers well know when they are called upon to replace the old rusty mains with new ones every few years. But, according to good chemical authority, the iron has an advantage with its defects. Professor Medlock proved by analyses, several years ago, that iron by its action on nitrogenous organic matter produces nitrous acid, which Muspratt called "Nature's scavenger." The latter chemist found, as a general result, that, by allowing water to be in contact with a large surface of iron, in about 48 hours every trace of organic matter was either destroyed or rendered insoluble, in which state it could be purified effectually by filtration. Medlock found, on examining the water at Amsterdam, which smelt and tasted badly, that the sediment charred on ignition, and was almost consumed, showing that it consisted of organic matter. He also found that, instead of taking iron from the service pipes, the water before entering those and an iron reservoir contained nearly half a grain of iron to the gallon; while in the water issuing from the pipes, there was only an unweighable trace. Before entering the reservoir, the water holding iron in solution formed no deposit; while the water coming from the pipes and freed from iron gave the organic sediment above mentioned. He then made analyses of water brought in contact with iron, and water not in contact, with the result that the water which had not touched iron contained 2.10 grains of organic matter, and 0.96 grain iron; the other gave only a slight trace of both, showing plainly that the organic matter in the water was either decomposed or thrown down by contact with iron; and this water, when filtered, was found to be clear, of good taste, with no smell, and free from organic matter. It is not stated in what shape the iron was held in solution, but it was probably in that of carbonate, the usual iron salt of springs, since carbonic acid is so common in water in general. These facts may be made useful in certain places and ways in effecting the purification of water rendered injurious and offensive by the presence of organic substances. And if the interiors of iron mains could only be kept from rusting by a swabbing with nitric acid, or by a paint of charcoal and plumbago, so much the cheaper.

SCIENTIFIC AND PRACTICAL INFORMATION.

MANGANESE IN SEEDS.

A chemical analysis made of seeds known as tapayons, which were brought to France by a missionary from China, has revealed the remarkable fact that the ash contains 17 per cent oxide of manganese, 14 per cent of magnesia, and 12 per cent of lime. This amount of manganese is much greater than is recognized in the leaves of the beech tree or in any other vegetable.

COPPER, A PREVENTIVE OF CHOLERA.

M. Burg, in a recent memoir to the French Academy of Sciences, states that workers in copper are never attacked by cholera, while the operatives whose labor in other metals is of similar character form no exception. This fact has not only been observed in France, but in Italy, Russia, Sweden, Spain, and Turkey. M. Burg concludes that copper acts as a protection against the disease, and advises the use of salts of the metal as a preventive medicine.

SCIENTIFIC MARKETING.

There is Science in this last attempt of our transatlantic cousins at household financiering, a great deal more Science than is necessary to accomplish that timeworn desideratum of making two blades of grass grow where one before flourished. By an ingenious little transfer of checks and bonds, a man may get his daily bread for nothing and be paid besides. A company sells tickets to a tradesman at a premium of five per cent of face value. Then the latter hands these over to his customers in quantities equal in amount to the cost of the goods bought, allowing the 5 per cent for ready cash. Then when the customer gets \$25 in tickets, he goes to the company and receives a \$25 bond in exchange. Meanwhile the tradesman's 5 per cent is put out at compound interest, and the profits accruing enable the company to make their own profit and besides pay off the bonds by ballot. Consequently, the customer not only eats his cake but more than has it too, for his whole expenditure is returned with interest.

SONOROUS SAND.

The *New York World*, in a report of a scientific meeting in San Francisco—the name of the association is not stated—gives an account of a very curious property of sand which is found in a large drift on the Island of Kanai of the Hawaiian group. The bank is about sixty feet high, quite steep, about one and a half miles long, and extends parallel with, at some hundred yards from, the beach. If, at the extreme south end and for half a mile north, two handfuls of the sand be slapped together, there is a sound produced like the low hooting of an owl—more or less sharp, according as the motion is quick or slow. Sit down upon the sand and give one hand a quick circular motion, and the sound is like the heavy bass of a melodeon. Kneel upon the steep incline, extend the two hands, and clap as much sand as possible, slide rapidly down, carrying all the sand you can, and the sound accumulates as you descend until it is like distant

thunder. In this experiment the sound was sufficient to frighten horses, fastened a short distance from the base of the drift. But the greatest sound produced was by having one native lying on his belly, and another taking him by the feet and dragging him rapidly down the incline, carrying as much sand as possible with them. With this experiment the sound was terrific, and could have been heard many hundred yards distant. With all the experiments that were made, it seemed that the sound was in proportion to the amount of sand put in motion with a proportionate velocity. Another consideration seems requisite—that is, its perfect dryness. The dry sand would sound on the surface where six inches beneath it was wet; but if any of the wet sand became mingled with the dry, its property of sounding ceased at once. The sand appears to the eye like ordinary beach sand, but ordinary beach sand will not produce the sounds. It has been said that it lost its sonorous properties when taken away from the bank, but no diminishing of its sonorous qualities, even with the bottle uncorked, was noticeable.

OUR NEW GOLD REGION.

The practical results of General Custer's expedition in southwestern Dakota are beginning to appear. This hitherto unknown region, as far as entered, has proved to be covered with magnificent timber and grazing, superior even to the famous Blue Grass country, in Kentucky. The valleys are admirably adapted to agricultural purposes, and the scenery is said to be lovely beyond description. In addition to these natural advantages of the country, gold, it is stated, is being found in great profusion, though no official investigation as to its richness has thus far been made. Veins of what geologists term "bearing quartz" crop out on every hillside, and from forty to fifty particles of pure metal, each as large as a pinhead, have been taken from the washings of a little over a single pan of earth. If the further reports from the expedition prove as satisfactory as this first one, another gold fever and rush of emigrants to preempt land will be very probable.

RAW HIDE BELTS.

In driving centrifugal sugar machines, Mr. J. Mason, of the Island of Bardadoes, found the use of the ordinary leather belts to be troublesome and expensive. He, therefore, substituted belts of raw cow's hide, simply dried in the sun, cut perfectly straight, and the joints, square and even, stitched with saddler's hemp thread. He states that in practice, a belt of this description, will last four times longer than, and cost only one fourth as much as, a leather belt. He uses an 8 inch belt of this kind, to drive a line of 3 inch shafting, from which 2½ inch belts drive the sugar machines.

Carbonic Acid as a Motor.

The possibility of employing carbonic acid as a motor—the successor of steam, as it is termed by the author—is foreshadowed by a paper by Dr. H. Beins, published in the *English Chemical News*. The writer considers that he has discovered a very cheap way of producing carbonic acid in a liquid state and consequently at high tension. When sodium bicarbonate, or the corresponding salt of potassium, in a dry, pulverized state or in a watery solution, is heated in a closed space, a part of the carbonic acid is given off and condensed in a non-heated portion of that space, so that, at a temperature of from 636° to 843° Fah., liquid carbonic acid, says Dr. Beins, can be distilled out of those salts, with a tension of from 50 to 60 atmospheres. This liquid carbonic acid, or "carbolem" as it is called, it is proposed to use to develop gas with which engines are to be driven. The paper on the subject contains a dissertation on the advantages of the plan, but gives so few details regarding its practical application, or with reference to the manufacture of the carbolem or liquid carbonic acid, that the gist of the matter is summed up in the above lines.

Sulphur in Iceland.

Dr. Blake gives a full and clear description of the vast deposits of sulphur occurring in Iceland, and points out the necessary steps for its utilization. For its shipment he recommends the port of Husavik, which is accessible all the year round, and which is situate very near to the sulphur beds of Lake Myvatn, Krabla, and Reykjahlid. The mines are not only rich and extensive, but easily worked. The sulphur can be supplied at half the cost of that furnished by the Sicilian mines, which it is believed will soon be exhausted. The earth impregnated with sulphur contains from 50 to 60 per cent, and is from three to six feet in thickness. Vapors arising from the interior of the earth continually deposit fresh supplies.

A Gigantic Grain Elevator.

The New York Central and Hudson River Railway Company is now building at the foot of 60th street, on the Hudson River, in this city, a grain elevator, capable of holding from 1,000,000 to 1,200,000 bushels of grain. This elevator will be used principally for storage purposes for the grain brought on in the company's cars, and intended for transference to sea going vessels and canal boats.

ANNATTO.—In the two French colonies of Martinique and Cayenne, there are more than six thousand acres under culture with annatto (*bixa orellana*), the annual produce being three million pounds. Although French Guiana has nearly five times the extent of land under culture with this plant that Guadeloupe has, it only produces about two thirds of the whole quantity. The production of annatto now exceeds the demand, as no fresh use has been found for this coloring substance, unless it is the manufacture of suet butter. Annatto is used to give the yellow color of true butter.

A NEW MOTOR.

According to the laws of the mechanical theory of heat, any difference of heat may be employed for production of mechanical work. If a cold body, then, be situated in air that is hotter, the passage of heat to it should be capable of giving mechanical work. The solution of this problem (says the *English Mechanic*) M. Enrico Bernardi, an Italian physicist, has recently sought to realize in the following way:

Two similar glass balls are connected together by a thin glass tube, the ends of the tube passing into the balls being bent at a right angle. One ball contains a small tube, by which ether can be poured into the apparatus; the ether is brought to boiling, and, when all air has been expelled, this small tube is closed by fusing. The quantity of ether inclosed in the system should be such as to fill about three fourths of one ball. At the middle of the connecting tube is fixed a piece through which passes a metallic axis, round which the system can turn. When the ether is equally divided between the two balls, the apparatus is in unstable equilibrium. The bearings for the axis are supported on the cover of a rectangular case, and in this cover is a slit through which the turning system passes. The case is filled with water, into which the balls dip alternately on their being turned round the axis. Each ball is covered with a very fine veil. It is easy to see that this apparatus will take a see-saw motion.

Owing to the unstable equilibrium of the system, one of the balls, A, sinks, and all the ether flows into it, while the rest of the space is filled with the vapor. The ball, A, is then in water, the ball, B, in air. Hereupon the moisture on the surface of B begins to evaporate, and the ball is so cooled that the vapor within condenses; from the ball, A, more ether is evaporated, and it is condensed in B, till at length B contains more ether than A, and sinks, while A rises; and the same process is repeated. This see-saw motion lasts as long as there is water in the case to moisten the surface of the under ball.

It would be rather troublesome to utilize this thermo-motor see-saw mechanically; and M. Bernardi has, therefore, preferred to alter the apparatus in the following way: The two balls of the above described system are connected by a tube, the ends of which are bent round (at right angles) to opposite sides. Three such systems are formed into a sort of wheel, the middle points of the six balls and the tube being in one plane. This wheel is supported at its axis, on the cover of a rectangular case, in such a way that, in its rotation, it is always half within the case and half in the air. The balls are covered as before, and so much water is poured into the case that, in turning the wheel, one ball is always immersed. By giving the wheel a turn, it can be set in continuous rotation; and, with a suitable arrangement of pulleys, it can be made to raise a weight, or do other work.

Such a thermo-motor wheel has, for two months, been working a clock in M. Bernardi's laboratory. The balls have a diameter of 0.78 inch; the distance of the middle points of two opposite balls is 3.1 inches, and the quantity of ether in each system fills three fourths of a ball. The clock maintained in motion by this wheel consumes, in 24 hours, 0.2 of a foot pound. The water level is, by a special arrangement, kept constant. M. Bernardi has had his see-saw working for three months without its becoming necessary to renew the water or clean the balls. He has calculated the quantity of heat which is removed by this apparatus from the surroundings. There was an average of 60 see-saw motions in 24 hours. This was found to be equal to 0.12 of a foot pound, or about half the work consumed in the same time by the clock.

FOLSOM'S IMPROVED LOCKING LATCH.

This invention is a simple, strong, and convenient door

Fig. 1

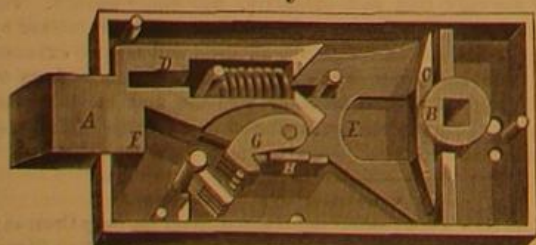
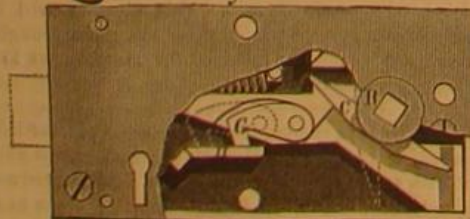


Fig. 2



lock, which may be opened by the knob and locked by a key, but in which only one bolt and one spring are used.

In Fig. 1, the bolt, A, is represented as shot forward so as to lock the door to which the device is applied. In Fig. 2, the same is retracted (dotted lines), and serves as an ordina-

ry latch actuated by the knob. As shown in Fig. 1, the rear or right hand end of the bolt, A, is flanged and also recessed so as to slide along the knob shank, B, being carried back by the crossbar, C, acting on the flanges. A glance at the corresponding portion in Fig. 2 will render the action of this bar, C, clear.

In the middle portion of the bolt is a recess, having small slotted extensions, D. In the former is placed a strong spiral spring, and the latter serve to guide the bolt as it slides over the spring-supporting pins. The action of this spring on either side of the bolt serves to carry the latter back to its original position, whether being operated by knob or key. A rectangular recess is made at E, equal to the distance from



BERNARDI'S THERMO-MOTOR

the crossbar, C, to the rear flanges, and allows of the forward motion of the bolt by means of the key acting on the shoulder, F.

At G are one or more pivoted catch hooks which enter recesses in the bolt and slide, during the to-and-fro motion of the same, with their hook ends along a horizontal guide plate, H. The front end of this plate is slotted, and has a slight downward inclination, so that, when the hooks are carried far enough forward, they drop into and interlock with the slots. The key is so made as to enter these slots, and pass between and through them. It then strikes the shoulder, F, and carries the bolt forward. This carries the hooks also far enough forward to drop with their ends into the recesses of the guide plate, so that they thus hold the bolt firmly locked.

To unlock the latch, the key is turned in the same direction as before, thereby lifting the hooks out of the guide plate recesses, when the spiral spring pulls the bolt back to its former condition.

The advantages claimed are simplicity, durability, and also cheapness of manufacture, owing to the fewness of parts. It is also very difficult to pick, as the key has to pass a very difficult guard and, as already explained, to strike a number of catches and raise them to a certain height. It cannot be unlocked with a wire, since every catch must be lifted, and, in brief, every lock must have its own special key. It operates by the knob with as much ease as the ordinary latch, and cannot be thrown back by force applied to the knob when locked.

Patented through the Scientific American Patent Agency, June 30, 1874. The inventor, Mr. F. W. Folsom, of Taylor's Falls, Minn., who may be addressed for further information, desires either to sell the patent or to make arrangements for the manufacture of the device on royalty.

T. MARR JOHNSON, C. E.

We regret to announce the sudden demise of this widely known engineer, which took place in England, July 22. His age was 48. Between the years 1860 and 1869 he was occupied, under Mr. John Fowler's instructions, in carrying out the works of the Metropolitan Underground Railway system in London. He was employed upon many other important works, and held a distinguished professional position. At the time of his decease, he was a member of the firm of George Smith & Co., builders and contractors.

Metachloral.

M. Lemousin has obtained metachloral by treating one part of chloral hydrate with three parts concentrated sulphuric acid, and washing the insoluble product obtained until acid reaction ceases in the washing water. The metachloral is then dried by chloride of calcium and reduced to fine pow-

der. It has the same formula as anhydrous chloral ($C_2H_3Cl_3$, O_2) of which it is an isomeric modification. It is less caustic than chloral hydrate, and has a great advantage over the latter in not absorbing moisture.

Spontaneous Combustion.

We are inclined to believe, says *Engineering*, that one great cause of spontaneous combustion, in cotton and woolen mills, rests on the length of the fiber of the material left as oily waste. The finer this fiber the greater is the danger of spontaneous combustion, and this becomes evident from the fact that in such cases the particles of the materials are in closer contact. In all our large docks of London, Liverpool, etc., thousands of tons of long stapled sheep's wool, imported from Australia, the Cape, and other places, full of animal oil, remain perfectly safe for years. In their transit, the bales containing such wool must have attained a temperature of at least 80° to 90° , yet we never hear of spontaneous combustion, either in the ships or the docks. But then comes the question of the character of the oil—as to whether the animal or the vegetable is the more dangerous. The late Dr. Graham, in reporting on the burning of the Amazon, considered that rags greased by butter, heaped together, would take fire within 24 hours. We question very much whether silk or sheep's wool is liable to spontaneous combustion, even in the presence of abundance of oil. Cotton, jute, all kinds of hemp and flax, mixed with oil, have an invariable tendency to spontaneous combustion at summer heat.

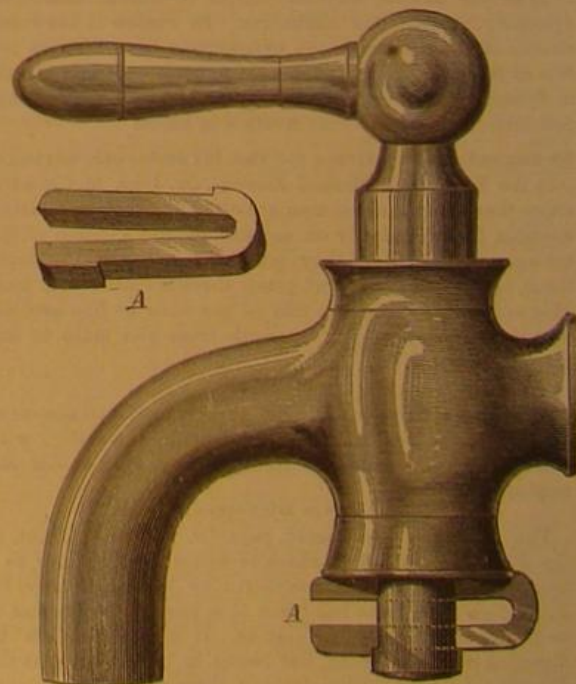
The only apparent remedy seems that of maintaining constant ventilation in all waste, etc., containing oil. Frequent turning is essential, and we have tried successfully the sprinkling of such waste with waste lyes or lime water. It is remarkable that jute warehouses are peculiarly liable to catch fire in fact, all members of the hemp and flax family are to be more feared than varieties of cotton.

A singular cause of fire may be traced to the glass of which the windows of warehouses is made. In the old fashioned kind the "punch" mark is found. This forms a double convex lens, which, concentrating the rays of the sun, constitute a burning glass. That fire should occur from such causes can be no matter of surprise. Water bottles exposed to the sun's rays have sometimes similarly caused fires in private houses by concentrating the heat rays on dressing table covers, etc.

WEBSTER'S IMPROVED FAUCET.

Our illustration represents a simple substitute for the screw, nut, and spring washer usually employed to secure faucet plugs in place. The inventor informs us that the device has now been in successful use in Brooklyn, N. Y., for several years, and that, in addition to other advantages, it possesses the important one of cheapness, as it can be manufactured for ten cents per faucet.

It consists of a spring key, A, punched out of ordinary brass, and inserted in a suitable slot in the lower part of the plug. It is claimed to take up all wear, and hence not to work loose, as frequently occurs with the usual screw and washer. By holding the plug in proper position, it also prevents grit or dirt from getting between the plug and the barrel of the faucet, making it self-grinding and obviating the necessity of frequent repair. Finally, by its yielding to expansion and contraction, the device is well adapted for use



with steam or hot water, while, besides, it prevents the chambers from being spoiled by freezing.

Patent for sale for the United States. Proposals for purchase should be addressed to Theo. L. Webster, M. M., U. S. Navy Yard, New York city.

MANUFACTURE OF MORTAR BRICKS.

Among the objects at the International Exhibition, London, which, though very interesting, are so modest in appearance as to be passed over by most without notice, are a number of bricks made not only without straw, but without burning.

The bricks are practically mortar, seeing that the materials of which mortar is commonly made are those which alone enter into their composition. Sand and lime form one variety of brick; sand, lime, and Portland cement make another. Pressure and air drying are the only operations, beyond the first mixing, that are necessary. At first thought it might be objected to such bricks that they would probably be too friable or too soft for use; but the sight of a piece of good old mortar should convince the doubtful that the hardening influences of time and carbonic acid—resulting in the production of a marble-like carbonate, and possibly silicate, of lime—are quite equal to those of the kiln. Bricks are also formed by pressure of mixtures of subdivided slag with lime, Portland cement, and blast furnace slag cement respectively. The slag cement itself is composed of from eight to ten parts of slag, and one part of lime. But little surprise need be felt at the employment of slag in the preparation of cement, since the chief condition for success is the presence of a silicate capable of decomposition by lime—a condition which is fulfilled by powdered slag.

The bricks give a good result on application of the usual tests. They have a good sound ring, are very hard, and can be made of various shades of color, or even enameled, we should imagine, by a little ingenuity.

The process of mortar brick making by the machine is simple. Hoppers are filled by hand with the materials employed, each into its separate hopper. From this point to the removal of the finished bricks all operations are automatic. Measured portions of each ingredient are caused to fall upon a traveling belt which delivers the mixture into an apparatus, in which it is thoroughly incorporated, and from which it is deposited upon a second traveling belt, which carries it to the press, where measured quantities are delivered into the molds. The press is hydraulic, consisting of a circular table revolving horizontally, and of course stopping when pressure is applied. The table contains six pairs of molds, making, therefore, one sixth of a revolution between the stoppages for application of pressure. Two pairs of molds are subject to pressure at once, two other pairs being automatically filled, and the bricks rising out of the remaining two pairs, simultaneously. The bricks are removed by hand to barrows, and conveyed to the yard, where they are left to harden. The time required for this varies according to the quality of the lime used, and also according to the weather, from one to two months, but the hardening goes on for years. Seven strokes per minute are made by the press, giving in that time twenty-eight bricks, or about 80,000 per week, as the result of the labor of two men and four boys, exclusive of wheelers and pilers. When sand is used, from one sixth to one eighth of its weight of lime is necessary; but with slag, as little as one sixteenth of its weight of lime may be employed to produce a good quality of building brick, weighing about 58 cwt. per thousand.

Bricks of this kind have long been in use in the United States. The machine above represented, which we copy from *Iron*, is made by Messrs. Bodmer, Hammersmith, England.

Improvements in Sugar Making.

The methods of purification employed in the sugar manufacture depend almost entirely upon the action of lime and its elimination by carbonic acid. These processes leave, in the saccharine products, a certain proportion of organic matters and mineral salts, which oppose, to a certain degree, the crystallization of the sugar, causing also the formation of molasses and the mingling of the sugar with the residue. M. P. Lagrange has recently devised a method which is

based on the elimination, by the joint action of baryta and phosphate of ammonia of the organic salts of lime, of certain vegetable acids combined with potash and soda, and of the alkaline sulphates existing in the sugar products. By this process, without the aid of lime or salts of lime, M. Lagrange believes that he is enabled to obtain the products, and to secure the best conditions of alkalinity, without forming glucose at the expense of crystallizable sugar. In factories, therefore, devoted to the manufacture of cane sugar, it would seem that this improvement is of considerable importance, as doing away with the serious difficulties and large losses due to the glucose formation and the lime salts.

M. Marguerite has recently patented a process for obtaining sugar from molasses by the addition to the latter of certain salts which provoke crystallization. The process is said to be especially valuable in treating third quality sirups as well as molasses. The operation consists in adding to the spent molasses (containing, say, fifty per cent of sugar, fifteen per cent of salts, and twenty per cent of water) crystallized sulphate of magnesia in the proportion of twenty per cent by weight, together with a little water, to make a

The New Lake or Sea in Africa.

The French government has recently voted the sum necessary for the formation of a great inland sea in Algeria, 190 miles long by 36 broad, to the south of Biskra. It is thought, by the *Revue des Deux Mondes*, that the result of this measure will be a great improvement in the climate of the interior, a great addition to the facilities for inland transport, and the introduction of commerce and civilization into the very heart of Africa. The Chott Mal-Rir, Chott implying the bed of a lagoon, the proposed site of this inland sea is found to be at least 90 feet below the Mediterranean; while the Chott Sellem, with which it communicates, which lies between it and the sea, is 54 feet lower still. A chain of chotts, of smaller area but equal depression, extends thence to within 12 miles of the coast of Tunis, at the Gulf of Gabes, and a canal connecting the nearest chott with the sea would admit the waters of the Mediterranean, and convert the desolate region of Chott Mal-Rir into a great inland sea. The estimated cost is only three millions of dollars, and the engineering difficulties, after the experience gained during the construction of the Suez canal, would be inconsiderable.

At a recent sitting of the Academy of Sciences, Paris, M. de Lesseps stated that, on the war budget being presented, a sum of \$5,000 would be applied for to cover the expenses of the definitive survey of the basin. The engineers intrusted with the operation of cutting through the Isthmus of Gabes will then start from Biskra, with the aid, not only of the Governor General of Algeria, but also of the Bey of Tunis, equally interested in the success of the enterprise.

It has heretofore been suggested in the *SCIENTIFIC AMERICAN* that, while it was very practicable to cut the proposed canal and admit the water of the Mediterranean to the desert, the ultimate result, owing to the rapid evaporation, might simply be the formation of an immense deposit of salt. This appears to be also the view taken by M. Ch. Honyvet, who, at the above sitting of the Academy, gave a paper on the subject. He observes that the Mediterranean may, of course, be tapped as they propose, and an immense inland sea formed; but that a vast surface of evaporation will thus be exposed to the sun's rays; and that, as the loss of water by this action can only be replaced by the sea through the canal, the end of the whole operation will be the formation of a thick crust of salt at the bottom, whereby all navigation will be stopped in a short time, and millions will have been spent to create a gigantic salt pit, and nothing more.

Artificial Furs.

Mr. Tussaud, of London suggests an ingenious way

of preparing the hair or fur of animals for use without employing the skin. The process consists in first soaking the fur in lime water to loosen the adhesion of the hairs. After washing and drying, the piece is stretched upon a board, fur side up, and a solution of glue laid over it, care being taken not to disturb the natural position of the hairs. After the glue has hardened, the skin may be pulled off, leaving the ends of the hairs exposed. The latter are then washed with proper substances to remove fat, bulbs, etc. An artificial skin of gutta percha, or other waterproof substance, is next laid on top of the glue and allowed to dry so as to form a continuous membrane, when the glue is washed out with warm water. These artificial skins are entirely free from any animal odor, and are more durable, lighter, and more pliable than the natural ones.

THE Mikado is making almost as good a thing out of his reformation as Henry the Eighth did of his. One of the discarded gods of Japan is advertised for sale in a Japanese paper in the following terms: "For sale, at Kama-Kura, a very fine idol with six arms. It is 15 feet high, and was cast in bronze, at Sheffield." Sheffield now shares with Birmingham the doubtful honor of supplying, with impartial generosity, missionaries and bibles to the more inquiring among the heathen, and idols to those who prefer to walk in the old ways.

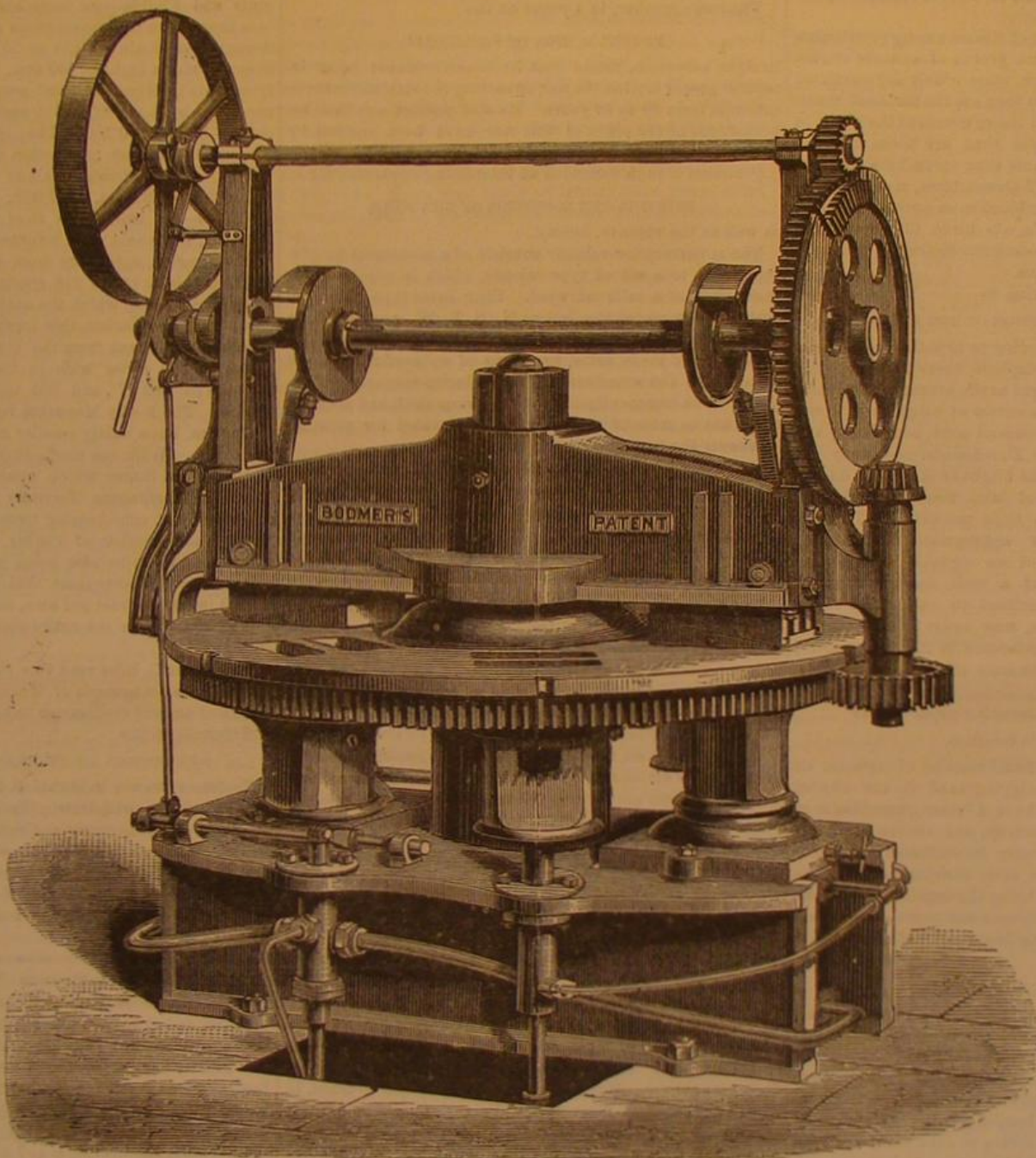
HYDRAULIC PRESS FOR MAKING MORTAR BRICKS.

solution of the sulphate marking 10° Baumé. The whole is then subjected to centrifugal action in a machine having either perforated slides or very fine wire cloth. The sulphates of lime and potash precipitated are retained, and the liquor is then filtered through charcoal and boiled *in vacuo*. After cooling, a certain quantity of pounded sugar is added to form nuclei, and the sirup is lastly subjected to the ordinary temperature of fillings, the heat being alternately raised and lowered.

After a few days, crystallization becomes exceedingly abundant, and continues to increase for some time, after which the hydro-extractor is employed. Other salts, such as sulphate and chloride of magnesium, chloride of manganese, sulphates of iron and zinc, and their chlorides, and also the acetates, nitrates, and ammonia salts, though these are not so desirable, may all be used instead of the sulphate of magnesia, the proportions of which vary according to the nature of the molasses.

The crystallization of the sugar results from elimination of the potash, the salts of which are prejudicial, its place being taken by the magnesia, whose salts are favorable thereto.

Work has begun in earnest on the Centennial grounds in Philadelphia. Daisies and clover have disappeared, leaving a vast expanse of level, bare, red earth, crossed by railroad tracks, and dotted here and there with shanties.



PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

We continue below our abstracts of the papers read before the Hartford convention. Professor E. S. Morse, in a paper on the ascending process of the astragalus in birds, expressed the belief that the above process represented the intermediate of reptiles. This view he has confirmed by studying the embryo of the common tern.

Professor Wheldon, on the lobster, said that the process of shedding the shell is generally known, excepting perhaps that relating to the large claws. The body opens in a straight line in the length of the back, while the tail, legs, and claws are drawn out from the shell, leaving it entire, as it has been called, an articulated skeleton which is thrown off periodically. It is found that in that portion of the claw near the body a part of the shell decays and falls out, making sufficient room for the passage of the claw. The portion of shell indicated is that small, smooth part that lies flat upon the body. The lines indicating this portion are to be distinctly seen in all lobsters which are approaching the period of shedding the shell, and these become gradually more distinct until that part becomes semi-transparent and finally decays.

In a paper on the significance of classes among vertebrates, Professor Gill considered that no groups of animals should be combined in classes which are more widely differentiated morphologically from each other than are the birds and mammals. The differences between the extremes of the group of fishes are immeasurably greater than are those between mammals and birds, and still more than those between birds and reptiles. Instead of the old classes, birds, mammals, and fishes, we should have eight, combined in an entirely different manner, namely: (1) Mammals, (2) birds, (3) reptiles, (4) batrachians, (5) fishes, (6) elasmobranchiates, (7) marsupio-branchiates, and (8) leptotardians.

Professor B. A. Gould, referring to

THE NUMBERS AND DISTRIBUTION OF THE FIXED STARS,

states that, if we assume, according to hypothesis, an equal number of stars in each hemisphere, there are altogether not less than 15,300 stars as bright as the seventh magnitude. But since the count indicates an excess of bright stars in the northern sky, there may be a thousand more, as given by the formula. The numbers of the *Durchmusterung* imply the existence of over 200,000 stars as bright as the ninth magnitude, though the magnitudes of faint stars in that work seem given on the average a little too bright. The two classes of considerations—the approximate method furnished by the hypothesis of an equable distribution of stars and the existence of a well marked zone of very bright stars as much inclined to the Milky Way as the equator is to the ecliptic, may assist in determining the position of our sun with reference to its own cluster, that of the cluster itself, and the scale of distances between its constituent stars.

Mr. J. H. Kuppert read an interesting paper on the

EXTINCT HOGS OF OHIO,

in which he alluded to certain fossil remains of animals of the *Irididae* family, found in digging sand in the city of Columbus, O. The skeletons have a close resemblance to that of the South American peccary, and are the first complete ones ever found. There may be sufficient differences to constitute a new species, the most striking peculiarities about the head of these fossils being the small incisors, the somewhat longer canines, the thinner and more compressed cranium, and the eversion of the lower and posterior angles of the lower jaw.

THE DISINTEGRATION OF ROCKS

was the subject of an address by Professor T. Henry Hunt. The change of the rocks in question is a chemical one, which is most obvious in the case of crystalline rocks; the felspar loses its alkalies and part of its silver, being changed into clay, and the hornblende its lime and magnesia, retaining its iron and peroxide. From this results a softening and decay to greater or less depths of the strata, so that, while the beds still retain their arrangement, and are seen to be traversed by veins of quartz and metallic ores, the strata are often so much changed, to depths of one hundred feet or more from the surface, as to be readily removed by the action of the water. This phenomenon is well seen in the crystalline rocks of the Blue Ridge, and not less remarkably in those of Brazil.

According to the speaker, it has been a subaerial process, which has been at work during past ages, when the composition of the atmosphere and the climatic conditions differed from those of today, and when carbonic acid, aided by warmth and moisture, abounded. He connected it with that slow purification of the atmosphere which from very early times has been going on. He thought it probable that the process of decay had gone on with decreasing energy to our own times, though it is now insignificant in its action, owing to changed atmospheric conditions.

THE POPULATION OF THE UNITED STATES

was discussed by Professor E. B. Elliott, in a curious paper in which he described calculations made by taking the differences between the figures as given by the various censuses, and making suitable interpolations for intervening years. Taking the average of these differences, we find that, had there been no war, the population in 1870 would have been 41,718,000 instead of 35,558,000, showing a loss of fully 6,000,000 people. In 1880, the population would be 54,017,000, but making the same allowance, he estimates now that it will be but 50,858,000. The population for the present year, 1874, is placed at 43,167,000. To statisticians, the table, given for every year from 1780 to 1880, is a very interesting

one, as is also a tabular statement giving expenditures of the government *per capita* of the population in periods of four years each. Except during war times, there has been great uniformity, rarely exceeding \$2 per head per annum. The highest was during Lincoln's first term, averaging \$16.76 gold, and the lowest during Jackson's first term, \$1.20 5. The present rate is estimated at \$1.69 gold, deducting war influence, or \$6.37 counting the same.

Professor W. A. Rogers described the Harvard College system of

SENDING TIME BY TELEGRAPH.

The method consists simply in inserting, into the circuit passing through the clock, an ordinary telegraphic sounder. At every second beat of the pendulum, the circuit is broken and a click of the magnet is heard. By a simple device the clock is made to omit every fifty-eighth second. When one, therefore, wishes to ascertain the error of his time piece, he has only to watch for the omitted beat, and the first click thereafter is the exact beginning of a minute as shown by the time clock at the observatory. At every even five minutes, there is an omission of about 25 seconds preceding.

The same speaker, in a paper on the

PROPER MOTION OF ϵ DRACONIS

in right ascension, stated that he found evidence of an irregular proper motion, the star appearing to complete its revolution in from 40 to 60 years. He also pointed out that no predictions of the plane of this star have been verified by subsequent observations.

Professor Hough described an interesting apparatus for

PRINTING THE DIRECTION OF THE WIND,

as well as the velocity, hourly.

The apparatus for velocity consists of a movement for giving motion to a set of type wheels, which is unlocked for each tenth of a mile of wind. Four brass type arms, on which are engraved the letters N. S. E. W., are placed on the prolongation of the shaft, carrying the type wheels for velocity; and these arms, by means of connecting rods, are attached to the armatures of four electro-magnets. Telegraph wires communicating with the vane shaft and magnets cause one or more of the letters to be elevated for printing whenever the battery current is completed.

By means of a half second pendulum clock, an impression for direction and velocity is made hourly on a slip of paper two inches wide and eight inches in length, as follows:

Time	Direction	Velocity	Time	Direction	Velocity
0	N. E.	342	1	N.	360
2	N. E.	372	3	N. E.	385

The first column is the time, the second the direction, and the third the velocity in miles.

So far as Professor Hough is informed, this is the first and only mechanism for printing the direction and velocity. The total distance traveled by the wind in a day, month, or year is read from the sheet without computation; consequently, the device is eminently labor-saving.

Professor Gill, on the relations of certain genera of *canids*, said that the division into two groups of wolves and red and gray foxes, does not express the true relation of the animals. He cited certain characteristics to prove that all should be united in one group.

Professor Le Conte read a paper on the

REPLACEMENT OF INJURIOUS INSECTS,

and mentioned the replacement of one caterpillar which had become a great nuisance in Philadelphia by another, equally as troublesome. No sooner had the sparrows exterminated the first than the second variety appeared. Its family is *orygia leucostigma*. The birds will not eat it. Having attained its full growth on the tree, it crawls quietly to a neighboring wall or fence, and, fixing its cocoon, undergoes transformation. The remedy against the annoyance is, therefore, very simple. Direct the servants, with stiff brushes, to sweep the cocoons from the walls and fences, and place around the trees to be protected rings of tin plate inclined at an angle. This will give the trees immunity, because the insects are not provided with wings for flight.

Professor C. H. Hitchcock discussed the

PHYSICAL HISTORY OF NEW HAMPSHIRE,

giving a sketch of its growth from the earliest times, when an archipelago existed there, up to the present. The first period was characterized by the formation of porphyritic granite, then came a series of gneisses composing the Mount Washington range of mountains. The Labrador period, the rocks of which are composed of granite and felspar, followed, and then the Huronian formation, of very great thickness, succeeded. The next period was the most extensive, the rocks consisting of mica schist; and the last period shows the area submerged by the ocean in the Helderberg period. It occupied the Connecticut valley to the depth of 1,000 feet.

In a paper on the pottery of the mound builders, Professor Cox drew the conclusion that the art of manufacturing concrete or artificial stone did not originate solely with the ancient Romans, but that it was alike understood by the earliest aborigines of America.

President Barnard delivered a brief address on the

METRIC SYSTEM,

in which he said that it will become the sole system in use by civilized nations before the year 1900. He added that the Metrological Society was urging the change in respect to uniformity—a change of only three tenths of one cent upon the dollar—upon our government. That Society will also urge a metrical international coinage; not for immediate use within our territory, but for convenience in commercial exchanges and to facilitate travelers in all parts of the world.

Whether such a coinage would eventually take the place of our usual currency might be safely left to the future.

Professor Elliot, in another paper on the United States government, said that its present borrowing power is 20 per cent superior to that of France, the rates paid by the former being 5 per cent, and those of the latter 6 per cent per annum. Professor Wm. H. Brewer, on the

DISTRIBUTION OF AMERICAN WOODLANDS,

said that the flora of the United States contained over 800 trees. Of these trees about 250 species are somewhere tolerably abundant, about 120 species grow to a tolerably large size, 20 attain a height of 100 feet, 12 a height sometimes of over 200, and a few—perhaps 5 or 6—a height of 300. New England contains 80 or 85 species, of which 50 may reach a height of 50 feet. The Middle States have about 100 to 105 species of trees, 65 to 67 of which sometimes reach 50 feet in height. Here were originally very heavy forests. There are still large areas heavily timbered, but the timber for all purposes is unquestionably rapidly diminishing, and there is no compensating influence going on for increase. In the southeastern region—that is, extending from Virginia and Florida—we have about 130 species. In each case these form the conspicuous elements of the landscape. Seventy-five attain a height of 50 feet or more, and about a dozen species a height of 100 feet. The northwestern region, from Ohio to Minnesota, and north of the Ohio River, is represented by about 105 to 110 species, 68 or 70 of which may reach a height of 50 feet. That is the district furnishing at present the largest production of sawn lumber within the United States. Michigan alone furnished in 1870, of the 12,750,000 of M. feet, 2,250,000; Wisconsin furnished over 1,000,000—the two States thus producing more than one fourth of the whole yield returned in that year. The southwestern region, extending from Kentucky to Texas and the Gulf, has about 112 to 118 species, 60 or 65 of which attain a height of 50 feet, which the author also analyzed. West of these last two districts, this treeless belt, extending entirely across the continent from the Gulf of Mexico to the Arctic Ocean, is 350 miles wide in its narrowest part, between latitude 36° and 37°, and 800 miles wide on our northern border. The Rocky Mountain region consists of from 28 to 30 species, but a vastly smaller number making up the timber region. With one single exception, all of the trees within the United States which attain a height of 200 feet are found in Washington Territory and Oregon. The forests are entirely of cone-bearing trees and the number of species is large, the number of timber trees being very large and their size and value also being great. In Washington Territory, official reports state that the land will produce from 25,000 to 300,000 feet per acre, and that there are vast tracts "that would cover the entire surface with cord wood 10 feet in height."

Mr. Porter C. Bliss read two papers, one on a classification of the Indian languages of Mexico, and the other relating to marks of ancient civilization in that country.

Referring to the

REVERSION OF THOROUGHbred ANIMALS,

Professor Brewer said that it is often claimed that, if the care of man be withdrawn, the improved breed will retrace the steps of its ancestry and revert to its original characteristics. For some years Professor Brewer has been investigating this subject by every possible means, and, finding no instances of the alleged "reversion" to be authenticated, he considers that the pernicious notion should be exposed and refuted.

Phosphor-Bronze Axle Bearings.

When two bodies are rubbed against each other (under equal pressure, and at equal velocity), the harder they are, the greater is the amount of heat generated; or on the other hand, the greater the difference of hardness between the two bodies rubbed against each other, the less is the heat produced. In the latter case the harder body is more heated than the softer, if of equal size. If, for instance, glass is rubbed against cork, the heating is as 7 to 1 (the copper being heated seven times hotter than the cork); if copper is rubbed against cork, as 4 to 1.

The ideal of a bearing which would wear little would be one made of the same material as the axle revolving in it, if there had not to be taken into consideration the wearing of the axle itself and the heating. A bearing made of the softest material, in which an axle of the hardest material revolves, would be the ideal of a bearing which does not heat, and does not cut the axle, if the wear of the bearing, and deformation by pressure, etc., had not to be taken into consideration.

In practice the best medium must be found which

1. Does not cut the axle.
2. Wears (in itself) as little as possible, and consequently requires a minimum of lubrication.
3. Does not heat, even in case lubrication should be neglected.
4. Is capable of resisting any possible shock without changing its form, or breaking.

Some railway companies desire to use few bearings, at the expense of many axles and much lubricant—(the consumption of lubricant is always in proportion to the wear of the axle on the bearing)—and therefore use bearings containing from 17 to 20 per cent of tin and 83 to 80 per cent of copper, which alloy, undoubtedly, is too hard, and must attack the axle, as has been shown on many railways. Other railway companies use alloys of lead with more or less antimony, which certainly do not attack the axles, but require much lubricant, and wear out very fast. A great number of railway companies in Germany take refuge in the so-called white metal, which, if of proper composition, appears cheap, but in the long run

certainly is the most expensive. The alloys of copper, antimony, and tin, or so called white metal, are bad makeshifts, as well as the so called lead composition bearings of lead and antimony; for it is impossible to give these alloys a hardness approaching that of the revolving axle without rendering them brittle. If an alloy is used sufficiently hard to avoid great wear, these bearings will heat much and are very brittle.

On most of the English, Belgian, German, French, and particularly on American railroads, white metal, and especially lead composition, bearings are little used, and this with good reason; for what would become, for instance, of a white metal bearing on an American railroad, where the bearings are subjected not only to heavy loads, but where they have to travel thousands of miles on rails belonging to other companies, and therefore are not much looked after.

Gun metal bearings, alloys of tin and copper, are not often homogeneous, with exception of the alloy of 17 to 18 per cent of copper, which is the most trustworthy alloy of tin and copper. In alloys containing a lower percentage of tin, the latter segregates in the form of tin spots, when the alloy cools slowly. All other compositions in use for bearings, such as 13 to 17 per cent of tin and 88 to 83 per cent of copper, do not make homogeneous bearings, unless they are cast in chill molds, which in practice is impossible. This heterogeneity of gun metal bearings is dangerous, as it produces gripping, and thereby a rapid wear. This specific quality of gun metal bearings (to grip) is theoretically easily explained: In cooling, the softer metal (composed of from 7 to 10 per cent of tin and 93 to 90 per cent of copper), being the less fusible, sets first, forming the skeleton of the bearing; later, the very hard and brittle alloy, containing 17 to 18 per cent of tin and 83 to 82 per cent of copper, sets and fills the pores of the softer skeleton. The particles of the harder alloy are easily torn away by the axle if the bearing is not sufficiently lubricated, and these tear the skeleton composed of the softer alloy; this I have frequently observed at rolling mills where the bearings were not sufficiently lubricated, and where particles in the form of small flakes peel off.

A good bearing which answers all purposes must not be homogeneous, but must consist of a strong and tough skeleton, the hardness of which nearly equals that of the axle, in order to resist shocks without deformation, and the pores of this skeleton must be filled with the soft metal or alloy.

The nearer the hardness of the skeleton approaches the hardness of the axle, the better the bearing will resist the pressure or shocks; and the softer the metal filling the pores, the better the bearing is in every respect. Such bearings are now made by melting two or more alloys of different hardness and fusibility together, in such proportions that necessarily a separation into two alloys of definite composition takes place in cooling.

Phosphor-bronze bearings consist of a uniform skeleton of very tough phosphor bronze, the hardness of which may be easily regulated to equal the hardness of the axle, while the pores are filled with a soft alloy of lead and tin.

Such a phosphor-bronze bearing may therefore be considered as having its wearing surface composed of a great number of small bearings of very soft metal encased in the tough and strong metal which equals the hardness of the axle; on the planed bearing surface this molecular disposition cannot be detected by the naked eye, but, if examined with a magnifying glass, the truth of the above will at once be seen. Another practical proof can be given by exposing such bearings to a dull red heat, when the soft alloy will sweat out, and the hard, spongy, skeleton-like mass remains.

In this consist the great advantages of phosphor-bronze bearings, which is proved wherever tested; for while the axle partly runs on a very soft metal and thus obviates heating, even if not sufficiently lubricated, the harder part of the bearing, its skeleton, does not allow of wear taking place; and as the hardness is arranged to equal the hardness of the axle, wear is reduced to its very minimum.—*Dr. Charles Kunzel*

Use of Iron instead of Lead Shot in the Rinsing of Bottles.

Lead shot, where so used, often leaves carbonate of lead on the internal surface, and this is apt to be dissolved in the wine or other liquids afterward introduced, with poisonous results; and particles of the shot are sometimes inadvertently left in the bottle. M. Fordos states that clippings of iron wire are a better means of rinsing. They are easily had, and the cleaning is rapid and complete. The iron is attacked by the oxygen of the air, but the ferruginous compound does not attach to the sides of the bottle, and is easily removed in washing. Besides, a little oxidized iron is not injurious to health. M. Fordos further found that the slight traces of iron left had no apparent effect on the color of red wines; it had on white wines but very little; and he thinks it might be better to use clippings of tin for the latter.

Fast Steaming.

One of the finest and fastest steamboats on the Hudson river is the Mary Powell. Recently she made the distance from New York to Piermont, 28 miles, in one hour, while the actual running time to Poughkeepsie, 74½ miles, was 3h. 19m., or at the average rate of 22½ miles per hour. Boiler pressure, 37 lbs. The Powell is fitted with the ordinary single vertical cylinder, walking beam engine.

PARASITES.—It is common to note that each species of animal has its own parasites, which can exist only upon creatures which have more or less kinship with their host. Thus the *ascaris mystax*, which torments the domestic cat, is found in all species of feline, while the fox, so closely resembling the wolf or the dog, is never troubled with the *tania senata*, common in the last mentioned animal.

THE VIBRATIONS OF SOLIDS OPTICALLY STUDIED.

Professor Ogden N. Rood, of Columbia College, communicates to the *American Journal of Science and Arts* a new method of ascertaining whether two tuning forks, for example, are in unison, or to determine the difference in the number of vibrations executed by them in a second. A short piece of fine steel wire is attached to each of the forks, and the latter are supported as shown in Fig. 1. The forks

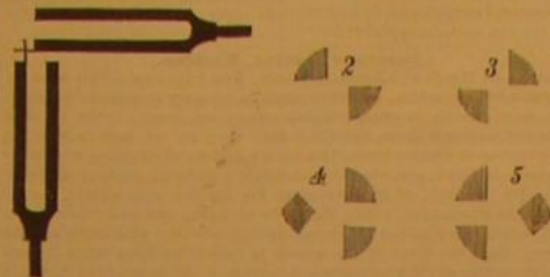


Fig. 1.

are now set in vibration, and the intersection of the wires viewed against a bright background with the aid of a small telescope. When the difference in phase is 0, an appearance like Fig. 2 is produced, which changes to Fig. 3 when the difference in phase has increased to one half a complete vibration. If the forks differ by an interval of an octave, an almost equally distinct figure will be produced, as is seen in Figs. 4 and 5, which represent the characteristic appearances in this case. Somewhat less distinct and more complicated figures are given by the quint, the duodecimo, and the double octave.

It is easy with this method to bring a vibrating string into unison with a given tuning fork, or to adjust it so that the interval shall be a quint, octave, twelfth, or double octave, above or below. It is also easy to ascertain the number of vibrations made by a string in a given case, by the aid of a bridge and a properly selected fork making a known number of vibrations, the string being shortened till it furnishes one of the above mentioned figures, and executes hence a known number of vibrations, after which the number of vibrations made by its whole length can readily be calculated by a well known law.

To bring two cords into unison, or to produce one of the above mentioned intervals, a cork cut at an angle of 45° is placed between the strings on the monochord, and, supported at this angle, is a small piece of looking glass of good quality. The reflected and vertical image of the farther string was then seen in the telescope crossed by the horizontal image of the nearer string; and the mirror being turned so as to reflect, at the same time, light from the sky, all the conditions were fulfilled.

Rods or bars, supported at one extremity or at two nodes, and provided with fine terminal wires, can by this method be brought into unison, or have one of the above mentioned intervals established between them. A preferable mode, however, is to study them in connection with the monochord and a tuning fork. The entire string of the monochord is first brought into unison with a tuning fork, or some definite interval established; the cord and rod or bar are then combined at right angles, and the bridge moved till unison is again effected, when it is possible to calculate the number of vibrations actually executed by the bar or plate. If the fine wire is attached to one side of a bell, the number of vibrations executed by the bell can readily be obtained with the monochord in the manner already indicated.

Vibrating membranes can readily be studied in this way by attaching to them a small piece of fine wire bent with two right angles, and using them in connection with the monochord or a tuning fork.

The more important of these figures may be easily rendered visible to a large audience. Wires about a millimeter thick are attached to two tuning forks placed in front of a magic lantern; an image is formed on the screen with the aid of a lens of about 0.815 inch focal length; the figures are then well shown, along with certain of their details not particularly mentioned in this article.

Great Expositions.

A correspondent of the New York *Tribune* writes from Vienna that the loss of the Austrian government, in its outlays on the recent Great Exposition of 1873, was nine millions of dollars. We have heretofore chronicled the recent suspension of the series of annual World's Expositions, which were inaugurated by the Exhibition Commission in London, and intended to continue until 1876. The losses were so heavy that the Commission was obliged to discontinue them. In view of facts like these, the American people may congratulate themselves that Congress, at its last session, refused to authorize the squandering of public money on the Centennial Exhibition at Philadelphia. The truth is that this Great Exposition business has "played out." It has ceased to be an attraction for the masses, and is chiefly useful for the advertising purposes of enterprising dealers.

C. H. C. suggests that telegraph companies plant trees on which to hang their wires. "In most sections of the country, the tree first planted would cost but little more than a pole, and after two or three years in growth would be a permanent pole which not rot at the bottom or need resetting, and would be seldom struck by lightning. Having many times seen from three to a dozen poles, in a row, shivered by a charge of electricity running along the wires, the above question arose in my mind."

Pittsburgh Manufacturers for 1873.

Some weeks since, the Pittsburgh *Dispatch* of this city published a list of sales of houses in Pittsburgh doing a business of over \$50,000 a year. The list was very imperfect; but as it is so difficult to get statistics in Pittsburgh we have compiled from this list, which was copied from the *Advertiser's* list, the items relating to our iron, steel, copper, and glass industries, believing that, imperfect as they are, they will be of value. We do not give the totals of each industry, as this would by no means give the volume of business. We would also say that none of the Allegheny manufacturers are included in this.

In the entire list there are but two houses outside of those connected with the industries given below that did a business of over \$1,000,000. As will be seen, three houses in the iron or steel business did above this sum, namely: Jones & Laughlins, J. Painter & Sons, and Hussey, Wells & Co.

IRON.

Graff, Bennett & Co.	\$914,700	Lloyd & Black	\$549,400
J. Painter & Sons	1,439,400	Zag & Co.	294,400
Chess, Smyth & Co.	625,400	Shoenberger & Co.	740,000
Jones & Laughlins	2,720,000	Wm. Clark & Co.	431,400
Brown & Co.	795,500	McKnight, Duncan & Co.	277,200
Everson, Graff & Macrum	425,000	Dilworth, Porter & Co.	393,000

* Including steel.

STEEL.

Singer, Nimick & Co.	\$879,600	Park, Bro. & Co.	\$498,500
Anderson & Woods	917,500	Pittsburgh Steel Casting Co.	97,500
Hussey, Wells & Co.	1,150,000	Miller, Barr & Parkin	559,000

GLASS.

Bryce, Walker & Co.	\$166,000	Thos. Wightman & Co.	\$300,000
Campbell, Jones & Co.	72,500	Dithridge & Co.	152,400
McKee Bros.	239,500	Glass, Neely & Co.	431,400
S. McKee & Co.	188,000	Crystal Glass Co.	25,000
R. C. Schmetz & Co.	112,300	Atterbury & Co.	168,800
Duff & Campbell	104,500	Adams & Co.	121,400
Excelsior Flint Glass Co.	125,500	Bakewell, Pears & Co.	150,000
Excelsior Flint Glass Co.	103,100	Challenger, Hoxian & Co.	148,100
Knox, Kim & Co.	67,200	Geo. Duncan & Sons	98,500
Jas. B. Lyon & Co.	119,400	King, Son & Co.	166,300
Wm. McCully & Co.	486,100	Dorington Bros.	81,000
Wolfe, Howard & Co.	100,000		

MISCELLANEOUS.

Brenneman & Wallace, boilers	\$12,300		
A. Hartup & Co., engines, etc.	326,000		
Wm. Miller, forges	140,300		
W. G. Price, Sr., foundry	68,000		
S. Snyder & Co., boilers	108,300		
W. P. Townsend & Co., rivets	185,000		
A. Bradley & Co., stores	14,200		
De Haven & Sons, stores	76,500		
Evans, Dalzell & Co., pipes	674,000		
W. Graff & Co., pipes	175,400		
Cacabus & Nimick Manufacturing Co., novelty goods	175,100		
Park & Co., copper	193,200		
Graff, Huges & Co., stores	120,000		
C. G. Hussey & Co., copper	575,000		
Mitchell, Stevenson & Co., stores	175,000		
Marshall Bros., machinery	56,000		
Rissell & Co., stores	113,000		
Park & Co., founders	279,400		
John B. Herron & Co., stores	29,400		
L. Peterson, Jr. & Co., founders	86,500		
Alex. Spicer & Sons, plows	150,500		
Jos. Marshall & Co., founders	140,000		
Dickson, Marshall & Co., founders	78,400		
A. French & Co., springs	366,000		
McCoway, Torley & Co., malleable iron	68,000		
Totten & Co., founders	321,100		
Schaal, Hoeveler & Co., boilers	98,200		
Kiehl, Logan & Co., tools	60,300		
Lewis & Rossiter, founders	90,000		

—American Manufacturer and Iron World, Pittsburgh.

IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the *SCIENTIFIC AMERICAN*.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The *SCIENTIFIC AMERICAN* has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN GARDEN, a Monthly Illustrated Journal devoted to Garden Art. Edited by James Hogg. Terms \$2 a year. Brooklyn, N. Y.: Beach, Son, & Co., 76 Fulton street.

This excellent journal is now in its third year, and the issue for September, 1874, commences a new series. It has been placed under the editorship of Mr. James Hogg, whose renown as a gardener and as a writer on his art, in its many and varied aspects, is widely extended. We predict an extended circulation for this periodical, under the new management.

TITUSVILLE, OIL CITY, AND FRANKLIN DIRECTORY FOR 1874. Compiled by J. H. Lant, Titusville, Pa.

Recent American and Foreign Patents.

Improved Construction of the After Hulls of Yachts, etc. Empeon E. Middleton, Southampton, England.—This invention has for its object to increase the capacity of vessels for carrying cargo or ballast, to enable them to carry more canvas to improve their sailing qualities, and to make them safer in rough weather and in heavy gales of wind. The invention consists in the arrangement of the stern post of yachts and other vessels with its lower end inclined to the rearward at an angle of 45°, more or less, in connection with a corresponding rearward extension of the keel.

Improved Saw Gummer.

Jason W. Mixer, Templeton, Mass.—As gumming machines have been heretofore constructed, the carriage ways are cast on the machine, so that the carriage and cutter cannot be adjusted to alter the direction of the cut; and the cutter being placed upon the end of the shaft, but one journal bearing and but one crank can be used. In the present device, by attaching the carriage and cutter shaft and feed screw to an adjustable "way" frame, the operator is enabled to vary the direction of the cutter so as to cut more toward the center of the saw, if desired. The cutter shaft is supported by an outer bearing on a curved arm. Two cranks may be used instead of one for operating the machine, which may be applied to either straight or circular saws, and without taking the latter from their arbors. The cutter is made detachable, so that it may be changed to adapt it to the diameter or size of the saw.

Improvement in Securing Knob Roses to Doors.

James Keady, New York city.—This invention consists in supporting the rose plate by a wooden bush arranged within the lock case. The bush is provided with holes, so that a screw from each rose plate may be inserted, or one from each side.

Improved Guide for Setting Lumber.

Peter Berry, Millersburg, Ohio.—The manner of using the device is as follows: A slab is first cut off from the log in the usual way, the head turning up into a horizontal position as the log advances. The head is then adjusted toward the log beyond the plane of the saw to the extent of the thickness of the board or other form of lumber to be cut from the log. Thereafter, each time a cut is made, the log is adjusted on the head blocks III its straight side comes in contact with the head, which thus acts as a guide. When the log is being fed to the saw, it moves in frictional contact with the head. The thickness of cut can be quickly and accurately adjusted by adjusting the shaft in the bearings.

Improved Egg and Fruit Carrier.

Wendelin Wells, St. Paul, Minn.—Vertical metal bands are fastened to the under side of the bottom, and pass through perforations of the same along stiffening straps to suitable height, being turned into a right angle at the top to form a lug, for binding over the top or cover. The longitudinal side pieces are provided with strengthening pieces, to which vertical bands with top and bottom hooks are fastened. The top hooks of the bands at one side of the carrier are twisted to extend over the cover in longitudinal direction. The cover is firmly bound to the hook ends at the other side by a pivoted wedge piece, carried under the same, securing thereby the rigid connection of all the detachable pieces when the carrier is filled with eggs. A band spring of the cover acts on a recess of the wedge piece, as soon as the same is placed under the hook ends, so that the wedge piece is secured in locked position.

Improved Fastener for Shade Roller Cords.

Mahault De Penhoel, Fort Snelling, Minn.—Two brackets are attached to a window casing to hold a rod, which is secured to one bracket and passes loosely through the other. Upon the rod is placed a short drum, which is secured by a set screw, which also passes through and serves as a pivot for a pulley, around which the cord passes. By this construction, by slightly loosening the thumb screw, the drum may be moved down upon the rod to tighten the cord, may be moved up to loosen it, or may be turned upon said rod to adjust the pulley to the direction in which the cord is desired to work.

Improved Hat Ironing Machine.

Robert E. Brand, Plainfield, N. J.—This invention consists of a hat-block supporting disk, which is rotated in horizontal or vertical position by being thrown into gear with a driving shaft. A quadrantal guide mechanism and spring clamp carry the disk into vertical position. The top of the hat and brim are finished by the iron in the former position, the side of the hat being finished in the latter. The hat and hat block are then transferred and adjusted to a second rotating disk, with central aperture, cushion, and spring clamps, for finishing the under side of the brim. The finishing run is made adjustable in any direction, and at different heights on the top of the supporting frame, and readily used on either side, it being detachable with its supporting frame for the exchange of the heating iron.

Improved Tool Post for Lathes.

Thomas Bonner, Chilcope, and Edward Bonner, Worcester, Mass.—The post is fitted to work up and down without lateral play in a socketed stand, and has a vertical rack in one side, in which an endless worm works, said worm being arranged in bearings attached to the socketed stand, so as to be firmly secured against endwise motion, and so that the worm works through a slot in the stand into the rack.

Improved Fire Place Grate.

John Bawden, Freehold, N. J., assignor to himself and G. Combs, of same place.—By a relative construction in three parts, this grate may be packed and transported in a small compass, while it may be put together and set up in the fire place with little trouble or expense.

Improved Breech-Loading Fire Arm.

Albert Karatz, Brooklyn, N. Y.—The barrel screws to a receiver at the place for receiving the shell. On the receiver is a casing tube, to which the handle may connect. This tube is capable of sliding on the receiver, and is connected by screws with a crosshead, which is employed to force the needle back to set it for firing the spring. The said crosshead works forward and backward in a mortise, in a tube within a receiver, pushing the needle back by its collar, and then, after setting the needle, going forward out of the way of the collar. The receiver has a collar, and on the opposite side a lug, which forms a bearing for a sleeve to rest on at its front end, the said sleeve being to lock the inside tube and outside tube in the forward position next to the barrel. At the rear end, said sleeve rests on a sectional collar, forward of lugs on the receiver, and the flange on the front end of the outside tube, which match so as to form a continuous collar when the parts are put together. The sleeve has a flange at the middle of the inside, which is notched so as to pass the lugs of the receiver and lock together with them by turning behind them after so passing beyond them. When the needle is to be set, the sleeve is turned so as to allow screws to pull out of notches, but not so as to allow the sleeve to unlock with the lugs; but when the cartridge chamber is to be opened, the sleeve is turned so as to escape from the lugs and be pulled back with the tube. A spring catch is arranged to arrest the sleeve in the different positions to which it is turned for thus releasing the tube, and also for holding it in the locking position.

Improved Corn Planter.

George H. Hume, Paola, Kan.—A wave wheel on the main shaft actuates sliding piece, which is thereby carried alternately from right to left, causing the dropping of the seed from the seed boxes in the usual manner. A lever is controlled by the attendant, so that, when the same is thrown forward, a roller is carried back, lowering runners and marking the furrows for the seed. Another roller, brought forward, raises the runners above the ground, for turning the planter from one row into the next, and for going to or from the place of work. To each end of the shaft are firmly applied rotating arms, which strike with their inclined end lugs the pivoted marker rods at both ends of a cross piece. Each lug strikes a rod simultaneously with the dropping of the seed from the adjoining seed box. The rods are carried back into horizontal position after being pressed down by band springs. The end of each marker rod is provided with a check, which leaves an impression on the surface of the ground after each stroke. By suitable devices for throwing the mechanism into or out of gear, the seed-dropping and row-making operation is interrupted and resumed at the will of the attendant.

Improved Gun Lock.

James Madison Grisham, Towash, Tex.—One end of the main spring is inserted in a hole in the rear end of the lock plate, and has a point formed upon it, which projects to serve as a dowel pin for receiving the rear end of the said lock plate in place.

Improved Compound for Dental Impressions.

Benjamin H. Teague, Alken, and Horace Parker, Edgefield, S. C.—This invention is a compound for taking dental impressions, consisting of plaster of Paris, gold mine sand, sulphate of potash, and carmine, or other coloring matter, mixed in proper proportions. It hardens quickly, and may be removed sooner than plaster from the mouth of the patient, allowing also, on account of its friability, the breaking away of parts of the impression and their accurate replacing, so that a perfect cast of the mouth is obtained.

Improved Hinge.

Moses L. Potier, Green Bay, Wis.—This invention consists in a peculiar construction for securing the cap piece of the pin, so that it must be turned on the latter before it can be removed. The inclined lower edge of the connecting plate of the sleeve on the gate passes along the curved edge of a lower socket part on opening the gate, and slides back thereon by the weight of the same till it arrives at the lowermost point. The gate thereby self-closing, whether thrown open in either direction, as the symmetrically inclined socket edge carries the same back toward the center point and retains it therein.

Improved Temporary Binder.

James Bennett, St. John's, Canada.—This invention consists in a file which opens and closes upon the principle of the parallel ruler. Pins are attached to the bed piece, so as to stand firm and rigid. Recesses are made in the bed to admit disks under a metallic strip, and disks are placed on top of the strip. Screw threads are cut on the pins, and the disks serve as screw nuts, into the center of which the pins are screwed, one disk nut being below and one above the strip for each pin. The screw threads are cut the whole length of the pins, and the roughened surface thus produced prevents the papers from too easily slipping up when the clamp is raised. Mortises through the clamp receive the pins when the clamp is pressed down in filing. When the clamp is raised for filing, bars serve as guides for the edge of the paper, so that the back edges of the papers filed present an even and uniform appearance.

Improved Adding Machine.

Charles C. Moore and Jacob B. Moore, New York city.—This is an improved adding machine, so constructed as to carry accurately whatever number of wheels are used, bringing each wheel exactly to the required point and leaving it there, and which shall have no lost motion from the imperfection of gearing teeth. In a plate a number of counting wheels are arranged, in which, near the circumference, is formed a circle of ten holes, to receive the point of an instrument for turning said wheels. In the face of the wheels, just within the circle of holes, and concentric therewith, is formed a circle of numbers, consisting of the nine digits and the cipher. Upon the faces of the wheels is formed a second circle of numbers, consisting of the nine digits and the cipher, and so arranged that each number of the inner circle may be the complement of the number of the outer circle. The wheels are so covered that only one number of each circle will be seen at a time, and these will always be the complements of each other, so that the number seen through one hole will always indicate through the space of how many holes the wheels will have to be turned to bring the wheels to the 0 point. In using the machine, the instrument is inserted in the hole of the wheel opposite the digit of the scale that represents the number to be added, and is moved around to the right until it strikes a stop. The units, tens, hundreds, etc., are added by turning the proper wheels. In turning either of the wheels, as each ten of the column of figures being added is reached, the next wheel is turned one space, the carrying being thus done automatically. The wheels are kept from being jarred out of place, or accidentally turned forward or back, by springs. Upon the under side of the main plate are attached ratchet wheels, to a tooth of each of which is pivoted a push rod, of such a length and in such a position that, when the figure of the scale shows through the notch, the forward end of the said push rod may rest against a tooth of the next ratchet wheel, ready to move it one tooth when the first ratchet wheel is again moved. By this construction, as soon as a push rod has pushed the next ratchet wheel through the space of one tooth, it drops away from said wheel, and, as its own ratchet wheel continues to move forward, its movements are so guided as to keep it away from the teeth of the next ratchet wheel until it is time for it again to operate said next wheel, when it moves forward, moves the said wheel one tooth, and again drops away.

Improved Explosive Compound.

Charles A. Browne and Isaac S. Browne, North Adams, Mass.—This invention relates to a new priming compound, which is exploded by a current of electricity or the electric spark, when properly secured in an interruption of the electric current. It consists of the mixture of fulminate of mercury with pulverized antimony in various proportions, with an addition of antimonious sulphide or other ingredients, if desired, for producing a greater or less degree of electric conductivity of the priming.

Improvement in Indexing.

Walter Knight, San Andreas, Cal.—The object of this invention is to furnish for bookkeepers, accountants, and others, a neat case for keeping the index of books therein, it being so arranged on the desk that it indicates, without loss of time, the page of the party in the book, and expedites work thereby. The device consists of a case with open top and front part, which carries in side grooves suitable frames with the index tables of the names said therein, said frames being raised by means of levers and keys, exposing thereby the index table required.

Improved Water Elevator for Wells.

William Mason, Providence, R. I.—In the inner part of the well spout is pivoted the outer end of a bent arm, the inner end of which projects sufficiently to catch upon the edge of the bucket as it rises above the spout and till it discharges the water automatically into said spout. Upon the lower side of the inner end of the arm is pivoted a small friction wheel which, should the bucket rise so that the arm catches upon the edge, near one end of the ball, may roll along said edge to a position midway between the ends of the said ball, so as to discharge the water properly into the spout.

Improved Ordnance and Methods of Constructing the Same.

Percival M. Parsons, Blackheath, Eng.—These improvements in ordnance relate, first, to the mode of manufacturing the inner tube of the gun, whereby the fibers of the metal are arranged spirally, and the capacity of resistance to strains greatly increased. The ingot of steel is first cast as usual. It is then drawn down, by hammering or otherwise, until it approaches the finished size. The ingot is then brought to a suitable heat in a furnace, and is twisted a sufficient number of times, which is accomplished by fixing one end in a box attached to an axle, which is made to revolve in suitable bearings, while the other end is gripped and held stationary in fixed jaws, or turned in the opposite direction. It is then rehammered, and, if necessary, the operations may be repeated. The improvement also relates to the method of constructing steel lining tubes for guns, intended for insertion into smooth bore cast iron guns for the purpose of converting them into rifled guns, or into a cast iron casting for the purpose of making new guns. A number of separate hoops of convenient width, formed by hammering or rolling or by both operations, are combined in such a manner that the diameter of the ring is increased during the operation, and the metal is thereby extended or drawn out circumferentially, and the fibers and any lines of weakness developed by flaws in the original casting are placed in a circumferential direction. The inner tube having been turned to the requisite size, a sufficient number of these rings bored to the requisite size are forced on its breach end side by side, to form the reinforcement tubes. These are then turned, leaving bands at their edges of slightly larger diameter than the intermediate portion between them. Another series of rings of the requisite size, in relation to the first series, are bored out, with an annular recess in each corresponding to a pair of bands of two adjacent rings of the first series; this second series of rings are then expanded by heat, and placed over the first series in such a position that they will break joint with them, and so that the bands or fillets formed on the edges of the first series will fit into the annular recesses formed in the second series, by which means the rings will be connected longitudinally, and form in effect a continuous tube, and may be treated as such to impart longitudinal strength to the inner tube. The improvements relate likewise to the form of the breach end of the lining tube and the interior of the cast iron casing into which it is fitted, and the general combination of the parts in guns of this description. In guns hitherto constructed on this system, the breach end of the lining tube, where the reinforcement occurs, and the recess made in the breach end of the casing to receive it, have been made conical, which form requires special machinery to bore out the casing, and offers difficulties to the proper fitting of the tube. The breach end of the tube is made cylindrical, and reduced in diameter in steps toward the muzzle, as required, and the interior of the casing is made in a corresponding form. The tube is inserted into the cast iron casing at the breach end, and is secured by a breech screw, in combination with which a nut is screwed to the end of the inner tube let into a recess bored out of the muzzle end of the cast iron casing.

Improved Bolt for Middlings Purifiers.

Joseph W. Wilson, Warsaw, Ill.—By this invention, middlings purifiers that use a flat screen are provided with a bolt, so constructed as to keep the screen cloth clean, and the middlings thoroughly agitated, increasing the capacity of the bolt or screen, and enabling a much finer screen cloth to be used.

Improved Car Coupling.

Gabriel Thomas, Reno, Nev.—A small plate is attached near the lower end to the back of the coupling pin. A spiral spring is placed in a recess behind the pin, which bears downward on the plate with a constant pressure, and reacts against a shoulder to throw the pin downward. A vertical bracket spring is attached to the under side of the drawhead, extending up through the link opening, with its end under the plate, so that it will naturally support the pin when the latter is raised. When the cars come in contact with each other, the end of the link strikes this spring, and pushes it from the plate, and the pin is forced down through the link. For uncoupling the cars, the pin is raised by means of a bell crank which connects with a rod which extends laterally to the side of the car. This rod has a series of ratchet teeth which catch on a plate through which the rod passes by which means the pin may be held up without the supporting spring. A similarly arranged rod extends to the top of the car.

Improvement in Refining Sugar.

A. H. William Schrader, Hoboken, N. J.—This invention consists in subjecting raw sugar when suitably moistened to the action of a very high degree of pressure acting from above on its surface, so that the compressed air percolates between the granules of the sugar and effects the bleaching and purging of the sugar previous to its dissolution. The invention consists, further, in the dissolution of the sugar in the same tank under the admission of steam and water for the purpose of repeating and completing the purification, or drawing it off for passing through the filtering and discoloring operations to be returned and purged completely, and finally dried.

Improved Steam Radiator.

James McCarthy, New York city.—The base of the radiator is made hollow, and on its upper side are formed openings, which form sockets to receive the ends of the tubes. The head of the radiator is also hollow, and receives the upper ends of the tubes. Rods pass through the tubes, enter the cavity of the head, and have eyes to receive other rods, which are passed through them. By this arrangement the rods and their supporting rods will not impede the passage of steam through the tubes. The washers in the tube sockets are hollow rings open upon their inner side, and are spun up out of ring plates of sheet metal. The washers thus constructed will yield sufficiently to pack the ends of the tubes steam-tight. With this construction the steam will circulate quickly and uniformly through all parts of the radiator, so that the radiator will heat up evenly in all its parts.

Improved Seal Lock.

John S. Lorimer, Detroit, Mich.—An inner removable plate is fastened to the back plate by a screw. A sliding bolt is thrown forward, to engage with the notch of the hasp, by a spring. A small knob on the bolt projects into an orifice of the inner plate. The seal plate is made preferably of glass, upon the back side of which is the railroad label. This slides in through a slit in the edge of the lock, and covers the inner plate, and consequently the knob of the bolt. The hasp is not hinged, but slides in and out, a shoulder on a long leg preventing its being entirely separated from the lock. When the hasp is down, the long leg entirely closes the slit, and effectually confines the plate, so that the seal plate must be broken before the lock can be unlocked.

Improved Machine for Cutting Clothes Pins.

Henry Mellich, Walpole, N. H., assignor to Wyman Flint and George H. Mellich, Bellows Falls, Vt.—The object of this invention is to rapidly cut bifurcated clothes pins of any kind, but more especially the kind described in letters patent granted to same inventor, dated September 23, 1873, No. 143,324, by the combination of a stationary channel or groove, in which to alternately move and hold the timber, by means of feed wheels and a holding plate, while the pins are being cut. When the feed ceases and the piece of wood is stationary, and the cutters ready to work, this plate is dipped by a cam, which strikes a rib and raises a plate, so that its other end presses on the wood in the groove and holds it down, to prevent splitting while it is being cut. This cam is so formed and arranged that the pressure is continued while the cutters are at work, and discontinued when they are withdrawn. For making the openings, the cutters penetrate half way through the piece as the lathe is passed through this machine. The next machine cuts the other side in the same manner, and then the piece of wood is split, which separates and completes the pins. Another cutter cuts into the piece to give the length of the pin. The cuts in the two sides of the piece are not opposite each other, so that the piece holds together until it is split to separate the pins.

Improved Lamp Cooking Apparatus.

John A. Miller, New Orleans, La.—A common petroleum lamp has its chimney provided with a closely fitting shell of sheet metal, which extends from the neck to the upper rim, and prevents its unequal expansion. The shell also serves to a certain extent to retain the heat in its passage through the chimney. The cooking vessels proper consist of a boiler and several additional vessels, which are fitted into each other and into the boiler, each forming a separate cooking chamber. The boiler is arranged at the bottom with worm-shaped channels, which take up the flame from the chimney and conduct it around the bottom and sides. A convex perforated bottom, loose or false, is placed on the boiler bottom to prevent the articles cooking therein from burning. The vessels are connected by steam tubes, which are arranged at opposite sides to compel the steam to spread under the bottom in passing to the next vessel.

Improved Adjustable Ferrule for Agricultural Implements.

William H. Bowman, London, Ohio.—The ferrule is made of two halves, which fit symmetrically over the handle end. When the handle shrinks, the ferrule is tightened by driving up a band. The band takes hold of the outer side of a tongue simultaneously with the ferrule halves, as it forms, on account of an inclined groove and its inner wedge shape, part of the circumference of the ferrule. The lug locks the tongue securely to the ferrule.

Improved Water Wheel.

Marquis D. Grow, Dubuque, Iowa.—The buckets are made straight and radial, and are formed upon or attached to the body of the wheel. The discharges extend rearward from the lower ends of the buckets, and are curved downward, so as to be convex upon their upper side, as shown. They are surrounded by a band, attached to their outer edges, and the upper edge of which rests against a shoulder formed by the thickening of the case for the chutes, so that the water from said chutes may be discharged directly against the buckets. To the top of the gate is bolted a ring, which fits around the edge of a cap plate in which the shaft revolves. To the cap are pivoted at their angles two elbow levers, the arms of which have short slots formed in them to receive pins attached to the ring. To the other arms of the levers, near their outer ends, are pivoted the ends of a connecting bar, so that the levers may operate together upon the opposite parts of the ring to move the gate. Upon the lower part of the outer side of the gate is formed a flange, upon which rests the outer gate, which has a flange, formed upon the lower part of its outer side, in one part of which are formed teeth, into which is geared a governor, so that the gate may be adjusted automatically to regulate the ingress of the water by the motion of the wheel.

Improved Pocketbook.

Gabriel Jasmagy, Brooklyn, N. Y.—The object of this invention is to improve the pocketbook patented by same inventor under date of April 28, 1871. It consists of a pocketbook, the partitions of which are connected, without stitching, by a lining made of a blank which extends continuously over the same, and is cut with sector-shaped side flaps for forming the side connection of the partitions, and also with the side flaps of the pocketbook. The invention consists, further, in the arrangement of a billbook formed as extension of the partition covering, and folding out of sight into a section of the same.

Improved Beam End Protector.

Norman McLellan, New York city.—The invention relates to a sheet tin casing for the ends of wooden beams as a protection against the influence of dampness or destruction by fire. The casing covers the beam end and so much of the contiguous portion as enters the mortise in the brick or stone wall, and it may also be made of sufficient length to project a short distance from the side of the wall.

Business and Personal.

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We make to Order Iron and Steel Drop Forgings of every description. R. A. Belden & Co., Danbury, Conn.

A machine that actually pays its cost in 30 days! Made by Humphrey Machine Co., Keene, N. H.

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Users of Baling Presses, address V. Pugsly, N.Y.

Millstone Dressing Diamond Machines—Simple, effective, economical and durable, giving universal satisfaction. J. Dickinson, 64 Nassau St., N.Y.

Engines 2 to S.H.P. N. Twiss, New Haven, Ct.

English Patent for Sale or to Let on Royalty. Article made by Machinery very fast. Used in every family in the land. Entirely new and novel. Extensively manufactured and sold in the U. S. Sample sent by mail, and full particulars given on application to the inventor and sole owner of Patent, Charles G. Cole, Bennington, Vermont.

Wanted—A Partner with \$8,000 to \$12,000, in manufacturing a Patented article. Address G. Schumann, Fabrikat St., Jersey City Heights, N. J.

A thorough Machinist and Draughtsman, an experienced Foreman, desires employment. Address Edward Clinton, Philadelphia, Pa.

For Sale—Good Machine Shop and Foundry Business, with Lease. Tools new and first class. Location and buildings very desirable. Terms easy. Address Toledo Machine Co., Toledo, Ohio.

Experience and Capital want employment in Foundry and Machine Business. Address Drawer 57, Catskill, N. Y.

For Sale—Two Steam Saw Mills and three Farms, by C. Bridgman, St. Cloud, Minn.

Wanted—Agents west and south. Asbestos Felt Co., 216 Front St., New York.

Lyman's Gear Chart, Price 50 cts. Address E. Lyman, C. E., New Haven, Conn.

"Boiler Sealing"—To C. C. Send your address to Barker & Co., Manufacturing Chemists, 211 Broad St., Richmond, Va.

Deane's Patent Steam Pump—for all purposes—Strictly first class and reliable. Send for circular. W. L. Chase & Co., 95 & 97 Liberty St., New York.

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Wanted—The Manufacture of "Specialties" made mostly of Wood. Sayer & Co., Meadville, Pa.

The Pickering Governor, Portland, Conn.

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Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

Gas and Water Pipe, Wrought Iron. Send for price list to Bailey, Farrell & Co., Pittsburgh, Pa.

Forges—(Fan Blast), Portable and Stationary. Keystone Portable Forge Co., Philadelphia, 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 \$5. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

All Fruit-can Tools, Erracuto, Bridgeton, N.J.

Brown's Coalquarry Quarry & Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

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

Lathes, Planers, Drills, Milling and Index machines. Geo. S. Lincoln & Co., Hartford, Conn.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Engines, Boilers, Pumps, Portable Engines. Machinists Tools. I. R. Shearman, 45 Cortlandt St., N.Y.

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

Price only three dollars—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., 263 Broadway, New York.

Rue's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 95 & 97 Liberty Street, New York.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

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

The French Files of Linet & Co. are pronounced superior to all other brands by all who use them. Decided excellence and moderate cost have made these goods popular. Homer Foot & Co., Sole Agents for America, 20 Platt Street, New York.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement. Andrew's Patent, inside page.

Automatic Wire Rope R. R. conveys Coal Ore, &c., without Trestle Work. No. 34 Day street, N.Y.

A. F. Havens Lights Towns, Factories, Hotels, and Dwellings with Gas. 34 Day street, New York.

Temples & Oilcans, Draper, Hopedale, Mass.

Best Philadelphia Oak Belting and Monitor Stitches. G. W. Army, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for new circular.

Buy Boulton's Paneling, Moulding, and Dovetailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 277.



P. D. R. and several other correspondents will find full descriptions of lighting rods on the editorial pages of this issue.—H. D. E. will find directions for making an acolian harp on p. 330, vol. 28.—S. H. C. will find explicit directions for brazing iron castings on p. 107, vol. 30.—G. M. E. will find directions for making asphalt pavement on p. 335, vol. 24.

G. W. B. asks: How can I polish meerschaum? A. Soak first in molten tallow, then in molten white wax, and then rub with a dry rag.

W. C. D. asks: Is there any difficulty in using a coiled pipe, of 1 1/2 or 2 inches diameter, as a water heater in a furnace? The fire pot is 30 inches in diameter, and I want to use from 10 to 15 turns or coils of pipe placed within the fire pot, the pipe passing out and connecting with a hot water radiator in an air chamber outside, the water passing back from radiator and entering bottom of coil, so as to keep up a continuous circulation. I am told that steam will form at points in the coil and choke the pipe, preventing a free and steady circulation. Is this so? What size of pipe ought I to use, and what is the best form of hot water radiator? Is there anything better than a simple manifold of plain pipe? A. A much larger pipe will be necessary to enable you to secure circulation with the arrangement that you propose. The manifold will answer very well for the hot water radiator.

B. B. B. asks: In a three mile boat race, would it take any longer to turn a stake boat at the end of the first mile and a half and return, than it would to row the three miles straight ahead? A. Yes.

J. G. asks: In what part of the world was the Garden of Eden? A. No one knows.

If the earth goes round on its axis, why do we not get to the part where there is no frost or snow, or to the part where there is no summer? A. If you will consult any elementary work on astronomy, you will readily perceive the reason.

Is there anything produced that will keep coal dust cemented together so that it will stand burning to ashes before it will part? A. There are numerous patents for this purpose, many of which have been described in the SCIENTIFIC AMERICAN.

J. H. K. asks: I am engaged in an experiment that requires the use of a series of small bellows. It will be necessary they should be absolutely airtight, and, as they will be exposed (probably) to water, it is equally important they should be waterproof. Will you tell me what material to use, and how to construct them to gain these ends? Will gum cloth answer? If so, how shall I fasten it to the heads, and should those heads be of wood or leather? A. We think you can obtain rubber bottles or syringes that will be cheaper and more satisfactory than the arrangement that you propose.

W. S. P. asks: If a piston were let fall 25 feet in such a manner that it would enter an airtight cylinder, would the sudden compression heat the air within the cylinder? If so, would the expansion of that heated air be great enough to throw the piston as high as the point it fell from? A. There would be some power consumed in overcoming friction, and some of the heat of compression would be dissipated, so that the useful effect would not be as great as the power exerted.

What would be the pressure of air per square inch on the inside of a hollow casting one foot square, it being heated to a red heat after being filled with cold air at atmospheric pressure? A. Professor Thurston has published a table of the temperatures and pressures of air. You can obtain it from D. Van Nostrand. Your other questions is of a business character.

W. S. F. asks: When is the transit of Venus to take place? When was the last? When will be the next, or how often do such phenomena occur? A. Transits of Venus always take place in June or December. There are two transits, eight years apart, and then more than a century elapses, after which there are two more transits, eight years apart. A transit was predicted by Kepler, in 1631, but was not observed. The transit of 1639 was observed by Horrox and Crabtree, in England. The last two transits occurred on June 6, 1761, and June 4, 1769, the latter being observed from various stations, widely separated. The next transit will take place on December 9, 1874, and preparations have been made for very complete observations. The last transit during the present century will occur on December 6, 1882.

J. T. B. says: I have moved into a large frame house, which rests upon pillars four feet high, with lattice work between them, so that there is a free circulation of air; the house is lathed and plastered throughout; yet, in a few days, articles of clothing, shoes, etc., will mold if put in the closets. Please tell me the cause, and if there is a remedy for it. A. A succession of rains and damp weather will sometimes produce moldiness in closets, but in your case it is caused most probably by the fresh plastering of the house. Plaster absorbs moisture from the atmosphere for some time after it is put on, and under certain conditions of temperature will give it off in large drops and streams. It is for this reason that new walls cannot be safely painted. We remember a case in point, where the newly plastered walls of the classroom in a school building were painted and their surfaces prepared artificially to serve as slate, to be used for writing upon in place of the ordinary blackboards. They were finished very handsomely, and the imitation was perfect; but in one week's time the paint began to run in such streams as to trickle down across the white base, and lie in black puddles on the floor. Your remedy is to keep your closets open, and let the wind blow through the house in the middle of the day.

H. A. W. says: You have been calling attention to the importance of educating the left side of the body and brain. Is it not a fact that more persons are paralyzed on the right side than the left, and may it not be accounted for by the fact that the right side is overtaxed by giving it too large a proportion of the work to be done? A. You evidently have forgotten that the left side of the brain is the index of the right side of the body. If you maintain that the left side of the brain and left side of the body are both paralyzed, it would show that the whole system was under that influence, the nervous force on the right side and the muscular system on the left side being the sufferers.

D. C. P. asks: Which will use the most coal, two high pressure engines, compounded, 12x8 inches, each cut off at half stroke, with 70 lbs. steam, with 150 revolutions per minute geared to a main shaft, its piston being 24 inches in diameter, and the engine's piston 12 inches; or a low pressure condensing engine, of dimensions equal to the task, with a good generator? A. The second would be the most economical, with the same grade of expansion as the first.

Where could I learn the millwright's trade? A. There are numerous good shops scattered over the country. It would be well for you to enter one of them as an apprentice, or in such capacity as you could arrange with the proprietor.

How can any one enter the Bureau of Steam Engineering at Washington? We do not understand exactly what position you want. Write your wishes definitely to the Chief of the Bureau of Steam Engineering, and you will probably obtain a reply. If there is still a difficulty, you might address the Member of Congress from your district.

C. C. A.—The instrument you describe is simply a pneumatic syringe. It is not a novelty, having been shown in courses of experiments, under the subject of heat, in our schools for years.

J. A. H. asks: Why does a glass bottle burst, when you expose it to the air and lay it on red hot coals? A. It is owing to the unequal expansion of the glass when placed upon the coals.

What is the telescope principle used for? A. Your questions are very indefinite. The telescope is composed of several lenses so arranged as to bring at the point of sight, objects magnified several diameters. Consult an elementary text book upon optics.

H. S. asks: My finger nails are very brittle. In fact, the least pressure causes them to break. Is there any remedy? If so, what is it? A. Bathe the nails with oil; glycerine will not answer; keep the nails cut close. If very sore, you must keep them bathed continually.

J. M. B. says: Please give a formula for calculating the proper dimensions of a fly wheel, dimensions and speed of engine being known. A. You will find rules on the subject on pp. 177 and 288, vol. 28.

J. W. M.—Your idea for an electro-magnetic engine is not a new one, and is impracticable, little or nothing being gained by its use; and instead of replacing the battery, you only lessen the reliability by complicating its machinery.

E. H. H. asks: Is there any machinery for cutting files in use, that is working successfully, and what has been the principal trouble with machine-cut files? A. There are several of such machines, machine-cut files being in common use. They are not, however, equal to hand-cut files, either in the regularity of the cut or in the quality of the cutting edge of the teeth.

G. S. asks: How can I harden thin brass wire, about the thickness of a common sewing needle or a pin, so as to make a spiral spring, by winding it over a mandrel the thickness of a common pinholder? A. Harden your brass wire by hammering it lightly while it is on the mandrel after it has been wound.

What kind of glue can I use to glue thick leather on wooden rollers about an inch in diameter? A. Any kind of superior glue.

To what color must I heat a watch spring to temper it, and must it not be well hardened before tempering? A. To harden such a spring, heat it to a red heat and immerse it in oil till cold. Then fry it in equal parts of oil and tallow until the mixture will blaze on the spring. When the mixture blazes, keep dipping the spring into it, and then holding it in the flame so that the spring will blaze of itself when held away from the flame. After blazing freely, allow the spring to cool of itself.

W. G. R. asks: Will immersion in a solution of sulphate of soda be sufficient to test the effects of frost upon a sample of artificial stone? A. We hardly think it will. Try a mixture of ice and salt; this will lower the temperature to -4° Fah.

P. J. H. asks: What is the effect of a daily application of rain water and ammonia to the hair? A. If the solution of ammonia is according to the regular formula, there will be no injurious effects. Inhaling the vapor of ammonia is injurious. It is in no way detrimental to the hair.

N. D. T. asks: Is there any better substance for removing the organic impurities from cistern (rain) water than the permanganate of potash? If not, what amount should be used in purifying a ton of water, and what manipulations are required? A. Sulphate of alumina is used to purify water. If you use permanganate of potash, a tablespoonful of a saturated solution of the permanganate will be found sufficient for one ton of water; if the water retains a pink hue, put a stick or chip in it, when the color will shortly disappear. You will find a new method fully treated on page 414, Science Record, 1874.

D. W. S. asks: 1. Will the copper lightning rod on my house injure the water in the well in which it terminates? A. Yes. 2. The galvanized rod on my barn terminates in a half hoghead of running water. Is it safe? No. 3. Would it be safer if it penetrated the ground eight feet? A. Yes, and it would be still safer if you deposited a cart load or more of well burned charcoal at the bottom of the rod, surrounding the rod for a length of several feet with the charcoal.

C. M. asks: In your issue of July 18, in answer to D. O. C., you have not stated how much nitre is to be used. A. In formula mentioned, nitre is 10 parts. What is meant by small? A. Small is pulverized cobalt glass.

What is peroxide of lead, and is it known by any more common name? A. Peroxide of lead is a heavy brown powder consisting of oxygen and lead.

Is anything mixed with the sulphur in which matches are dipped, to thin it? A. No.

J. E. S. asks: Is it a fact that the water 150 miles from the mouth of the Amazon river is suitable for drinking, or does it mix with the ocean and become brackish or salt? A. It is brackish.

What number of emery and what grade is most suitable for grinding molding tools? I make my tools on emery wheels from blanks made as planer knives are, that is, with steel faces and iron backing; and I find that wheels that manufacturers recommend are all right to cut the steel, but the iron will glaze the wheels. I want them for fast cutting. A. We advise you to consult a reliable dealer.

What would be the actual horse power of a locomotive, with two 18x26 inch cylinders, at 130 lbs. per inch, and 4 feet 6 inch drivers, making 30 miles per hour? A. The mean effective pressure of steam in cylinders is required for the solution of this problem.

G. G. McC. asks: What degree of heat is necessary for the incubation or hatching of the egg of the common barn yard fowl? A. From 102° to 104° Fah.

J. P. A. asks: What is pip among chickens? Is it injurious to the fowls? What is the hard substance on the end of chickens' tongues? A. "The pip" by some is considered a catarrhal disease producing a thickened state of the membrane lining the nostrils, mouth, and tongue; others consider that the disorder originates in a small vesicle formed on the tip of the tongue, the contents of which, being absorbed, lead to the inflammation and the thickening of the skin. The common and well known symptom is a white scale or horny substance growing upon the tip of the tongue, by which the breathing becomes partly impeded; the beak is frequently held open as if gasping for breath, and he comes yellow at its base, while the feathers on the head appear ruffled or disordered. The tongue is also very dry; and while the appetite is not much impaired, the disordered fowl can eat only with considerable difficulty, and sits in corners, pining away. The most effective cure we have ever employed, and that, when the disease has not proceeded too far, was to tear off the scale with the nails of our forefinger and thumb; and it is not difficult, as it is not adhesive; and then Boswell recommends to fill the mouth and push down the throat a large lump of fresh butter, which has previously been well mixed with Scotch snuff. "Tols," says Boswell, "is a recipe which we conscientiously and confidently recommend; and again we beg to repeat, that, in our experience, we have never known it to fail, except from our own negligence in the delay of its application."—American Poultryer's Companion.

E. A. F. T. says: I have constructed a galvanic battery as follows: One cup of copper, 3 inches high and 6 inches in diameter, is made of very thick sheet copper. This vessel I charge with 1 part sulphuric acid to 10 parts of water. Then I insert a glass cylinder (3 inches in diameter), closed at the lower end with blotting paper. In this I insert a cylinder of rolled up sheet zinc, 1 1/2 inches diameter, and charge it with 1 part of muriatic acid and 10 parts water. The battery works very well for silver plating; would it also do for nickel plating? A. Several cells of this description may be used for nickel as well as silver plating on a small scale. How should nickel salts be prepared for plating? A. You will find a recipe on p. 31, vol. 30.

C. W. G. says: I have discovered (near the waters of Hickory Creek, Texas), some bones of enormous size; they were cropping out of the bank. One bone measured 27 inches in circumference, 1 1/2 inches from surface of bone to the marrow. One of the upper jaw teeth measured 11 inches in length and 4 1/2 inches in width. The side of the jaw from which these teeth were taken weighed 25 lbs., the teeth being, seemingly, all connected together. About 5 1/2 feet away, I found the rest of the upper jaw, somewhat decomposed, though the teeth were in a good state of preservation. Can you give me the name from this description? A. No. We might, if you sent on some of the teeth. If you can obtain more data in regard to the size of the skeleton, length of body, legs, neck, etc., we might be able to answer you fully.

M. E. P. says: Please inform me how to prepare pickles so that they will keep good and retain their green color? A. Small cucumbers, but not too young, are wiped clean with a dry cloth, put into a jar, and boiling vinegar, with a handful of salt, poured on them. Boil up the vinegar every three days, and pour it on them, till they become green; then add ginger and pepper, and tie them up close for use. A permanent green color cannot be obtained without the presence of copper, and pickles so prepared are injurious.

What will prevent insects from eating wall paper? A. You do not state what the insects are. Some can only be driven away by putting poison in the paste when putting the paper on the wall.

How can I preserve citron to have it like the dried citron we buy? A. Take citron and sugar, pound for pound, and simmer until tender. Allow to dry in the sun, keeping it covered with sirup during the process.

C. C. M., Jr., says: I have just completed an electric machine, but it will not work, although every thing appears to be in good order. Rubbers are made of wood and chamolite skin, covered or coated well with amalgam of mercury, zinc, and tin. The prime conductor is made of insulated wood, covered with tin foil, which acts or should act as a good conductor of the electricity, if any were developed. The negative conductor is not insulated as most are, but is made of wood connected with the base. Perhaps I may have made a mistake in making the machine as I did. If so, you will greatly oblige me by stating it. The glass is insulated from the atmosphere by oiled silk. A. Your negative conductor, namely, the chain attached to the rubbers should be placed in connection with the earth, if the positive fluid is desired; and if the negative spark is required, the chain should be placed in connection with the prime conductor and the earth. One of the conductors must always be in connection with the earth otherwise the machine will not work.

A. C. H. asks: 1. A tank full of water has 4 outlets. If it is open, it takes 15 minutes to empty the tank, 30, 45, and 60. How long will it take if all four are opened at once? A. It will take about 7 1/2 minutes. 2. Has the amount of water anything to do with pressure of the different sizes? A. Under the same pressure, a large tube will discharge more water proportionally than a small tube.

Which is the real American eagle, the one with a white head, or a brown one? A. The one with a white head commonly called the bald eagle.

How can I prepare leaves of plants so as to leave the veins only, all the soft green mass being taken off? A. Put them in water and allow to stand until the parts desired to be removed are nearly decomposed. The length of time will depend upon the kind of plant. Remove the desired parts with a camel's hair brush and dry in sheets of blotting paper. Then bleach by a preparation sold in the market for the purpose. If this cannot be obtained, use chloride of lime.

What is osmic acid? A. "The tetroxide of osmium Os O₄, commonly called osmic acid, is the volatile strong smelling compound formed when osmium or either of its lower oxides is heated in the air, or treated with nitric or nitro-muriatic acid. It may be prepared by heating osmium in a current of oxygen gas, and condenses in the cool part of the apparatus in colorless transparent crystals. It melts below 212° Fah., and boils at a temperature a little above its melting point. Its vapor has an intolerably pungent odor; attacks the eyes strongly and painfully, and is excessively poisonous. Osmic acid is dissolved slowly, but in considerable quantity, by water, forming an acid solution. It is a powerful oxidizing agent, decolorizing indigo solution, separating iodine from potassium iodide, converting alcohol into aldehyde and acetic acid," etc. (Fowne's 'Chemistry.') Recently some osmic acid was presented to the French Academy; though but a small amount, it was calculated that it was enough to poison the whole world.

J. W. H. asks: If the exhaust steam from an engine contains 4 of the entire units of heat used in generating it, would it not be practical and economical to pump it back into the boiler? Is this idea new or old? A. The idea is neither novel nor good.

G. F. R. asks: How can I bend brass tubing without injury to the tube? A. Fill the tube with resin or with lead, before bending, and melt the same out after the bending is completed. Lead is the best.

H. Z. E. asks: 1. What is an accurate second of time, and how is it determined? A. 1. You will find table below, upon which to base your calculations. 2. Is it a natural, or artificial unit of measure? A. 2. Artificial. 3. What proportion does the ordinary yard bear to the length of a pendulum beating seconds? A. 3. The length of the seconds pendulum—that is to say, of the pendulum which makes one oscillation per second—varies, of course, with the intensity of gravity; at the level of the sea it is, according to Sabine: 39.13974 inches at the equator (St. Thomas), 39.13965 inches at London, and 39.1409 inches at Spitzbergen.

What is meant by the molecular theory of matter? A. The molecule is the smallest quantity of any elementary substance which is capable of existing in a separate form. H, for instance, represents the atom of hydrogen, while H₂, or H₂, indicates its molecule.

How does the greenback paper dollar compare with specie, as a measure of value? A. Specie is worth about 24 cents more on the dollar than paper, but its comparative value is constantly varying.

W. S. P. asks: Has the hatching of hen's eggs by artificial heat ever been a success? If so, when, where, and by what process? A. Artificial incubation is considerably practiced. You may see the apparatus in operation at agricultural and industrial exhibitions.

F. B.—For cleaning the ink (containing iron) from your blanks, try a strong solution of caustic potash.

W. B. asks: How much does pure water weigh to the cubic foot? A. Pure water weighs 1,000 ounces per cubic foot.

Will not water drive an engine as well as steam or compressed air, if supplied through a suitable pipe from a reservoir 50 feet above the engine? A. Water will drive an engine, but not so well as steam or compressed air, because of the difficulty of getting the water into and out from the cylinder with sufficient rapidity. Power from water is best utilized by means of a water wheel.

I propose to use a friction arrangement, consisting of a smooth bar, with a dog on each side to clamp the bar, and to have springs to keep the dogs on the bar. Will it work accurately? A. Your friction arrangement would, if the springs were powerful enough, drive the bar; but it would be liable to spring the bar out of true, if one spring were more rigid than the other, as is very likely to be the case.

I have an attachment for lathes by which the speed of tool travel can be changed without stopping the lathe, and can be changed from any one feed to any other in 15 seconds. It is very simple in its construction. There are two shaves running lengthways of the lathe bed, each having a number of wheels, running from large to small, on the back, on which they are keyed fast, while on the front one they are not keyed. They are thrown into action by means of a gear clamp. The clamp is made double (so as to work both ways), the levers of which (when out of motion) rest in the middle one of three notches; and when in the left hand notch, the feed is, say, 20 to the inch, while, when in the right, it will be, say, 15 to the inch. The front shaft imparts motion to the feed screw, and the back receives its motion from the main spindle, and it can be attached to any lathe. Do you think it is of any value? A. It would be highly advantageous to be able to alter quickly the feed of a lathe tool by a simple contrivance, especially in lathes whose screw serves the purpose of tool feeding as well as screw cutting. A moderate range of tool feed is, however, obtained in lathes having an independent tool feed by simply shifting the belt on the cone which drives the tool feed spindle. We are not prepared from your description to speak decisively of your arrangement, but should judge that a wide range of alteration in tool travel could be easily obtained by it.

M. A. G., in answer to several inquiries about keeping water pure in cisterns: Wooden or other cisterns constructed to receive rain water from the roof of buildings, as generally made, soon become foul, with sediment, smoke, and other impurities from the roof. In a short time the water becomes stagnant, and unpleasantly odorous. To remedy this, carry the pipe which brings the water into the cistern to within two or three inches of the bottom, thus discharging the fresh water at the bottom, and causing an entire change of water every time it rains. Then there ought to be an opening or valve of some sort at the bottom, by which you can drain out all the contents, and thoroughly rinse and scrub the inside as occasion may require. An auger hole and plug so placed as to be easily accessible would answer the purpose. Such a cistern placed under a woodhouse, or in some secure place out of the reach of frost, with the outlets arranged to be reached from the cellar, and discharging the surplus water into the cellar drain, and a pipe to connect with a pump in the kitchen, will be a wonderful convenience in places where soft water is not easily obtained. I constructed one which has proved very satisfactory after six years' use, in the following manner: About four or five feet outside the cellar, and under a wing of the house, I dug down nearly to the depth of the cellar, and of the required size, say six or eight feet. The ground was a very solid clay, except the surface soil of about 18 inches. This upper portion, in the soft soil, we dug larger, perhaps a foot or more all round. In this portion I laid a stone wall in lime mortar, so that the inside was even with the lower portion of the cistern; I then placed a piece of iron pipe from the bottom of the cistern through the earth, into the inside of the cellar, with the end opening over the cellar drain, wedging the pipe in firmly with small stones and cement, and closing the cellar with a wooden plug. I then plastered the entire inner surface of bottom and side (laying a flat stone in the center to stand upon) with the cement called water lime, mixed with sand, putting on two coats and allowing time to dry; afterwards I put on a coat of clear cement very thin, with a brush, to close any little cracks caused in drying. The house was then built over it. The rooms were warm and frost never troubled, and through a man hole in the floor we could go down, and with a broom thoroughly clean the inside, thus at all times having a full supply of water for all household purposes. To illustrate the importance of conveying the incoming water to the bottom, spoken of above, I note the case of a glass aquarium with a fountain in the center, which, though supplied with running water through the fountain, in a few weeks became offensive in odor, and the fish died. We then had a pipe put on conveying a portion of the water into the aquarium at the bottom, which did not interfere with the appearance or efficiency of the fountain, but caused a continuous change of water, and we had no further trouble.

D. says: In answer to several of your correspondents who wish to know how to make rubber hand stamps: Vulcanized rubber used, as prepared by the manufacturers, and can be procured in strips about 3 inches wide and about 1/4 of an inch thick, and of any desired length. The name and address should be set up in common printing type, and the type well oiled: a rim about 1/4 inch in height should be placed around the form, and dentist's plaster, mixed to the proper consistency, poured in and allowed to set; then the plaster cast is separated from the type. A piece of the soft vulcanized rubber is then cut, of the size of the plaster mold and laid upon it, and both together are placed in a screw press, and heat sufficient to thoroughly soften the rubber is applied. The screw is then turned down hard and left for a short time until the rubber is perfectly forced into the mold. After the whole is cold, the rubber is separated from the model, and any irregularities trimmed off with a sharp knife; the rubber stereotype is then fastened, with glue or other cement, to a block of wood, and the stamp is ready for use.

H. R. C. sends a description of an improvement upon a leg supporter: On p. 250 of your vol. 99, in answer to "Sufferer," Dr. Chapman, of New Haven, Conn., says: A stiff and straight iron rod, flattened at each end and padded, of the length of the leg, is fastened to the outside of the leg. Now it seems to me this arrangement would be uncomfortable to wear, inasmuch as it does not allow of a free use of the knee joint. I have made a support for a number of parties which works admirably. The support is made entirely of steel except the heel covering, which is made of brass fitted to the heel. The bands placed behind the limb are three in number, covered with calfskin, and lined over a padding of thick beaver cloth with soft sheepskin. These three pieces are stitched together and extended far enough to go around the leg, where they are fastened by metal strips which button on small steel knobs.

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

H. W. S.—We are unable to decide what the plant is, from the flower. To analyze a plant, we must have stem, leaf, and flower, and sometimes it is necessary to have the roots also. There is no plant, to our knowledge, that is called the Thousand Dollar Plant, either in this country or in Europe. It is doubtful if the plant growing so abundantly in Texas would grow in the colder climate of Germany.—A. J. H.—It is a specimen of iron ore, containing a large percentage of silica.

J. M. K. asks: Can you tell me of the best treatment for asthma by inhalation?—A. M. G. asks: Can you give me a recipe for cleaning an oil painting from particles of paper, etc., that are stuck to it?—L. H. R. asks: What size should I make the steamports of a cylinder 1 1/2 inches diameter x 1 1/2 inches stroke, to be driven at as high a rate of speed as possible, by an upright cylindrical boiler without any flues (10 inches in diameter x 12 inches high), capable of carrying 30 or 40 lbs. steam?—J. E. W. says: I have a great deal of trouble in obtaining a good light upon my work when engraving on bright surfaces. The reflections are so great at times as to render it difficult to follow the tracings with the graver. I have used shades of various kinds, but find no relief. What will remedy the difficulty?—A. C. F. asks: 1. With what can I size some fancy paper articles for varnishing, the paste of which would be dissolved by the common size? 2. What varnish is best for such articles? It should be nearly transparent, and not readily soluble.—S. M. T. asks: Who made the first cast iron plows used in America, and in what year were they made?—G. W. asks: What kind of varnish would be the cheapest, besides possessing strong adhesive and entirely waterproof qualities, with which to coat paper and not penetrate said paper but very slightly?

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 Tides of Lakes. By L. L.
- On a Mercurial Telescope. By H. S.
- On Car Ventilation. By S.
- On a Chemical Coquette. By S. H. T.
- On Worn Out Clay Soils. By G. V.
- On the Influence of the Pole Star. By P. H.
- On the Alcohol Question. By Z. C. W.

Also enquiries and answers from the following:

C. M. D.—G. W. W.—H. C. A.—S. H.—L. C. J.—R. H. N. J. O. R.—B. G.—A. H. F.—C. I. A.—H. R. C.

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 enquiries analogous to the following are sent: "Please to inform me where I can buy sheet lead, and the price? Where can I purchase a good brick machine? Whose steam engine and boiler would you recommend? Which churn is considered the best? Who makes the best mullage? Where can I buy the best style of windmills?" All such personal enquiries 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

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APPLICATIONS FOR EXTENSIONS.

7,608.—CARPET.—C. A. Richter, Philadelphia, Pa.
7,609 to 7,616.—OIL CLOTHS.—J. Hutchinson, Newark, N. J.
7,617 to 7,621.—CARPETS.—C. T. Meyer et al.
7,622 to 7,624.—BORDERS.—C. Osborne, N. Attleborough, Mass.
7,625.—OIL CLOTH.—J. B. Violette, Paris, France.
7,626.—FURNITURE LEGS.—F. Robertson, New York city.

TRADE MARKS REGISTERED.

1,911.—YEAST POWDER.—A. G. Dooley, New York city.
1,912.—RUM.—L. H. Felton, Boston, Mass.
1,913.—BUTTONS.—Newell Bros. Co., Springfield, Mass.
1,914.—INKSTANDS.—A. Teyssonnier, Paris, France.
1,915.—MEAT EXTRACT.—San Antonio M. E. Factory, Tex.
1,916.—SILK GOODS.—E. Warburg & Co., New York city.
1,917.—CHEWING TOBACCO.—Beck et al., Chicago, Ill.
1,918.—GLUE, ETC.—Champion Glue Co., Chicago, Ill.
1,919 & 1,920.—SOAP, ETC.—Colgate & Co., N. Y. city.
1,921 & 1,922.—FELT SKIRTS.—Elliot Mills, Boston, Mass.
1,923.—MEDICINE.—Leath & Ross, London, England.
1,924.—CIGARS, ETC.—Consolidated Tobacco Co., Gilroy, Cal.

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
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On an application for Design (3 1/2 years).....\$10
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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
AUGUST 3, 1874.

3,730.—T. Y. Cassiano, San Antonio, Bexar county, Tex., U. S. Improvements on hats, called "Cassiano's Improved Hat." Aug. 3, 1874.
3,731.—P. F. King, G. N. Beard, and E. J. Beard, St. Louis, Mo., U. S. Improvements on nut locks, called "King Excelsior Nut Lock." Aug. 3, 1874.
3,732.—G. P. Draper, Rochester, N. Y., U. S. Improvement on sewing machine tables, called "Draper's Sewing Machine Table." Aug. 3, 1874.
3,733.—L. Draper, North Attleborough, Mass., U. S. Improvement on curryscombs, called "Draper's Self-Cleaning Curryscomb." Aug. 3, 1874.
3,734.—C. Callahan and E. E. Sibley, Chelsea, Mass., U. S. Improvements on knitting machines, called "Callahan's Knitting Machines." Aug. 3, 1874.
3,735.—R. C. Cuff, Hamilton, Ont. Machine for mincing meat, called "Cuff's Meat Mincing Machine." Aug. 3, 1874.
3,736.—A. H. Wagner, Windsor, Ont. Improvements on pitchers or vessels for containing thick or cohesive liquids, called "Wagner's Double Lipped Pitcher." Aug. 3, 1874.
3,737.—A. Harvey, Toronto, Ont. Improvements on the mode of applying for insurances and of writing or printing and issuing policies therefor, called "Harvey's Insurance System." Aug. 3, 1874.
3,738.—J. W. Cuthbertson, Brantford, Ont. Improvements on frames for window screens, called "Cuthbertson's Improved Window Screen." Aug. 3, 1874.
3,739.—W. J. Burieligh, Rome, N. Y., U. S. Improvements on the manufacture of starch polish, called "Burieligh's Starch Polish." Aug. 3, 1874.
3,740.—T. Young, Montreal, P. Q. Improvements on a cooking stove, called "The Mechanic." Aug. 3, 1874.
3,741.—J. E. Cisco, Conneautville, Pa., U. S. Improvements on car couplings, called "Cisco's Car Coupling." Aug. 3, 1874.
3,742.—A. A. Griffing, Jersey City, N. J., U. S. Improvements on steam radiator, called "Griffing's Radiator." Aug. 3, 1874.
3,743.—W. Thilmany, Cleveland, O., U. S. Improvements on the art or process of treating textile fabrics to prevent mildew and decay, called "Thilmany's Process of Treating Textile Fabrics to Prevent Mildew and Decay." Aug. 3, 1874.
3,744.—S. C. Hendrickson, Brooklyn, N. Y., U. S. Improvements on electric railway signalling apparatus, called "Hendrickson's Electric Railway Signal." Aug. 3, 1874.

Advertisements.

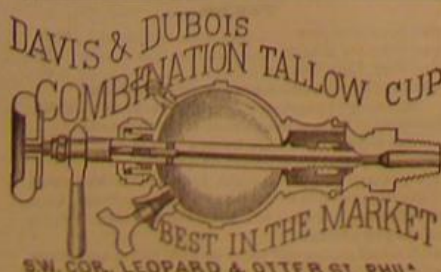
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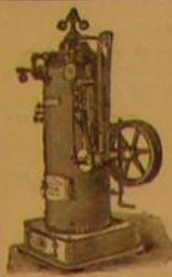
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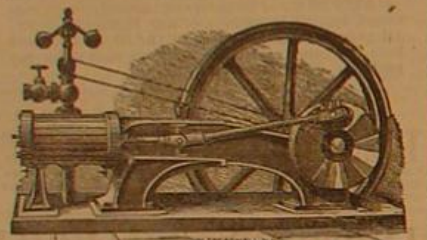
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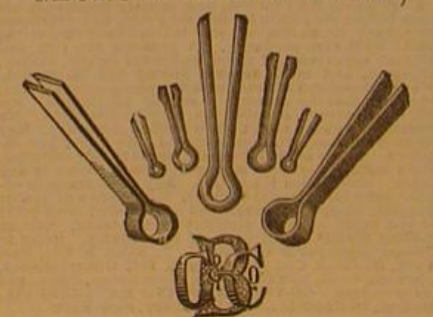
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[NEW SERIES.]

NEW YORK, SEPTEMBER 12, 1874.

[33 per Annum.
IN ADVANCE.]

IMPROVED DIAMOND STONE SAWING MACHINE.

The working of stone, although one of the greatest of human industries, has, up to this time, probably received less assistance from steam machinery than any of the principal arts. It is therefore with special gratification that we chronicle and portray the new mechanism here presented, which, by its remarkable performances, entitles it to rank among the important mechanical achievements of the age. As a labor-saving device, this Emerson machine executes in stone almost what the common circular saw does in wood.

Our engraving is from a photograph of the original machine as arranged for practical operation. It is very strongly built, weighing about 34,000 lbs. The metal portion alone comprises about 20,000 lbs. of this weight. The apparatus is mounted with a circular saw, 73 inches in diameter, carrying 48 diamonds and steel points.

Without changing the velocity of the main shaft, the speed of this saw may be varied from 5 revolutions to 500 per minute, an advantage of importance, as in the use of hard metal points a slow speed and heavy feed are required, while in the use of diamonds for the cutting points the reverse is necessary. The feeding of the stone to the saw may be varied from one sixteenth of an inch to four inches at each revolution, the feed motion being taken from the mandrel of the saw. The carriage or bed upon which the stone is mounted are moved by a separate feed motion, back and forth, much faster than when the saw is cutting. A single hand lever suffices for this operation.

By the aid of simple mechanism in connection with another hand lever, the saw, with all of its appliances, may be raised or lowered without stopping its motion or changing the tension of a belt; so that when it is desirable to saw stone more than thirty inches in thickness or in width, the saw can be elevated and an upper cut made through the stone as deep as the saw will cut. The stone is then run back, and the saw lowered. The carriage next passes over the top or upper part of the mandrel, and an under cut is made. The time taken in raising and lowering the saw does not occupy more than five minutes, notwithstanding that the weight raised and lowered may exceed 4,000 lbs. In ordinary work, the stone is not moved after it is placed upon the bed until it is sawn into slabs or pieces of the required thickness. The saw is made movable upon its own mandrel by the turning of a small hand wheel. At each revolution the saw is moved sideways one fourth of an inch, being four turns of the crank to one inch. The carriage or bed, upon which the stone rests, runs, it is claimed, as perfectly as the bed of an iron planer. It travels upon heavy iron rollers, the journal boxes of which are made perfectly grit proof and self oiling.

Stone may be sawn to any length up to 14 feet, and of any angle or depth to five feet, so that a corner piece may be sawn out of a stone block. All stone to the hardness of ordinary grindstone, may be sawn with hardened steel or

metal points; diamonds are substituted in working upon the harder grades.

It is claimed that one circular saw in this machine will do the work of more than one hundred hand saws, and this accurately true and out of wind. The machine has already sawn one hundred and twenty-five superficial feet of actual cutting in one hour, of the hardest kind of Berea sandstone, a material harder than ordinary grindstone grit. This was done with the diamonds as cutting points.

In our second figure (see page 163) is shown a section of two teeth of the saw with the holders in position: A is the diamond holder, and B the steel point holder. The steel holders are made adjustable and interchangeable in the saw,

sufficient hardness to press the casing into every jagged shape and irregularity of the diamond, but not of sufficient hardness to crush or break the same. The surplus part of the casing is then cut away. A cavity is then formed in the steel holder, approximating the outer shape of the diamond casing. The latter is then placed between the jaws of the holder, and under pressure is forced, to a perfect fit or profile, into the steel and on the diamond. The lower portion of the casing is gripped between the jaws of the holder, as in a vise, forming a perfect fit and substantial connection. This exceedingly simple method enables any mechanic of ordinary skill to set the diamond.

Fig. 4 (page 163) is a holder with three or more diamonds set in one piece, designed more particularly for straight saws, to be used with reciprocating motion.

Machinery for the use of this saw may be varied and constructed to suit all kinds of stone sawing and dressing.

We understand that the machine here illustrated is to be set up and operated at the Cincinnati Industrial Exposition, which opens September 2, 1874. The stone saw and machine is the invention of Mr. J. E. Emerson, and is covered by numerous patents.

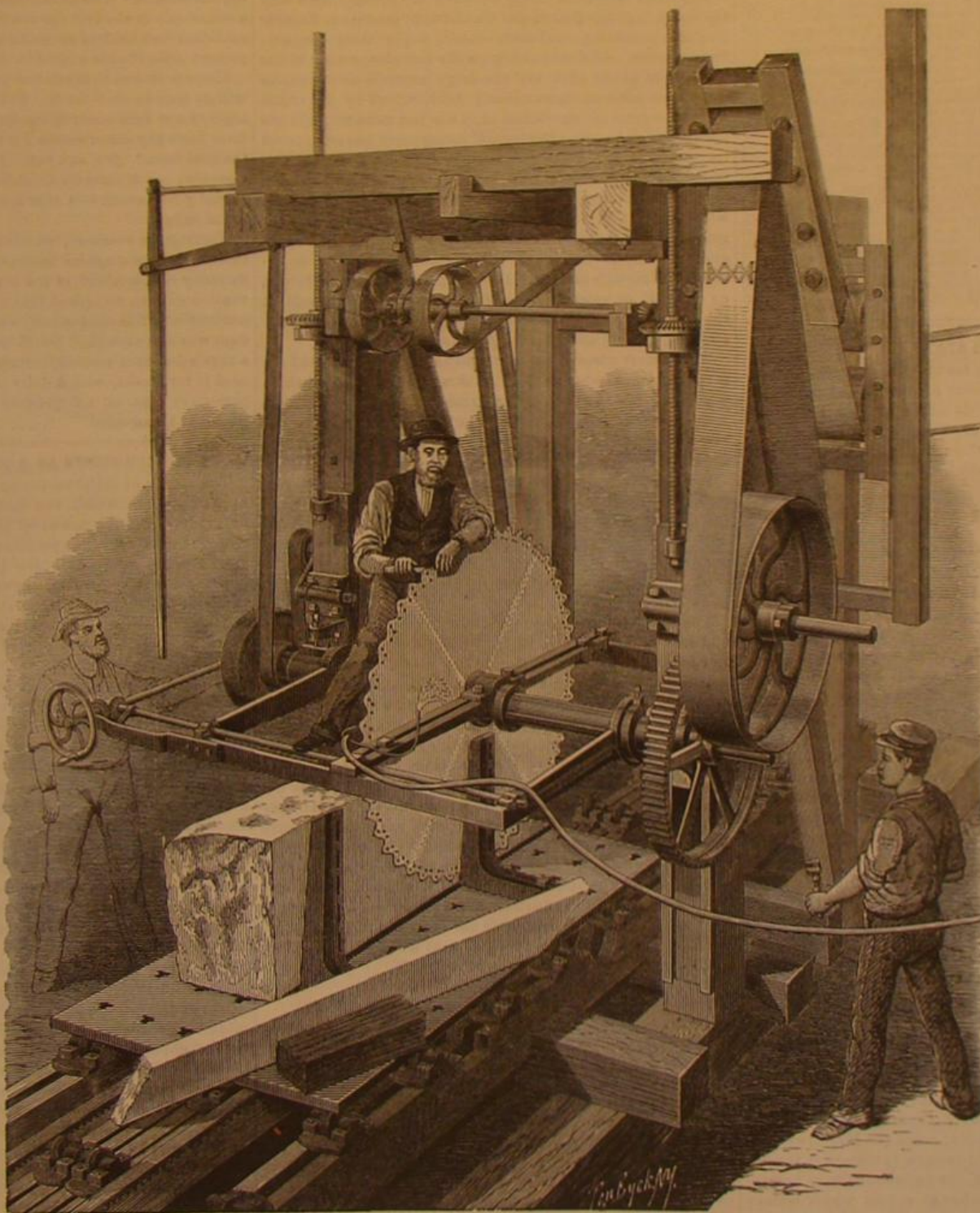
Further information may be obtained by addressing Messrs. Emerson, Ford & Co., Beaver Falls, Pa., or Richard S. Robertson, Esq., No. 12 Smithfield street, Pittsburgh, Pa.

Structure of Coal.

By close investigation E. W. Binney, F.R.S. believes he has established the following facts: Soft caking, or cherry, coal is chiefly composed of the bark, cellular tissue, and vascular cylinders of coal plants with some macrospores and microspores. Caking coal has much the same composition, except that it contains a greater proportion of bark. Splint, or hard coal, has a nearly similar composition, but with a great excess of macrospores. Cannel coal, especially that yielding a brown streak, is formed of the remains of different portions of plants which had been long macerated in water; it contains a great excess of microspores. Macrospores are from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch in diameter, and can be easily seen by the naked eye. Their exterior is composed of a brown coriaceous sub-

stance, containing within it carbonate of lime or bisulphide of iron, according to the nature of the matrix. The microspores are about 320 times less in size, and contain some form of hydrocarbon, which, by the action of heat, becomes paraffin. These conclusions were arrived at merely as to the composition of the different kinds of coal. Each seam is materially affected by the nature of the roof, since, if it is an open sandstone, gaseous matter can freely escape, which is of course not the case when the seam is roofed in with airtight black shale or blue blind.

THE Pilot Knob Iron Company have recently sunk a shaft on Shepherd Mountain, Iron county, Mo., and have now passed through 70 feet of almost solid ore.



EMERSON'S PATENT DIAMOND STONE SAWING MACHINE.

so that either the steel tooth holders or diamond holders may be used in the same blade.

Fig. 3 (page 163) shows the diamond holder and diamond detached from the saw, C C being a full sized holder with diamond inserted; D a half section, showing the cavity cut to receive the diamond, and E the diamond, inclosed or partially embedded in a soft metallic casing (copper by preference). The method of setting and holding the diamond, as now adopted, is here clearly represented. The diamond is first wrapped in a casing of copper, and placed so as to present the most desirable cutting part in suitable direction and position. The casing is then closed around it so as to maintain it in position. The diamond is then, with the casing, placed between two metal or other suitable substances of

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NEW YORK, SATURDAY, SEPTEMBER 13, 1874.

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CAN WE STAY?

It is time some one stood up for his country: some American, we mean. Not for its present prosperity and immediate prospects, there are plenty to do that: but for its distant past and distant future. We are tired of hearing the Continent called a graveyard of nations, the tomb of antecedent races, the one spot on earth which man cannot permanently inhabit!

It is bad enough to be told, by would-be wise ethnologists, that our climate is hostile to the Aryan type, that an irresistible Indianizing influence pervades the air and is rapidly converting us all into lean, high-cheeked, billous-looking copies of Mr. Lo; and that our great grandchildren will be no better than so many Sioux. But that is not half so bad as to be told that it is a question whether their descendants will be able to stay here at all, except underground. Any existence is better than extinction: and it is possible to hope good things of our race even if it should assume the physical characteristics of the so-called American type.

The latest advocate of the extinction hypothesis is the somewhat prominent author of "Sex in Education." His essay, read before the National Teachers' Association the other day, set out with the discouraging announcement that no race of human kind has yet obtained a permanent foothold on this continent; and the lesson he sought to enforce was that, unless something extraordinary is done, we are doomed as a race to untimely extermination. The Asiatics, he said, trace their life to beginnings immensely remote. The descendants of the Ptolemys still linger in the valley of the Nile. The race which peopled Northern Europe, when Greece and Rome were young, more than maintains its ancient place and power. But the ancient races of America—where are they? "We only know that they are gone."

When Dr. Clarke talks of "Brain Building" and the "Education of the Sexes," he says much that is sensible and true: but when he infers our early destruction by climatic influences from the fact that other American races have vanished, our confidence in his judgment is seriously shaken. Grant that vestiges of two or more departed races are to be found within our borders, and that when the Mayflower discharged her marvelous cargo of cottage furniture to furnish hearthrooms for all New England, the native race were hastening to the happy hunting grounds at a rate which whisky and gunpowder have but slightly accelerated: does that prove American races to be short-lived? Rather let us call it evidence of exceeding long life. Where else on earth will you find so few races bridging over so vast an interval of time?

When the pioneers of Italy and Greece, wild as Mohawks, fought their way into Europe, a peaceful and populous nation—whose unhappy remnant has lately given a President to Mexico—was cultivating maize in the valley of the Mississippi, mining copper at Lake Superior, and building temples in the South. The man of the Florida corals antedates not merely the Ptolemys—men of yesterday—but the Pharaohs, the shepherd kings, it may be the very land they owned and ruled. What wonder that his lineage is lost? We know from recent exploration that the desert regions of North Africa were under water in later tertiary times. Since then the sea has dried away, and across its sandy bottom the

Nile has laid its annual layers of mud for the creation of the ancient granary of the world. There is geological evidence that, when the first mud layer was put down, a broad fresh water sea covered the now barren Bad Lands of our great West. There is similar evidence that men dwelt on its shores and fished from its headlands.

Since the pioneers of Western Europe sought shelter in the caves of France and Belgium, the Somme has sunk its bed through a hundred feet of gravel. Since a settled population flourished on the then fertile, now arid, plains of the Colorado, that stream has cut its mighty cañons deep in earth through two, four, perhaps six, thousand feet of solid rock! When the upper strata of the Himalayas were in process of deposition, and before our Aryan fatherland began its upward course in civilization and altitude, human beings were fishing among the islands of our Pacific coast, since lifted up to form the Coast Range. Ages afterward, when the Golden Gate had been opened and California drained of the sea which had filled the valleys of the Sacramento and San Joaquin, but before the gold gravels were ground into existence or buried beneath lava floods, other men came in and occupied the land, leaving their remains, with those of animals long extinct.

Yet because we cannot trace these nations historically through intervening ages, because they seem to represent a number of distinct successive races, shall we blame the climate and call the land inimical to humanity?

PREPARE FOR THE CENTENNIAL.

The short time intervening between the present date and the opening of the Centennial Exhibition renders it imperative that intending exhibitors should begin their preparations at once. We need not urge the fact that, owing to the magnitude of the affair and the large interests involved, the delays, so common in our yearly fairs, caused by not transmitting objects for exhibition until the last moment, will not here be possible. The Centennial commission has announced its readiness to receive applications for space, so that this important matter can now be definitely settled, leaving nothing to be done but to get the articles ready in conformity with the area of surface secured. Applications should be made immediately, in order that the commission may be allowed time to decide on the amount of room to be assigned to foreign nations. Lack of promptitude, therefore, on the part of intending exhibitors will probably result in their finding the space desired already occupied by less tardy applicants or set apart for foreign contributors.

Those most directly interested at the present moment are manufacturers who propose making large entries which will take time to construct or arrange, and the people who contemplate collective exhibitions of the natural resources or raw materials of different sections of the country, which cannot well be made by individual exhibitors.

It is especially desirable that provision for these aggregate contributions should be speedily made. The importance of the plan, as an incentive to immigration and to the investment of foreign capital, is very great: and liberal arrangements for the prompt and thorough performance of the work will amply repay those States or communities which undertake it.

The advertisement of the Director General of the Centennial will be found in another column, and from it may be learned how applications should be made. It is high time that the public should realize the fact that, leaving out all debatable questions as to its expediency as a national enterprise, our Exposition of 1876 is not an abstraction, as seems to be the prevalent idea, but something upon which work, now commenced, is briskly progressing. Ground has been broken, and the foundations of the great buildings are beginning to appear. Foreign commissioners have already established offices among us, and foreign governments have set apart liberal sums of money to ensure the representation of their industries. If we propose to make the fair a fit celebration for the anniversary which it commemorates and worthy of the high industrial and intellectual standard of our people, we must begin work for it at once—not at some vague, future period in next week, next month, or next year, but, earnestly and emphatically, now.

PENHOLDERS.

Goosequills are round: consequently penholders are round. Professor Syllogism might dispute the logic of this observation; it is correct, nevertheless. Evolution—the clearest expression of the Great Artificer's will in Nature—is the one unbreakable law which determines the products of human invention. Solomon's assertion that there is no new thing under the sun was therefore true in a wider sense than the kingly preacher imagined. In Nature and in Art alike, everything is the offspring of something gone before; and however unique it may seem at first sight, it will prove on examination to be only a more or less modified copy of something else.

Downward from the first metal worker, whose weapons and implements of bronze were exact copies of those his neighbors were toilsomely chipping from stone—thus allowing the necessities of one substance to determine the fashion of objects made of another, of entirely different character, by entirely different processes—one may trace the tendency of men to perpetuate form, even at the cost of sacrificing substance and usefulness. The material may change, and the mode of working, to correspond; but the figure remains, as though to justify Goethe's assertion that form alone is real.

The original maker of metallic pens could do no other than imitate the time-honored goosequill, thrusting a round stick into the end of the barrel for a holder. Subsequently

the barrel was taken from the pen and made a part of the holder, which has since been modified in numberless ways, without departing essentially, however, from the cylindrical form. Accustomed to this shape, we can with difficulty think of any other. Indeed, so strong is the natural feeling that whatever is right, it is more than likely that, if our readers were individually asked why a penholder is round, the majority would reply: "Because that is the proper shape."

But the argument from universal assent, so convincing to the theologian, is practically as little worth in matter of fact as in matters of faith. At best it only proves the matter not intolerable. Penholders are round because no one has ever made them otherwise. It by no means follows that a change would not be beneficial.

Place your thumb and forefinger against the second finger as in the act of grasping a pen, and notice the shape of the space between them. It is triangular. It is easy to put a round stick into a three-cornered hole; but it needs no mechanical genius to see that it will not make the closest possible fit.

To write steadily and with a uniform slope, the pen needs to be firmly held in a fixed position. To write easily the pen must lie in the hand naturally, so as to maintain its position with the least effort. With a rolling penholder, these conditions are but poorly met. The contrary obtains with a three-sided holder, which presents a broad surface to each side of the finger's triangular grip, and gives a steady hold, without apparent pressure and without appreciably separating the fingers. The advantage of a triangular holder over a round one in the last particular is very great; and we are confident that holders so made would rapidly supersede the present style if once placed in market.

There is reason to make the change, and pen stick makers will do well to consider it. Should it be made, would the logic of our first observation be impaired? Would the new form have any other reason for being than the fact that it is the best form? No, and yes. It is the best form unquestionably; yet it owes its existence not to that, but to the apparently irrelevant fact that horsefoot crabs have three-cornered tails!

Visiting the seashore, we chanced to find the empty shell of one of these singular creatures. While holding it up by its spiky tail, a friend, of the sex that is said to have no inventive genius, remarked that the tail would make an odd penholder. The suggestion was carried out, and the product was odd enough. But it was something more. It was a revelation of a needed reform in penholders. We have used it for weeks, with a daily increasing conviction that the goosequill was an unfortunate model. The perfect penholder is three-sided.

THE MICROSCOPE AS A CRIMINAL DETECTIVE.

The annals of criminal jurisprudence furnish an abundance of cases in which the microscope, in the hands of an expert has been the means of eliciting missing links in the circumstantial evidence pointing to the guilt of the accused. Instances are cited where the instrument has shown hairs, clinging to the edge of an ax, to be those of a human being, in direct contradiction of the statement of the prisoner, ascribing them to some animal; and similar scrutiny of fresh blood upon clothing has proved the origin of the stain beyond a reasonable doubt.

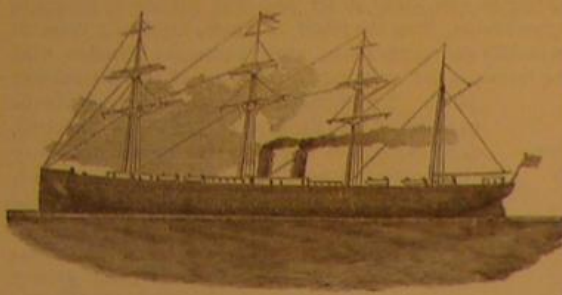
When blood, however, has once become dry, several authorities assert that it is impossible to distinguish it from that of the ox, pig, sheep, horse, or goat. It is urged that the differences between the average sizes of their corpuscles are too irregular to measure accurately, and that a man's life should not be put in question on the uncertain calculation of a blood corpuscle's ratio of contraction in drying. In opposition to these views are some recent experiments, made by Dr. Joseph G. Richardson, of Philadelphia. This investigation disposes of the first objection above mentioned by pointing out that, while it may be valid as regards feebly magnified blood disks, it becomes void when these bodies are amplified 3,700 times. Regarding the second, he stamps it as incorrect, and cites a case in which seven human blood disks, whose mean diameter had been accurately determined at $\frac{1}{325}$ of an inch, were subsequently computed to average $\frac{1}{325}$, or only $\frac{1}{325}$ of an inch less than their actual magnitude. Dr. Richardson also points out, with reference to the last objection, that, all the blood disks likely to be mistaken for those of man being normally smaller, instead of contracting they would have to expand to become conformed to those of human blood. This expansion does not occur, so that the only possible mistake in diagnosis would be to suppose that ox blood were present when man's blood had actually been shed; so that at the worst we might contribute to a criminal's escape, but never to the punishment of an innocent person.

In order to afford a positive demonstration of the facts, Dr. Richardson obtained, from each of two friends, three specimens of blood clots, from the veins of a man, an ox, and a sheep respectively, selected without his knowledge. By microscopical examination alone, he was able to determine, with perfect accuracy, the origin of each sample. The corpuscles of human blood averaged $\frac{1}{325}$, with a maximum of $\frac{1}{314}$ and a minimum of $\frac{1}{338}$ of an inch; those of the ox blood gave a mean measurement of $\frac{1}{382}$, with a maximum of $\frac{1}{371}$ and a minimum of $\frac{1}{393}$; while those of the sheep's blood afforded a mean of $\frac{1}{372}$, with a maximum of $\frac{1}{363}$ and a minimum of $\frac{1}{381}$ of an inch.

From these and other experiments, Dr. Richardson concludes that, since the red blood globules of the pig, ox, red deer, cat, horse, sheep and goat "are all so much smaller than even the ordinary minimum size of the human red

disk, as computed in my investigations, we are now able, by the aid of high powers of the microscope and under favorable circumstances, positively to distinguish stains produced by human blood from those caused by the blood of any one of the animals just enumerated; and this even after a lapse of five years (at least) from the date of their primary production."

THE ENGINEER'S TRIAL TRIP OF THE PACIFIC MAIL STEAMER CITY OF PEKING.



About fifteen hundred guests assembled, in response to invitations issued by the Pacific Mail Steamship Company, on July 22, to witness the trial of the company's new steamer City of Peking. This vessel is one of a pair, built by Messrs. John Roach & Son, in their yard at Chester, Pa., during the last year. The mate, City of Tokio, has been launched and is now receiving her machinery and equipment at the Morgan Iron Works, foot of East 9th street, New York city. These vessels were designed to meet the requirements of a law passed in 1872, granting the company a subsidy for carrying the United States mails between the United States and China, but stipulating that they should be carried in American built iron vessels of more than five thousand tons burden. The following are the principal dimensions of the ship:

Length over all, 423 feet; length on water line, 407 feet; beam, 48 feet 9 inches; depth of hold, 38 feet 6 inches; tonnage (registered), 5,080 tons; draft of water when loaded, forward 22 feet, aft 24 feet; displacement when loaded deep, 7,600 tons; midship section, 930 square feet; total weight of iron used in construction of ship 2,400 tons; thickness of iron in skin of ship, $\frac{1}{2}$ to 1 inch; tons of space occupied by machinery, 1,120.

There are six watertight compartments. Three of the four masts are of iron, and the after or jigger mast is of wood. The total area of canvas that can be spread is 2400 yards.

5 in the one cylinder, and from 15 to 5 in the other, as is now the case.

The steam to work these engines is furnished by 10 cylindrical boilers, having each 3 internal cylindrical furnaces. The products of combustion return through tubes above the furnace, each furnace having its own nest of tubes, separated from the others by water legs. The steam passes through two superheaters on its way to the engine, where it is freed from the water held in mechanical suspension, and slightly superheated. The boilers are arranged in two sets, each set having its own superheater and smoke stack, coal bunker, feed pipes, and all fittings complete, as if placed in separate ships. The following are the principal dimensions of the boilers: Diameter, 18 feet; length, 10 feet 6 inches; diameter of furnaces, 3 feet 2 inches; length of grate bar, 5 feet 6 inches; diameter of tubes, 3 to 3 $\frac{1}{2}$ inches; length of tubes, 7 feet 6 inches; thickness of shell, $\frac{1}{2}$ inch; thickness of furnace, $\frac{1}{4}$ inch; diameter of smoke stack, 8 feet 6 inches; height of smoke stack, 70 feet; total grate surface, 520 square feet; total heating surface, 16,500 square feet; total superheating surface, 1,600 square feet.

It will be seen from the foregoing that, with the exceptions of the late Ville du Havre and the Great Eastern, the City of Peking is the largest trading ship yet built. The Great Eastern, on account of the tremendous space occupied by her machinery, did not prove a commercial success until she was employed in laying telegraph cables. The Ville du Havre was wrecked too early in her career as a screw vessel to determine her economy; but she was increased in size, after having been run a number of years, with the expectation of an improvement. The following comparison of the two ships shows that the City of Peking is not an experiment in marine engineering, as the managers of the French line gave their ship the same proportions after years of trial, although both vessels were being constructed independently at the same time

	City of Peking	Ville Du Havre
Length	423 feet	423 feet
Beam	48 feet 9 inches	49 feet
Tonnage	5,080 tons	5,086 tons
Draft	22 to 24 feet	22 to 24 feet
Diameter of screw	20 feet 3 inches	19 feet 6 inches
Pitch of screw (mean)	30 feet	29 feet 6 inches
Grate surface	520 square feet	532 square feet
Total length of ship occupied by machinery	92 feet	90 feet

The results of experiment may be more plainly seen by

coal bunkers. There are eight doors to the coal bunkers for getting the coal into the fire room, four being forward and aft.

The starting engines and working handles are on the platform above the floor of the ship, allowing room for the oilers to walk beneath while watching the bearings, without interfering with the men working the engines, on the platform. The two independent centrifugal circulating pumps—one for each engine—are on the starboard side, on the floor of the ship. All other pumps, as also the donkey boilers, are on the deck, in order to be accessible if the lower hold of the ship be filled with water.

On the trial made on August 23, it was not attempted to run the engines at full speed, but only slowly, in order to wear the journals smooth, preliminary to the more extended trial which has since taken place, and to test the working of all parts of the machinery at sea. Such a trial was the more necessary, as the ship has, in addition to the propelling machinery, steam engines to move the rudder and to hoist the anchor. The ship left the North river, abreast of pier 42, at ten minutes past eleven, steamed around the light ship off Sandy Hook and returned, arriving abreast of the Battery at five minutes past four, having been under way five hours and fifty-four minutes. Only eight of the ten boilers were in use, and the pressure of steam carried was 50 lbs. The tide was running in during the whole trip, and there was a fresh east wind.

During the first part of the trip, the engines were run slowly, but were allowed to increase in speed; and during the last hour, they averaged the following:

Revolutions per minute, 46; horse power, 2,250; vacuum, 26 inches; temperature of feed water, 85°; temperature of discharge water, 87°; temperature of injection water, 70°; steam pressure 40 lbs.; speed, 12 $\frac{1}{2}$ knots; draft of water forward, 18 feet; draft of water aft, 19 feet.

The draft to the furnaces was very strong, and they will probably be able to burn 15 lbs. of coal per square foot. Therefore the following is an estimate of the probable performance of the ship at maximum power: Consumption of coal per hour = $520 \times 15 = 7,800$ lbs.; horse power = $\frac{7,800}{12} = 650$; speed of ship = $\sqrt{\frac{650}{220}} \times 12\frac{1}{2} = 14\frac{1}{2}$ knots. This speed can probably be maintained in smooth water without the assistance of the wind.

In a series of voyages, the winds blow as long in favor of as against any ship. When the wind is against her, she furls her sails; but when it is in her favor, she spreads them and takes all the advantage. Thus, on a long voyage or series of voyages, the wind helps more than it hinders. It appears from an average of a number of voyages that the

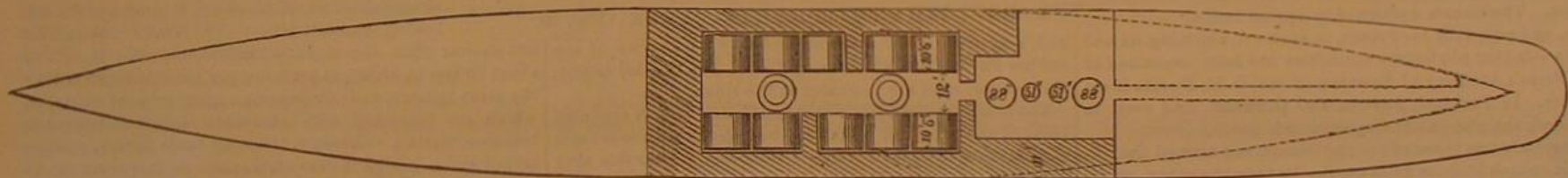


DIAGRAM SHOWING THE GENERAL ARRANGEMENT OF THE MACHINERY AND COAL BUNKERS OF THE CITY OF PEKING.

The ship is propelled by two pairs of compound engines, each pair having two cylinders: Diameter of high pressure cylinders, 51 inches; diameter of low pressure cylinders, 88 inches; stroke of pistons, 4 feet 6 inches. The object of using two pairs of engines is to guard against having the ship disabled if one engine should break down. As the ship has to make a trip of more than five thousand miles, through an ocean which is almost always in a perpetual calm, the breakage of one pair of engines might necessitate her to make her way, under sail alone, twenty-five hundred miles to the nearest port. But now, if any accident (with the single exception of breaking the crank shaft of the after engine or the line shaft or screw) happens, the remaining engine will suffice to bring the ship into port at a very slightly reduced speed. In order to avoid as far as possible the liability of breaking the crank shaft, it has been made in excess of strength, the diameter being 18 inches (in place of 17 $\frac{1}{2}$ inches as it would usually have been made), giving an excess of strength of 8 per cent over the usual practice.

The object in using a pair of cylinders in place of a single one was to divide the maximum strain upon the machinery into two portions, which are successively applied as each engine passes the center, thus allowing the machine to be built lighter, and still to retain the advantage of a high boiler pressure and great expansion, and to obtain as good or better economy than can be had in a single cylinder.

The general style of the engines is of the type developed by the late John Elder, of Glasgow, Scotland, having two cylinders connected to cranks at right angles, and an intermediate reservoir called a receiver. The steam enters the high pressure cylinders and follows the piston through about $\frac{1}{4}$ of the stroke, at a pressure of about 50 lbs., the difference between this and the boiler pressure of 60 lbs. having been lost in the friction of the steam pipe and the intricate passages in the valves. The steam is expanded in the high pressure down to 8 lbs. above the atmosphere, and is exhausted into the receiver at a pressure of 5 lbs. above the atmosphere. From the receiver it is admitted into the low pressure cylinder during nearly $\frac{1}{4}$ of the stroke, and is still further expanded to 7 lbs. below the atmosphere or an absolute pressure of nearly 7 $\frac{1}{2}$ lbs., where it is exhausted into the condenser, giving a total measure of expansion of nearly 9 times. In order to obtain this in a single cylinder, the steam would have to be cut off at less than $\frac{1}{2}$ of the stroke, and the variation of pressure would be from 68 lbs. to 6 $\frac{1}{2}$ lbs. per square inch, in place of from 50 to

reasoning from the following facts: 1. The cost of a ship depends upon her tonnage or displacement. 2. The cost of fuel to propel her at a given speed is proportional to the square of the cube root of the displacement.

Take then the cases of two ships, to make a voyage of 5,000 miles at a speed of 15 knots per hour; and we have the following:

Tonnage	5080 tons	2600 tons
Displacement	7200 tons	3600 tons
Power required	5270 horse	3400 horse
Space occupied by machinery and coal	2130 tons	1380 tons
Available space for cargo and crew	2950 tons	1220 tons
Ratio of paying load	100	41
Ratio of cost to run	100	64
Ratio of first cost	100	52

Thus, it appears that, as the size of a ship increases, the economy increases, from the less cost of fuel to propel her in proportion to the paying load that she can carry, without considering the less proportionate cost of officers and crew for a larger ship. The size of ocean steamers has been continually increasing since their introduction, wherever they are able to run full and can be rapidly discharged and loaded. In addition to their economy, the large ships are much more comfortable for passengers on account of their less motion in rough weather.

The City of Peking will take the place, on the China and Japan route, of a vessel of 3,500 tons burden. She is fitted for 150 cabin and 1,800 steerage passengers. The saloon and state room accommodations are as luxurious as in any ship entering the harbor of New York, while the comforts of the steerage are probably in excess, as will be appreciated by any one noticing the light between decks, 8 feet, and the numerous air ports, whose light above the water line at deep draft will allow of their being kept open in smooth weather. There is a Root's rotary exhauster, worked by a separate engine placed in the engine room, from which pipes are led into the most inaccessible portions of the hold and through the steerage, to withdraw the foul air and gas which would otherwise accumulate, its place being supplied by fresh air from the deck. The application of this exhauster is an experiment on merchant vessels, but it is believed that it will mitigate the poor ventilation incident to all ships, and the tendency of the inside of the skin of the ship to sweat, sometimes a serious objection to iron ships in warm climates.

The diagram shows the arrangement of the boilers and machinery in the City of Peking. The shaded portion shows the

wind increases the available power of a ship about one third, and therefore the available power of the City of Peking will be equivalent to 5,200 horse power, and the average speed, if worked at full power, at a draft of water of 18 feet 6 inches, will be: $\sqrt{\frac{5,200}{220}} \times 12\frac{1}{2} = 15.9$ knots. This speed would carry the vessel from San Francisco to China in 13 days on 85 tons of coal per day. The amount of coal carried would have to be 1,500 tons, leaving 4,000 tons of space for crew and paying load.

The Royal Yacht.

The new royal yacht Osborne was launched in 1870, but, proving weak, has been strengthened, replanked, and finally finished. She recently made a trial trip of six hours, and attained a speed of 14.85 knots per hour. The following are some of her particulars: Extreme length, 278 feet; extreme breadth, 35 feet 1 inch; oscillating engines, cylinders, 6 feet 8 $\frac{1}{2}$ inches; feathering paddle wheels, floats 11 feet 6 inches; 2 funnels, twenty furnaces; mean steam pressure, 23.3 lbs.; mean revolutions, 24.98; mean speed, 14.85; mean indicated power, 3,374; mean consumption of coal, per indicated horse power per hour, 3.95 lbs.; capacity for fuel, two days' steaming.

The Liverpool Landing Stage.

This structure, probably the most magnificent floating platform in the world, was recently totally destroyed by fire. It consisted of a large number of pontoons, having iron frames and wooden fittings, which in all aggregated a length of 700 yards, and a width of 80 feet. The structure was used as a place of debarkation and embarkation for the many steamships in the harbor. The timbers were creosoted or tarred, and it is believed that the gas arising therefrom became ignited, communicating the flames to the newly caulked deck.

John E. Gavit.

We regret to learn of the death of Mr. John E. Gavit which took place on August 25, at Stockbridge, Mass. Mr. Gavit was President of the American Bank Note Company, Secretary of the American Institute, and an earnest student and promoter of microscopical science, in which branch of knowledge he was recognized as an authority. He was also identified with the art of steel engraving.

AMERICAN shad have been lately shipped in cans to Persia

THE GRAPE PHYLLOXERA—SIXTY THOUSAND DOLLARS REWARD OFFERED FOR A REMEDY FOR THE GRAPE DISEASE.

The French National Assembly has recently passed the following law, the text of which we translate from *La Nature*:

Article 1. A prize of three hundred thousand francs (\$60,000), to which will be added the voluntary subscriptions of departments, of communes, of associations, and of individuals, will be granted by the State to the inventor of a method, both efficacious and economically applicable in the generality of soils, for the destruction of the phylloxera or the prevention of its ravages.

Article 2. A commission, named by the Minister of Agriculture and Commerce, will be charged; I. To determine the conditions to be fulfilled in order to compete for the prize. II. To decide upon the methods presented and to make the award.

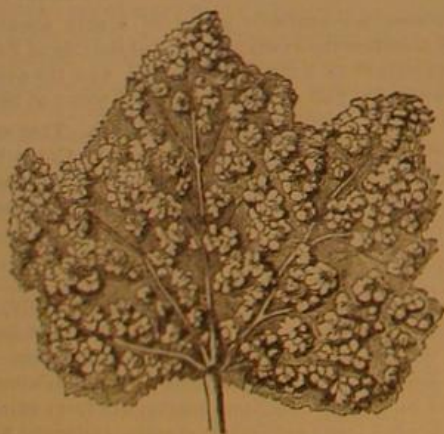
The commission, under M. Dumas, President, has already entered upon its labors. The reward, we believe to be open to the citizens of all nations.

None of the methods proposed for the destruction of that scourge of the vineyard have proved availing. The insect is indigenous to the North American continent, and has been found in nearly all portions of the United States; so that in this country abundant opportunity is offered for its study and for experiment. The successful inventor will not only earn a worldwide fame, but a large fortune, for the definite sum above named will probably be greatly augmented by the private rewards offered by the wine manufacturers of Southern France, whose business has been terribly injured by the destruction of their vines by the parasites.

The phylloxera is a peculiar genus of plant lice, comprising several species, none of which affect man's interest excepting that known as the *vastatrix*. Its attack upon the vines of France began to attract serious attention soon after the close of our civil war, the roots of the plants affected becoming swollen and bloated, and finally wasting away. Professor Planchon, in 1868, recognized the injury as caused by the puncture of a minute insect, to which, after study, he gave the name by which it is now known, and which Professor Riley, State Entomologist of Missouri, from whose recent report we extract the following facts and engravings, subsequently found to be the same as that indigenous to the United States. The disease continued to spread in Europe, and especially in France, to such an alarming extent that a standing phylloxera committee has been organized in the French Academy of Sciences, of which M. Dumas is secretary. In Portugal, Austria, and Germany, and even in England, the plague has also appeared.

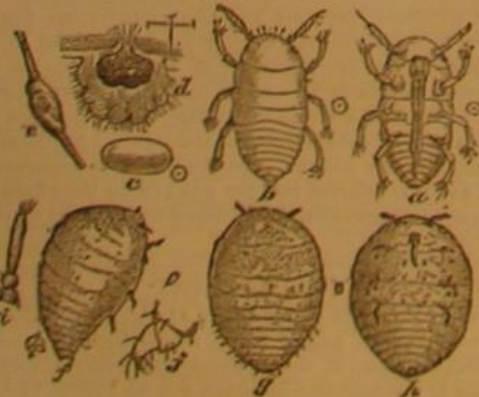
There are two types of the phylloxera, one termed the *gallicola*, which lives in galls on the leaves: the other, or *radicicola*, in swellings of the roots. In Fig. 1 is shown the

Fig. 1.



underside of a leaf covered with the galls. On opening one of the latter (see d, Fig. 2) the mother louse is found at work, surrounding herself with pale yellow eggs. She is about 0.04 inch long, spherical in shape, and of a dull orange color. When six or eight days old, the eggs hatch into little oval hexapod beings, which differ from their mother in being of

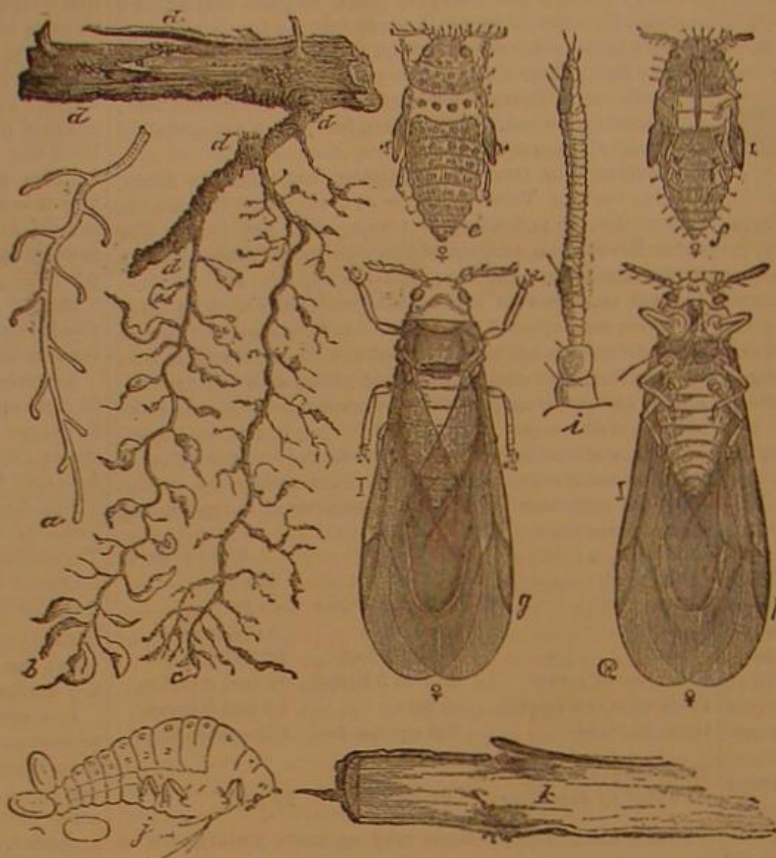
Fig. 2.



a brighter yellow, and having more perfect legs and antennae. These issue from the gall, scatter over the vine, and, on reaching the tender terminal leaves, begin to pump up and to appropriate the sap. In a few days the gall is formed, and the louse, also growing, begins a parthenogenic mater-

nity by the deposition of fertile eggs, from 200 to 500 in number. Each egg brings out a fertile female. So prolific is the generation that Professor Riley estimates that the product of a year would encircle the earth thirty times, each individual touching the end of another.

In autumn, the dwellers in the galls descend to the roots, and there hibernate. During the summer the number of the parasites is immensely reduced by their natural enemies. The precise conditions which determine the production and multiplication of the type cannot be stated, but it is said to be evident that the nature and constitution of the vine are important elements. In our second figure are shown various characteristics of the type. *a* and *b* are ventral and dorsal views of newly hatched larvae, *c* is an egg, *d* a section of



THE ROOT-INHABITING PHYLLOXERA (Fig. 3).

gall, *e* swelling of an attacked tendril, *f g h*, views of the mother larva, *i* her antennae, and *j* her two jointed tarsus. The natural sizes are indicated at the sides.

The newly hatched larvae of the *radicicola* at first resemble those of the type just described; but they shed the smooth skin, and acquire raised warts or tubercles. After this they appear in two principal forms; one, *e f g*, Fig. 4, is of a more dingy greenish yellow, with more swollen fore body and tapering abdomen. In the same illustration, *b* is the larva, hibernating; *c* the roots of the vine; *d* the antennae and leg of larva, and *h* the granulations of the skin. The second or more oval form eventually develops wings. In Fig. 3, *a* is a healthy root; *b*, one on which the lice are working; *c* a deserted and decaying root; *d* shows how the parasites are found on larger roots; *e* is a female pupa (dorsal view), and *f*, ventral view; *g* and *h* are similar views of winged female; *j*, side view of wingless female, and *i* the antennae; and *k* shows how the puncture of the lice causes the larger roots to rot.

As to the best means of coping with the disease, Professor Riley suggests grafting the more susceptible vines on the roots of the more resistant varieties. The Southern fox (*vulpina*) is the only species exempt from both leaf and root lice, but this does not flourish above latitude 35°. The same authority recommends a bath of weak lye or strong soap suds before planting the young ones, as the best safeguard. A thorough sprinkling of the ground with lime, ashes, sulphur, salt, or similar substances destructive to insect life, in from July till fall, will also have a beneficial effect. Planting the vines in a soil mixed with sand and soot is also advised. The natural enemies of the phylloxera are the thrips, the lace wing fly, the lady bird, the synchus fly, and the phylloxera mite. Fig. 5 represents the last mentioned. The leaf lice, it seems, may be controlled by care in destroying the first galls and in pruning and destroying the terminal growths of infested vines later in the season. The root lice are not so easily reached, and it is for a direct remedy for these that the large French reward is offered.

The only known and certain cure is submersion for 25 or 30 days, in September and October, or 40 or 50 days in winter. Temporary irrigation will not answer. Carbolic acid, oil of cade, arsenious acid, sulphide of calcium, sulphide of mercury, and arsenate of potash, will all kill the insect when brought in direct contact; but this, in field practice, cannot be done, or else a strong enough solution cannot be used without injuring the vine. A thorough mixing of the soil with carbolic powder has given good results. Bisulphide of carbon, upon which extensive experiments have been made by a special French commission, proves to be costly and laborious in application: while there is great difficulty in its reaching and killing all the lice without injuring the vine. Besides, it is dangerous to use, its vapor being extremely volatile and explosive. The application of fertilizers intended to invigorate the vine, and, at the same time, injure the lice, has been productive of good. Especially has this been the case with fertilizers rich in potassic salts and nitrogenous compounds, such as urine. Sulphuret of potassium dis-

solved in liquid manure, alkaline sulphates with copperas and rape seed, potassic salts with guano, soot, and cladders, are among other applications favorably mentioned.

The Bamboo.

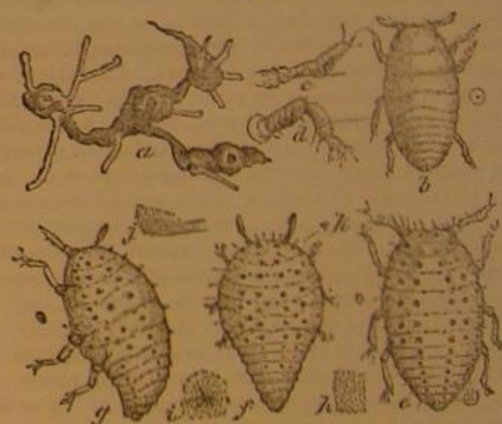
A pamphlet has been published at Cairo by the Agricultural Department of Egypt, on the Indian bamboo, which, it is said, is being acclimatized there with great success. We append a few notes therefrom:

The gigantic bamboo, which is of colossal dimensions, growing to the height of 64 feet, and is 15 to 18 inches in circumference, from the joints of which, especially those of the middle and upper parts, grow numerous branches with long leaves, is the most vigorous species of this arborescent plant. It was introduced some years ago into the gardens of the Khédive of Egypt, at Ghézireh, from whence it has been multiplied in two or three other gardens of Egypt. It was so much admired by the Emperor of Brazil, on his visit to the gardens of the Khédive last autumn, that he expressed his determination to import it into Brazil, and to cultivate it upon the Imperial estates as a shade for animals during the heats of summer. The gigantic bamboo originates in India and China, and is highly appreciated wherever it is cultivated, being used for posts in pavilions and the houses of the inhabitants. The hollow joints are utilized for carrying liquids, for flower vases, etc.; and in China, and especially in India, for bottles and tobacco boxes, highly wrought and polished, and sold at great prices. The larger stalks are also used for bridges, water pipes, and carts and other vehicles. In fine, the wood is employed in the arts, in a multitude of industries, and for implements of agriculture. This species of bamboo vegetates with such rapidity that it can almost be said that one can see it grow. Its progress may be seen from day to day, and at Ghézireh it has been known to grow 9 inches in a single night. In China, criminals condemned to death are subjected to the atrocious punishment of impalement by means of the bamboo.

A humid soil is congenial to the gigantic bamboo, although it suffers under a prolonged inundation. It is proposed in Egypt to cultivate it upon the borders of the canals in the vast domains of the Khédive.

There is also in the gardens of Egypt another species of bamboo, believed to be the *bambusa arundinacea* of Willdenow. It presents the following characteristics: The stalks are smaller and shorter than the gigantic bamboo of India; it attains about 39 feet in height; it forms larger tufts or clusters than the great bamboo, and throws out a great number of stalks, which are furnished with numerous slender and flexuous branches, bearing, ordinarily, tolerably large thorns, a little arched at the joints or articulations; and the leaves are smaller than those of the gigantic species, being rounded at the base, lance-shaped, tapering to a point, and a little downy.

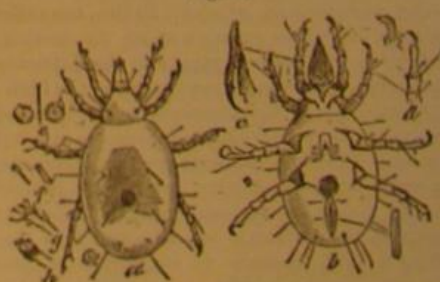
Fig. 4.



There is another species of bamboo which it is proposed to cultivate in Egypt. It attains a height of 16 or 20 feet, produces enormous clusters of canes, about the size of the finger, and makes excellent props for use in horticulture. A plant of two or three years' growth will furnish a hundred stalks, forming a cluster of vast size. This species is the *bambusa edulis*, so called from the fact that its young shoots are edible, and in China regarded as very nourishing.

There is still another species of bamboo to which the attention of the cultivators in Egypt is called. It is the black bamboo (*bambusa nigra*). It is distinguished principally by

Fig. 5.



its slender branches, which are of a fine black color, and from which canes are manufactured extensively for exportation. Pens are made from the smaller stems, which are commonly used for writing in Egypt.

Static Induction Produced by Means of Ruhmkorff's Coil.

The author finds that if the current of a battery, alternately interrupted and re established, is made to pass through the thick wire of a Ruhmkorff's coil, two induced currents in contrary directions appear in the fine wire, and for a certain explosible distance there seems to be only one current produced. This current is direct, and the sparks given by it have quite the appearance of sparks of static electricity. Reciprocally, if a series of sparks of static electricity are passed through the fine wire, we receive in the thick wire

Interesting Experiments upon the Suspension of Clay in Water.

In a paper read before the Royal Physical Society, Edinburgh, by William Durham, F.R.S.E., he says: "It has been long known that pure water has the power of holding clay in suspension for an indefinite time, and also that salts of lime when added, even in small quantity, to water, destroy this power. I have made a considerable number of experiments on this subject, and the results appear to me extremely interesting.

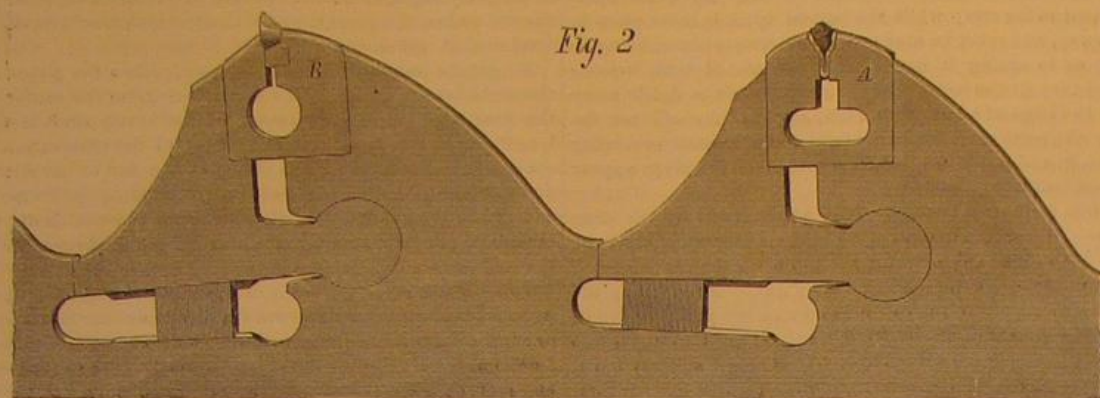
The power which water possesses of sustaining clay is

opaque for three days, while water only was seen through in about a day and a half.

In solutions of sodium carbonate of varying strengths (and most probably in all alkaline solutions), the greater part of the clay sunk to the bottom, and the liquid cleared in the inverse order of the specific gravities of the solutions, so that the densest liquid settled and cleared first.

Water whose power of sustaining clay had been destroyed by an acid had this power restored, in great measure, to it by the addition of any of the alkalis.

On substituting finely powdered white silica for clay, the



EMERSON'S DIAMOND HOLDERS, AS INSERTED IN CIRCULAR SAWS. See page 159.)

currents quite analogous to those given by the battery. On examining these currents by means of a voltmeter, there appears to be merely one current in an inverse direction.—*M. E. Bichat.*

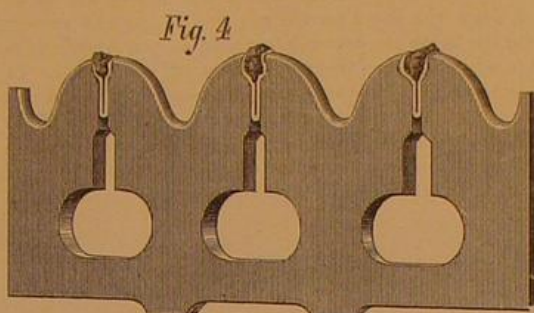
Leaf and Flower Impressions.

Oil a piece of white paper on one side; hold the side that is oiled over a lamp or pine knot smoke till quite black; place the leaf on the black surface, as the veins and fibers of the leaves show plainer on the under part; now press it on all parts of the leaf with the fingers; then take up the leaf and put the black oiled sides on the page of a book (made for leaf impressions) with an extra piece of nice paper on the top to prevent smutting the opposite page; press it a few moments; then remove the green leaf, and the impression will be left on the page as beautiful as an engraving. Flowers of single corolla can be pressed in like manner. Many of the geranium leaves make beautiful impressions. The impression book can be made still more interesting by giving botanical classifications of each leaf and flower.

IMPROVED VERTICAL PLANING MACHINE.

Vertical planing machines are now becoming pretty general in engineering workshops of the first class. The Chinese Government have lately established arsenals and dockyards on the European system at several of their principal ports, and among the tools sent out from this country by Messrs. John Bourne & Co., to furnish these establishments, there is a type of vertical planing machine which offers several features of advantage. Of this machine we give an illustration, for which we are indebted to *The Engineer*.

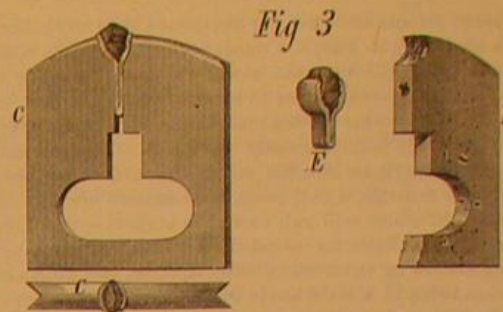
Upon a planed base of cast iron formed with grooves fitted with T headed bolts, for the attachment of the object to be operated upon, two strong standards are erected which carry planed cross pieces at the top and bottom, along which is drawn, by means of screws, a great upright bar, which carries the cutting tool. The tool holder with the tool, or, if desired, three tools, is made to travel up and down upon the vertical bar by means of a screw—shown in the engraving—and after each cut the vertical bar is drawn sideways by the top and bottom screws through a suitable distance, whereby an action resembling that of an ordinary planing machine is maintained, except that the cut is vertical. The foundations in many parts of China being precarious, the tool is so constructed as to be independent of walls or buildings. The vertical travel is 12 feet, and the horizontal 16 feet. The cutting tool travels up at twice the speed that it travels down, and, as will be seen by a reference to the engraving, the design is one which combines strength with simplicity. The base plate is formed in two parts bolted together laterally for facility of shipment. Only about one third of its depth is shown above the floor. At the back of the machine there is a pit about 3 feet deep in which the attendant stands when the machine is at work.



DIAMOND HOLDER FOR STRAIGHT SAWS.

gradually destroyed by the addition of an acid or salt. For example, by stirring the jar of water with a glass rod slightly wet on the point with sulphuric acid, the power of sustaining clay was considerably diminished; by adding one drop of acid it was still further diminished, while with two drops the power seemed completely destroyed, as the water cleared rapidly.

In solutions of sulphuric acid and sodium chloride of varying strengths, the greater part of the clay sank to the bottom



DIAMOND HOLDER AND DIAMOND.

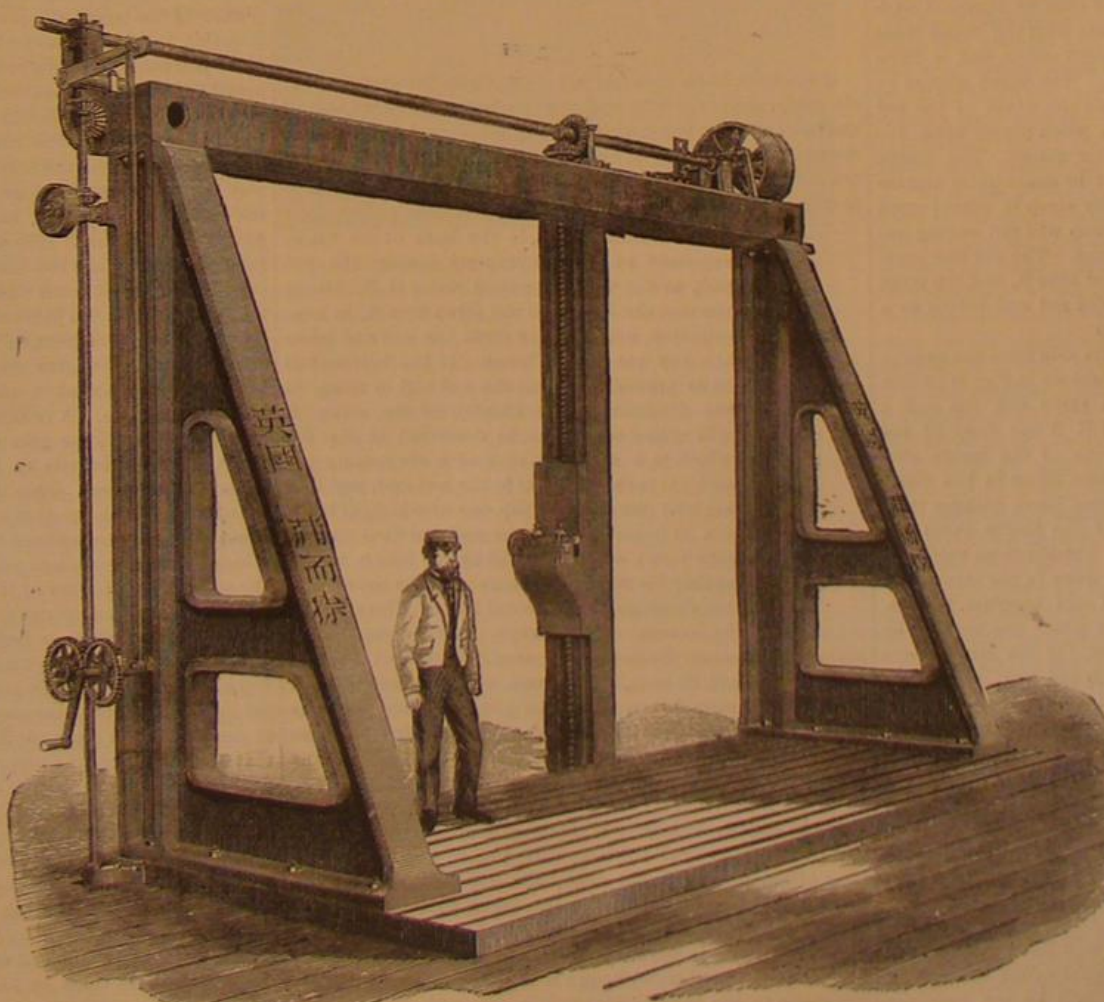
same general results were obtained, but in a much modified form as to the time of clearing, the silica settling much more rapidly in every case than the clay.

These remarkably contrasted actions of acids and alkalis have not been noticed before, so far as I know, and, besides being of much scientific interest, may be of practical importance. I have not been able as yet to discover the cause of these phenomena, but it appears to me extremely probable that the clay, in falling through the water, generates, by friction, electricity; and as water is a bad conductor, the difference in potential between the clay and the water continues for some time, hence they are mutually attracted; but, when acid or salt is added, the liquid becomes a good conductor, the potentials are equalized, and the clay falls. With the alkali, on the other hand, although the liquid does become a better conductor, it at the same time becomes a better generator of electricity; and it is only when, by adding a considerable quantity of alkali, the conducting exceeds the generating power that the potentials are equalized and the clay falls. I hope to be able shortly to put this idea to the test of experiment."

Dealing with Workmen.

In a recent address to the British Association of Gas Managers, Mr. Geo. T. Livesey, the president, made the following observations, which apply not only to gas men, but to workmen of every class and profession:

"A source of great anxiety has been, and is still, the difficulty of dealing efficiently with their workmen. Undoubtedly the advance of wages so universally applied for, or expected, has been founded on circumstances that must be admitted in many cases to be a justification for the claim. When such grounds exist for an advance, I hold it to be to the interest of the manager, as well as his duty, to be the first to move in the matter, for I have found that men in regular constant employ, being generally steady, honest workmen, do not often make a request for an increase unless they have fair reasons for doing so, and it is a mistake to wait until they make the application. I have felt, when this has been the case on the part of a good servant, that I had done him an injustice in not giving him the advance unsolicited. I would further say, 'Do not put a man off with excuses. Consider the matter at once, and give him an answer. If he is already sufficiently paid, tell him so; but, if not, remember that 'he gives twice who gives quickly'; and from that day let the extra pay be granted.' So small a sum as 3d. or 6d. a day may make all the difference between a contented and



VERTICAL PLANING MACHINE FOR THE CHINESE GOVERNMENT.

of the jar, and the liquid became clear in the order of the specific gravities of the solutions, so that the densest liquid settled and cleared last. This effect was more decided in the acid than in the salt solutions.

The power which water possesses of sustaining clay in suspension is gradually increased by the addition of small quantities of the alkalis, or their carbonates, and lime. Thus water having 3 grains of sodium carbonate in it was quite

a discontented workman; while the one may be worth, in the value of the work done, twice or four times that amount more than the other.

It is all very well to say that the price of labor, like that of coal or iron, is regulated by the inexorable law of supply and demand; but this law, though perfect in its application to the purchase of materials, has only a partial application where a man's labor is concerned."

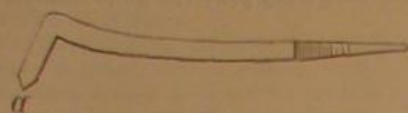
PRACTICAL MECHANISM.

NUMBER VIII.

BY JOSHUA ROSE.

VISE WORK—TOOLS FOR SCRAPING SURFACES.

Surfaces requiring to be very true may be got up with the scraper, the best form of which is that shown in the following illustration, the point, *a*, being the cutting edge. It is



less liable to jar and more readily sharpened than any other. For use on wrought iron, the cutting edge should be kept moistened, or it will tear the metal instead of cutting it cleanly. All surfaces intended to be scraped should first be filed as true as possible with a smooth file, care being exercised to use a file that is evenly curved in its length and slightly rounding in its breadth. After the surface has been scraped once or twice, a well worn, dead smooth file may be passed over it, which will rub down the highest spots of the scraper marks and greatly assist the operation of scraping. Scraping should be executed in small squares, the marks of one square being at a right angle to the marks of the next; then, after the surface plate has been applied, repeat the operation of scraping in squares, but let the marks cross those of the previous scraping. The face of the surface must be wiped off very clean before the surface plate is applied, or the surfaces of both the plate and the work will become scratched. The face of the plate may be moistened by the application of a barely perceptible coat of Venetian red, mixed with lubricating oil, rubbed on by the palm of the hand, to operate as marking to denote the high spots. In applying the surface plate, move it both ways on the work, and reverse it endwise occasionally. If the work is light, it may be taken from the vise and laid upon the plate; but much pressure need not be placed upon the work, or it will spring to suit the surface of the plate, and thus appear to be true when it is not so. Small surfaces should be rubbed on the outer parts of the surface of the plate, by which means the wear on the surface plate will be kept more equal.

FITTING CONNECTING RODS.

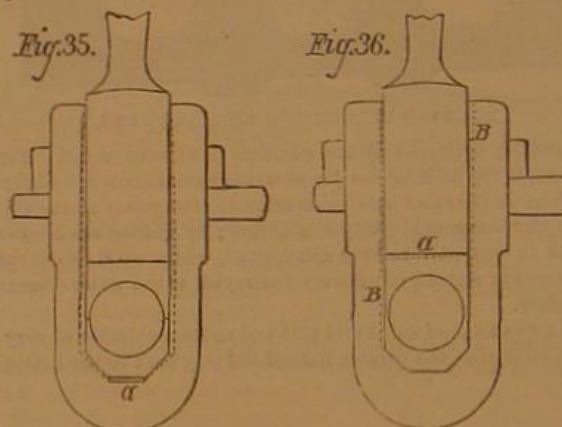
The planing work on a connecting rod being complete, the first thing for the fitter to do is to mark off the key ways, the bolt holes (if there are any), the holes for the set screws, the oil holes, etc., so as to have the drilling completed before the straps or rod ends are filed up, because drills leave a burr where they come through the metal, and because the clamps, which hold the work while it is being drilled, are apt to leave marks upon it. The holes should then be tapped, when the rod will be ready for the file. The faces of the rod whereon the straps fit should then be surfaced with a surface plate, and made quite square with the broad faces of the rod, parallel crosswise with each other, and a little taper with each other in the length. The strap should be made narrower between its jaws than the width of the rod end, so as to require to spring open when placed upon the rod end if the brasses are not in their places. The inside faces of the jaws of the strap must be made quite square with the side faces, so that, when the strap is placed upon the rod end, the latter faces of the strap will not spring out true with the broad faces of the rod end. The rod end must have a light coating of marking rubbed over it, and the strap moved back and forth on it, so that the rod end serves as a gage and surfacing block to the strap.

If, when the strap is on its place, its side faces are uneven with the side faces of the rod end, as shown in Fig. G (which is a sectional view of a strap and rod end, *a* being the rod end, and *B B* the jaws of the strap), either one or both of the inside side faces of the strap require filing in the direction denoted by the dotted lines, because it is only in consequence of the inside faces not being square with the outside faces that this twist occurs. The key ways in the strap and rod end should be filed out together, that is, while the strap is on its place and secured by being clamped or bolted. If the strap is one held to the rod by a gib and key, the width, from the end of the rod to the crown of the strap when it is placed in position to cut or file out the key way, should be that of the extreme width of the brasses when the joint of the

brasses is close, less the amount of taper there is on the key. The key way should then be filed out parallel, both in its width and breadth, and surfaced with a surface plate, the breadth being equal to that of the gib and key together when the head of the key is even with the head of the gib; then when the key way is finished and the strap is placed in its intended position on the end of the rod, the strap will have moved back from off the rod end for a distance equal to the amount of the taper on the key, so that there will be the requisite amount of draw on the key way of the strap on the one side and on the key way of the rod on the other side, while the key will at the same time come through the strap to its required distance. The faces of the rod end, whereon the jaws of the strap fit, having been made (as directed) a little taper, and the strap allowed (as described) a little spring, the rod end will enter the strap somewhat easily, and tighten as it passes up the strap, so that, when quite up, the strap will fit a little tighter than it is intended, when finished, to do. When the

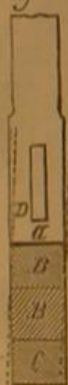
strap is fitted and keyed to the rod, a light cut should be taken off the faces of the rod and strap while they are together, the bolts of a bolt rod being sufficient to hold the strap for that purpose; but in the case of a gib and key, a piece of wood should be placed between the rod end and the crown of the strap, that is, in the space intended to be filled by the brasses, and the wood keyed up so as to lock the strap on the rod while the faces of the rod and strap are planed. This being complete, the strap is ready to receive the brasses. The bottom of back brass must be made to a tight fit, so as to spring the strap open sufficiently to make it fit the rod end as easily as required; thus both the brass and the strap will be closely fitted. The top brass must be fitted to the strap while the bottom brass is in its place in the strap, and must be made to fit the strap without being so tight as to spring it open. The corners of both brasses where they fit the corners of the strap should be eased away with the edge of a half round file, so that they will not destroy the corners of the strap (when the brasses are being driven in and out to fit), which would make the strap appear to be a bad fit on the rod.

While fitting the top brass, it is necessary to try the strap on the rod end (the brasses being in their places) at intervals, so as not to take any more off the top brass than is necessary to let the strap fit the rod end. As a guide, when fitting the brasses to the strap, the callipers may be set to the width of the rod end where the strap fits, and applied to the strap when the brasses are driven in to fit. The gib and key must, when placed together edgewise, be quite parallel in their total breadth, so that they will fit properly against each other and against the key way in the rod end and the strap. When setting the gage for the size to which the brasses are to be planed, place the strap on the rod end to get the correct size, for the strap is narrower (between its jaws) when it is off than when it is on the rod, because of the spring. In bedding the back brass to the strap, let it bear the hardest, if anything, upon the crown, for if the bevels of the brass should keep the crown from bedding, the strap would spring away from the rod end, in spite of the gib (or the bolts, if there are any), when the key is driven home, as illustrated in Fig. 35.



If the back brass does not bed down upon the crown, *a*, of the strap, the latter will spring away from the block end of the rod and from the brasses on the sides, and will assume the shape denoted by the dotted lines. Should the top brass not bed properly against the rod end, the trap will spring as described in Fig. 36.

Fig. 37.



The dotted line, *a*, is the back of the brass, supposed to bed improperly against the rod end, as shown; the dotted lines, *B B*, denote the manner in which the strap would, in consequence, spring away from the rod end when the key was driven home. If the brasses fail to fit properly against the rod end or strap, in the direction of the breadth of the strap, it will spring out of line, as described in Fig. 37, which is a sectional view of a connecting rod end. *C* is the strap, *D* is the rod end, and *B B* are the brasses, the top one of which, if it did not fit square against the rod end (but on one side only), as represented by the line *a*, would spring the strap out of true with the rod end, in the direction of the dotted lines. The strap is, by reason of its shape, very susceptible to spring; and unless the brasses, or even the gib and key, are quite square and fit well, it is certain to spring out of true. The brasses should be a fit on the journal when they are "brass and brass," that is, the joint of the two brasses close together, so as to take the pressure of the key, which thus locks the strap and brasses to the rod end, and prevents them from moving, or working, as it is called, when the rod is in action; especially is this necessary in straps having a gib and key to hold them to their places, because, if the joint of the brasses is not close, the key cannot be driven home tightly, and hence there is nothing to lock the strap firmly to its place. If, however, the strap is held to its place by bolts, it is not so imperative to keep the joint of the brasses close together, although it is far preferable to do so, especially in the case of fast-running engines, not only on account of the assistance lent by the key to hold the strap firmly, but also because it holds the brasses firmly, and the key cannot bind the brasses too tightly to the journal, even though the key be driven tightly home, so as to assist the set screw in preventing it from slacking back.

The brasses should be left a little too tight in the strap before boring, because they invariably shrink or go in a little sideways from being bored, as do all brasses, large or small, even if bored before any other work has been done on them.

For driving the brasses in and out of the strap to fit them, use a piece of hard wood to strike on so as not to stretch the skin of the brass and alter its form, as will be explained in future remarks on pening.

The brasses should be of equal thickness from the face forming the joint to the back of the brass, so that the joint will be in the center of the bore of the brasses. The respective faces forming the joint should be quite square with both the faces and sides of the brass, so that they will not spring the strap when they are keyed up, and so that, when the brasses are let together in consequence of the bore having worn, the faces may be kept square, and thus be known to fit properly together without having to put them together in the rod and on the journal to try them, which would entail a good deal of unnecessary labor.

To get the length of a connecting rod, place the piston in the center of its stroke, and the distance from the center of the crosshead pin to the center of the crank shaft is the length of the rod from center to center of the brasses. Another method is to place the piston at one end of its stroke and the crank on its dead center corresponding to the same end of the stroke, and the distance from the center of the crosshead pin to the center of the crank pin is the length of the rod.

To ascertain when the crank of a horizontal engine is upon its exact dead center, strike upon the end face of the crank axle or engine shaft a circle true with the shaft, and of the same diameter as the crank pin; then place a spirit level so that one end rests on the crank pin and the other end is even with the outline of the circle; and when the spirit level stands true, the crank will be upon its dead center.

The length of a connecting rod cannot be taken if the crank is placed in the position known as full power, because the position in which the piston would then be cannot practically be definitely ascertained; for the angle at which the connecting rod stands causes the piston to have moved more or less than half the length of the stroke when the crank has moved from a dead center to full power, according to which end of the cylinder the piston moved from. If it was the end nearest to the crank, the piston moved less, if the other end, it moved more, than half of its stroke; so that in either case the piston stands nearer the crank than is the center of the length of the cylinder when the crank is in the position referred to. This variation of piston movement to crank movement is greater in the case of short connecting rods than with long ones.

To fit a connecting rod to an engine, first rub some marking on the crank pin, and put the crank pin end of the rod on its place, with the brasses in and keyed properly up. The other end of the rod, being free, can be placed so as to touch against the crosshead pin, when the eye will detect if it will go into its place without any spring sideways; if it will do so, the rod may be taken off the crank pin, and the brasses, if necessary, fitted to the pin sufficiently to allow each to bear on the crown. But if the rod end will not fall into the crosshead journal without being sprung sideways, then move it clear of the crosshead, placing a side pressure on it in the direction in which it wants to go to come fair with the crosshead journal, and move it back and forth under such side pressure, which process will cause the crank pin to mark where the connecting rod brasses want filing and scraping to bring the rod true. The rod must then be taken off, and the brasses eased where the marking and the knowledge of which way the rod wants to go determine, the rod being placed on the crank pin as before, and the whole operation repeated until the rod "leads" true with the crosshead journal. The crosshead end of the rod must be fitted in like manner to the crosshead journal until the crank pin end of the rod leads true to the crank pin journal. The rod must then be put on its place, with both journals keyed up, and, if it can easily be accomplished, the engine moved backwards and forwards, the brasses being then taken out and bedded, when the rod will be fitted complete. A connecting rod which has both straps held by gibs and keys gets shorter from center to center of the bore of the brasses as it wears, and that to half of the amount of the wear. This is, however, generally rectified by lining up the brasses—that is, placing pieces of metal behind them (they may be fastened to the brasses if it is desirable)—which pieces are made of the required thickness to replace the amount of the wear of the brasses.

A connecting rod whose crosshead end has a strap with a gib and key, or, what is better, two gibs and a key, to hold it, the crank pin end having its strap held by bolts, and the key, between the bolts and the brass, would maintain its original length, providing the wear on the crosshead brasses was as great as is the wear on the crank pin brasses; but since that on the latter is the greatest, the rod wears longer to half the amount of the difference of the wear between the crosshead and crank pin journals. If both the straps of a rod are held by bolts, the key of one end being between the brasses and the main body of the rod, and the key of the other end between the brasses and the crown of the strap, it would maintain its original length if the wear on both ends was equal; but this not being so, it wears longer, as above stated. When marking off the end of the rod (that is, the circle on the brasses to set them by for boring), or when trammeling a rod to try its length, stand it on its edge; because if it rests on its broad face the rod will deflect, and appear to be shorter than it is; this is especially liable to occur in coupling or side rods, which are generally longer and alighter in body than connecting rods.

The oil hole of a strap for either a connecting or side rod should be in the exact center of the space intended to be filled by the brasses. It will thus be central with the joint of the brasses, and from center to center of the oil holes, and will, therefore, represent the proper length of the rod

When, therefore, the brasses of a rod end whose strap is held by a gib and key, have worn so that the key is let down the brasses must be lined up to bring the key back to its original position, the back brass being lined up so that its joint face comes even to the center of the oil hole, and the other brass being lined up sufficiently to bring the key back to its original position; then the rod is sure to be its proper length. But if the strap is held by the bolts (in which case it does not move when the brasses are let together and the key further through), lining the back brass up to the center of the oil hole at once ensures the rod being of its correct length, without any reference as to what thickness of liner is put on the other brass, or how far the key may come through. In either case it will be observed that the center of the oil hole, when placed as described, forms a gage to keep the rod its proper length. To ascertain what thickness of liner is required for the brass back, place it in its place in the strap, and scribe a line (on the inside of the strap) even with the joint face of the brass; then mark a line across the strap so that the line will intersect the center of the oil hole, and the distance between the two lines will be the requisite thickness of liner.

To find the thickness of liner necessary to the other brass, put the strap in its place with both brasses in, and the back one lined up; then key the brasses up, and scribe a line on the key at its narrowest end, even with the face of the strap; then the difference between the width of the key (on the taper face) at the line (which is the distance it does come through), and the width of the key at or near the narrow end (that is to say, the distance it ought to come through) is the thickness of liner required.

Correspondence.

Car Ventilation.

To the Editor of the Scientific American:

If the public generally knew how soon the air in a railroad car is spoiled and vitiated, there would probably be more zeal in searching for a remedy of the evil; but comparatively few know it, and only those who make the subject a particular study.

Pure air, so called, contains 4 parts of carbonic acid gas in 10,000; and a large passenger car contains about 4,100 cubic feet of floating atmospheric air. If pure, it should not contain more than 1.66 cubic feet of carbonic acid gas. A man exhales 18 cubic inches of carbonic acid gas in a minute. If we suppose that there are 50 passengers in a car, they would exhale 900 cubic inches in a minute, or 5.21 cubic feet in 10 minutes, which is at the rate of 12.55 parts in 10,000; so that in 20 minutes the air is vitiated at the ratio of 25.10 parts in 10,000. Twenty-five passengers would need 40 minutes to come to the same result. This is from the impurities from round lungs. Take into consideration the breath from diseased lungs, and uncleanness of person and clothes, and the case will be still more desperate. For this there is only one remedy: The air must be continually renewed. The question only is, how?

What is called natural ventilation is the flow of air caused by difference of temperature and weight. Where the temperature is equal, or nearly so, in and outside, there is little or no motion of the air. The displacement will increase with the difference in temperature. Suppose the external temperature to be 32°, and the internal 62°, a difference of 30°: the height of a car from floor to ceiling 8.5 feet, and the opening for the discharge of air 2.25 square feet, or 1.5 feet square in all. We would then have: Difference of temperature, $30^\circ \times 0.002036$ (coefficient of expansion) $\times 8.5$ (height of car) = 0.51918 inches difference in height of the pressing column. The amount of air displaced in a second is ascertained by the formula for falling bodies, which, in our case, would give $2\sqrt{0.51918 \times 15.6}$

$\times 2.25 = 2.54$ cubic feet. The amount really displaced is $\frac{1}{2}$ the theoretical result. In a minute, 152 cubic feet are driven out; and as the car contains 4,100 cubic feet, it will be $\frac{4100}{152} = 27$ minutes before the air in the car can be renewed, when the atmosphere is at freezing point outside and moderately warm within, keeping, in all, 2.25 square feet continually open; but with a difference of temperature of only 15°, it would require 54 minutes to renew the amount of air which is vitiated in 10 to 20 minutes. It is very doubtful, however, if ever, in the most approved passenger cars, so large an area is always kept open. In winter it would soon reduce the temperature to below the comfortable point, and most of the passengers would protest, preferring even a bad atmosphere to a chilling draft. In summer, for fear of suffocation, all windows must be kept open; and, of course, dust, smoke, and cinders cannot be kept out. Air may be forced in by funnel-shaped tubes provided the wind blows in the right direction, but with it dust and smoke will come in.

We see that natural ventilation will not fully answer the purpose; and all the neat and ingeniously arranged so-called ventilators, in the frieze and skylight, are more ornamental than useful. There seems to be no other way to solve the question but the application of mechanical means, such as fans or blowers driven by some power, to exhaust the foul and supply the fresh air. The exhaustion should be near the top in summer, and at the bottom during winter. If the power be given, this can easily be done; and any plan for distribution, warming, or cooling can be combined with it.

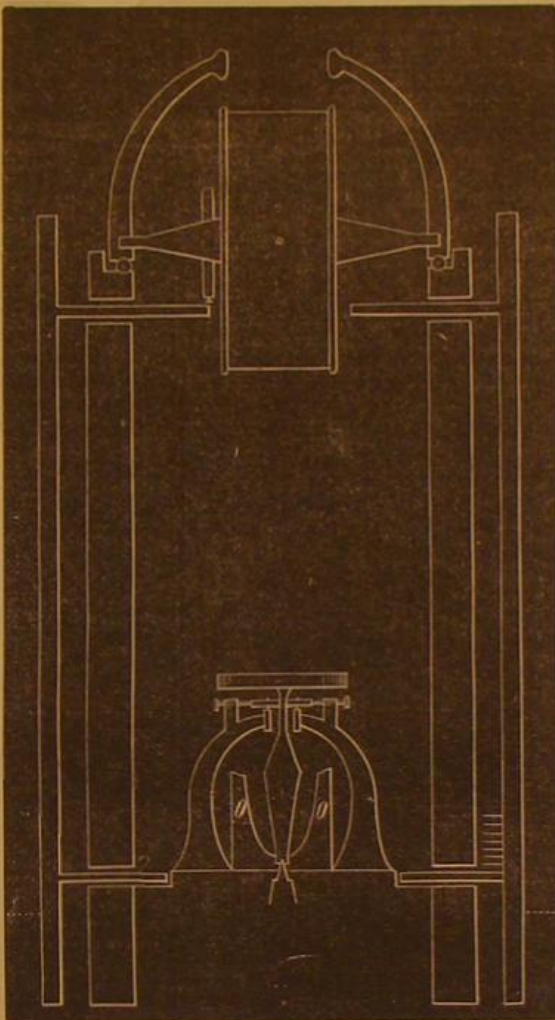
Constructing Mammoth Telescopes.

To the Editor of the Scientific American:

Seeing in your widely circulated paper that a project is entertained in America of constructing a gigantic astrono-

mic telescope, and as various methods have been proposed for carrying out that undertaking, I send you an account of a mercurial reflecting telescope (invented by me and exhibited before the New Zealand Institute), published in the "Transactions" of that Institute, Vol. V., p. 119; whereby advantage is taken of the parabolic figure assumed by liquids rotating in the plane of the horizon; so that objects at the zenith and a few degrees distant therefrom can be magnified by eyepieces in the ordinary manner. A zone of the heavens, a certain number of degrees in breadth, can thus be examined, the sweep of the telescope in right ascension being made by the earth's rotation. For viewing objects not near the zenith, a large plane reflector of silvered glass is used, which first receives the rays from the object, and then reflects them vertically downwards on to the mercurial speculum, which speculum then collects the rays and reflects them convergently upwards through an aperture formed in the plane reflector. In the publication (which I inclose) the theory is fully explained, together with a contrivance for causing the plane mirror to be always at the proper inclination, whenever the finder is directed to the object.

In the accompanying figure, showing the vertical section



of the telescope and observatory, the speculum cup containing the mercury is attached to the top of a long, hollow, conical axis, and a thin, hollow metal float is attached to the bottom of the axis. This float revolves in a vessel of liquid, and this liquid is rotated by conducting it tangentially into the vessel at its circumference, at the parts, O O, while its outlet is close to the bottom of the axis; a spiral motion is thus imparted to the liquid. The size of the float is so adjusted that it displaces nearly as much of the liquid as corresponds to the weight of the speculum. There is then but little weight upon the pivot supporting the axis, which is inserted in solid masonry.

Three curved pillars of stone, two of which are seen in the figure, form supports for three levers for levelling the speculum. These levers have a slow motion, communicated to them by screws fixed near the long end of the levers; and when properly adjusted, the short ends of these levers have contact with, but exert no pressure on, the axis. By this arrangement, the axis is secure from any vibration arising from the gyratory motion of the liquid round the float. Then, if this liquid is supplied from an elevated vessel kept full to overflowing, and if the inlets, O O, and the outlet be kept of a constant size, as gravity is a constant and friction at all parts of the axis nearly annihilated, therefore its periodic revolution is a constant too.

This arrangement contains within itself a centrifugal pendulum for regulating its velocity, and that without adding any other apparatus to the parts already described; for let the vessel containing the float be supplied with a slight excess of the liquid, it is then always full up to its edge, and, when rotating, its surface is rendered concave. If, then, from any circumstance, the revolution becomes accelerated, the liquid becomes still more concave, and consequently exerts less buoyant power upon the float; this leads to extra friction on the bottom pivot, which tends to retard the velocity.

A cylindrical wall of masonry surrounds the speculum, forming at the same time the tube of the telescope and also the observatory. The top of this wall supports a rotating dome with suitable openings, and attached to and rotating with this dome is a large plane mirror of glass silvered on its

anterior surface and optically tested in every part, while constructed by a novel method.

The axis on which this mirror moves vertically is supported in a similar manner to the axis of a transit circle, and similar vertical graduated circles can be attached thereto; and if the dome is made to revolve on a graduated horizontal circle, we shall have a symmetrical arrangement for an altitude and azimuth instrument on a large scale. Exterior to the wall supporting the plane mirror, and entirely unconnected therewith, is another circular wall, and it is this outer wall that supports the floors, through apertures in the interior wall somewhat larger than the supports; so that any movement of the observer will not vibrate the telescope. The steps up the observatory are in the space between the walls and are attached to the outer wall only.

The symmetry of the horizontal speculum precludes any danger either of deflection by its weight or of irregular expansion arising from increase of temperature; for it possesses the same shape and weight in whatever position it is turned; it is, in fact, self-compensating.

The speculum admits of being beveled with extreme precision by an optical contrivance which can also be applied to test the figure of the plane mirror in all its parts, while being constructed.

HENRY SKEV.

Dunedin Observatory, Otago, New Zealand.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

In reply to the last two communications of Mr. Hawkins upon the above subject, I have to say:

1. An experience of twenty years of workshop practice, here and in Europe, under the most favorable conditions, has proved conclusively to me that, by tempering taps, reamers, etc., in a tube "moderately heated," by performing the operation "slowly," and by tempering them to a "brown color," I could obtain a better tool than by the sand bath, or than by any other method of tempering at present practiced in our workshops. What difference there would be in the temper (the color being the same) if more rapidity, or some other changed conditions of tempering, were employed, I have no need to discuss.

2. My given methods for taps, dies, reamers, etc., determine both the elements of time and access of the air; for I say that the tube must be "heated," by which the workman understands "heated to a red." I then say that "care should be taken not to make the tube too hot, for the more slowly a tool is lowered, the more even the temper will be." I think that, if these instructions are followed, there is not much option as to time, since the tempering cannot be hastened, and can only be delayed by intentionally holding it out from the tube; by the term "slowly," I mean as slowly as it can well be performed without purposed delay. If the tube is merely "heated," the operator cannot go wrong.

3. In the tube process given by me, there is a current of air continually passing the steel being tempered, and it receives at the same time its heat equally all around. No other prevailing shop practice gives so free access to the air, and such evenness of heat at the same time. In the case of dies, my plan, as given by me, surrounds all but one face with air, and turns them over and over, that all parts may have equal access to both the air and the heat. Here again my conditions regulate themselves for the given purposes.

4. As to the oxide question, my reason for declining to discuss it was that I thought it liable to divert attention to matters not germane to workshop practice; and J. T. N., in disputing or questioning with Mr. Hawkins whether the colors produced in tempering are films of oxide, or of carbonization (as claimed by Nobili, who gives an excellent reason for his conclusions), proves the correctness of my premises. I have no objection to a discussion of this interesting but disputed question; it is of importance, I grant, but I can go on using my "color thermometer," be it caused by oxidation or carbonization.

5. It may be that the benefits I have found from the methods I give arise from the very fact that they permit of the proper access of the air, and entail, of themselves, a sufficiently defined limit of time to insure results, correct in themselves and at all times equal; and thus they are merely proofs of Mr. Hawkins' elements of time and exposure. I am inclined to think this to be the case, because the departures from the sand bath process (the most generally approved method), recommended by me, give, as Mr. Hawkins advises, free access to the air, and determine of themselves the time by specifying that, in tempering, the hardened steel be subjected to the rays of heated (that is, red hot) iron; for iron "red hot" gives some idea of a certain temperature, while heated sand, not being made red hot, may be made of a wide range of degrees of heat with nothing to denote it, and may, as I have before stated, be hotter in one part than in another in consequence of the unevenness of the fire or of the depth of the sand.

6. I have never tried tempering under conditions which would give a more free access to the air, nor do I know of any method by which more free access to the air and, at the same time, more even heating of the hardened steel can be secured than by the methods I have given; but if Mr. Hawkins can suggest any, I shall be happy to test the same and to report thereon.

JOSHUA ROSE.

New York city.

MR. SAMUEL WEBBER, of Manchester, N. H., requests us to state that the power ordinarily required to card one pound of cotton is $\frac{1}{25}$ of a horse power, and not $\frac{1}{10}$, as printed in our article on his book entitled "Facts on Power," on page 43 of our current volume. Similarly, the best results in carding cotton should be $\frac{1}{10}$ of a horse power instead of $\frac{1}{25}$.

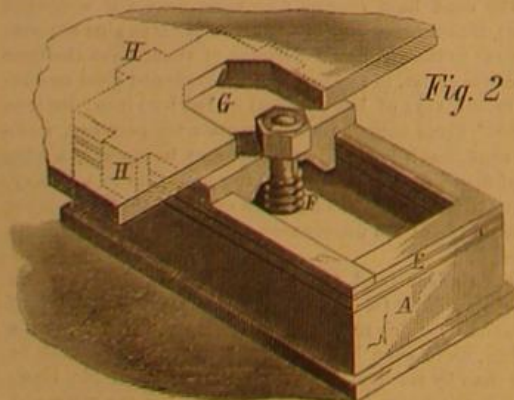
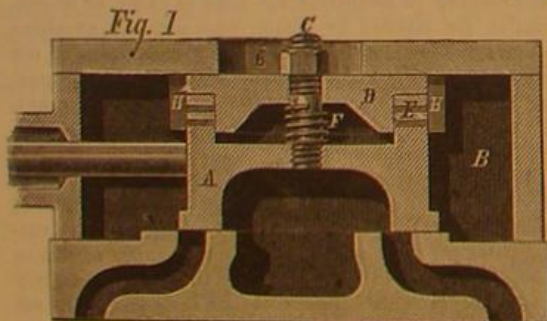
IMPROVED GAS REGULATOR.

We give herewith perspective and sectional views of a new gas regulator, patented through the Scientific American Patent Agency, May 5, 1874, by Mr. Joseph Adams. The pressure of the gas acts on a flexible diaphragm, which is connected with a valve, which opens or closes as the gas is turned on or off from the burner or as the pressure varies in the street mains. The devices arranged with the diaphragm, described below in detail, contribute, it is claimed, to render the regulator extremely sensitive to differences in the flow.

The exterior of the invention is represented in Fig. 1, and from Fig. 2 the interior arrangement will be readily understood. The circular casing of the regulator is of metal, and the parts are joined together through the flanges shown. The latter also fasten, with a gas-tight joint, the outer edge of a flexible annular diaphragm, A, the inner edge of which is riveted between the flanges of the thin metallic hemispheres which form the balloon, B. Upon the top of the latter is a rod, upon which are placed weights, C, to adapt the governor to the variation of pressure for different elevations. The lower hemisphere opens through a pipe, D, to the supply of gas from the meter below, said pipe terminating in a funnel-shaped valve which plays in the valve seat, E. The latter is attached to the bottom of the case, and is adjustable, so as to be lowered to reduce the orifice around the valve, and by this means adapt the apparatus to a low pressure of gas. A movable plate, F, is screwed into the upper portion of the outer casing, and has in its center a small hole for the admission of air to counteract the pressure of gas upon the diaphragm. G is a conduit for the gas, and H the connection for the service pipe. In operation, the valve is adjusted to the particular elevation or pressure of the locality by means of the weights. As the valve, pipe, and diaphragm are in a state of suspension by reason of the buoyancy of the balloon, the pressure on the gas being neutralized by the atmospheric air on one side and by the weight on the other, the diaphragm becomes particularly sensitive to an increased or diminished flow. If the pressure be increased, the diaphragm, balloon, and valve are raised, and the valve orifices proportionally closed; if diminished, the same portions are depressed by the air pressure and weight, the orifice opened, and the flow augmented. For very low pressures, the weights may be entirely removed and the valve seat lowered, or both, as required. By this delicate arrangement, it is claimed, the flow of gas through the burners is made uniform and independent of the pressure from the main and also of the number of burners employed at a time. For further particulars address Joseph Adams, 1,025 Market street, Philadelphia, Pa.

YOUNGMAN'S IMPROVED SLIDE VALVE.

The invention herewith illustrated is an improvement on the ordinary D valve, which is designed to overcome the difficulties arising from the expansion of the metal when heated by steam. The valve fills up the whole of the space of the steam chest vertically, and, while highly elastic, is claimed to be as indestructible as the D valve under any speed or pressure. When the steam is shut off, the valve cannot cock in the yoke, as it takes no air in through the



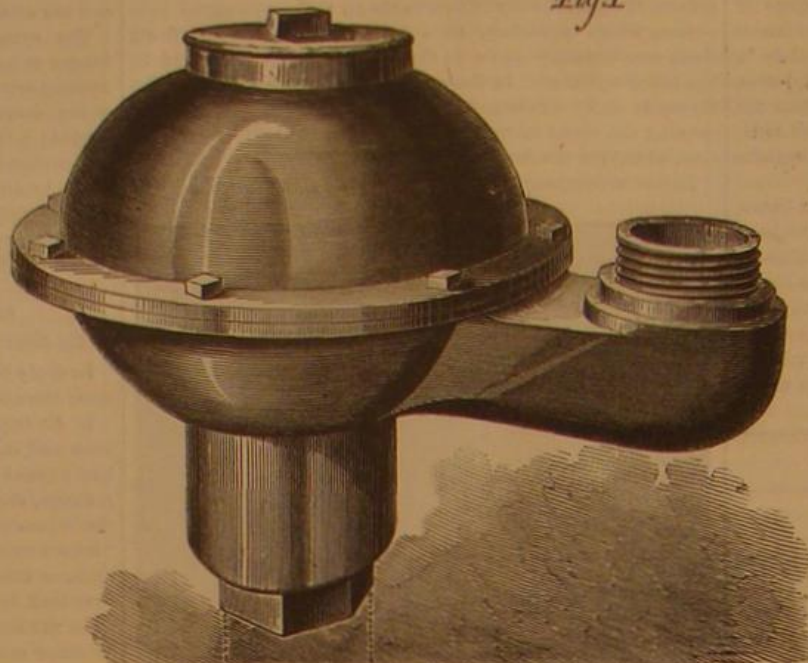
smoke stack, but through the opening in the chest head by the sinking of the cap. The oil is received at the same place.

Fig. 1 is a transverse vertical section of the valve, A, as located in the chest, B. Fig. 2 is a perspective view showing a portion of the steam chest above. Attached to the valve is a screw bolt, C, which passes through the adjustable cap, D, Fig. 1, and is secured by the nut shown. At E,

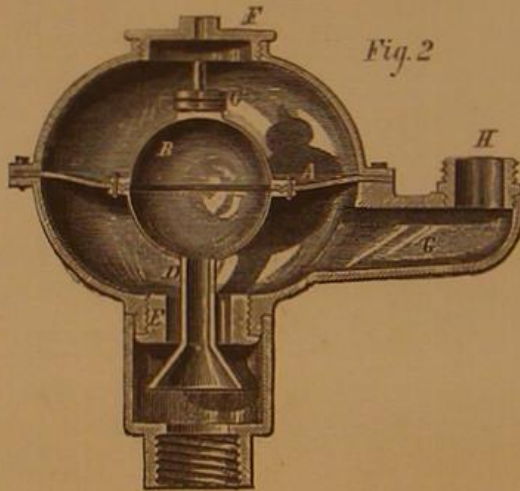
packing is placed, and at F, a spiral spring. An opening, G, Fig. 2, is made in the top of the steam chest in order to allow the nut to travel the full extent of the movement of the valve, and also to give access to the nut to use a wrench whenever necessary.

The packing is kept in place by lugs, H, depending from the cap. A gum gasket, we are informed, is placed between the cap and valve, is all that is necessary on machinery where drifting cannot occur, consequently metallic packing can be dispensed with on steamboats.

The nut, in connection with the spring, regulates the cap, which forms a ground joint in connection with the inside



ADAMS' IMPROVED GAS REGULATOR.



surface of the steam chest head, elevating it and depressing it at will. All the upward force falls upon the nut, and not upon the chest head. Between the valve and the cap exists a space the full square of the valve, in which the packing is placed, consisting of four pieces of brass, three sixteenths of an inch in thickness and one half inch in width, shaped precisely like a carpenter's square. These are laid one on top of the other so as to break joint, and also so that, if expansion should take place and shove one out of position at the point of intersection, the other may take its place. Between each layer of metallic packing a gum gasket is placed. A space of about one eighth of an inch exists between the cap and the upper layer of packing. This forms a square of packing around the shoulder which occupies the chamber. The effect of this is that, when the steam is forced into the steam chest, it presses upon the packing inward and downward, inward against the shoulder and downward against the top of the valve. The packing is subject simply to pressure; there is no movement whatever connected with it. When the steam is off, and the engine is in motion, the cap sinks and rises according to the motion of the piston head and the operation of the spring, the shoulder sinking within the square of packing without any abrasion whatever. As the different parts of the packing are separated one sixteenth of an inch, and are brought instantly into place through the pressure of the steam, it never can become disordered.

The inventor claims the present device to be superior to a somewhat similar arrangement employed on board of the Great Eastern, and mentioned in a recent work by Mr. John Bourne. The English invention consists of two rings embedded in the chest head, between which is a gum gasket. This combination is subject to the operation of set screws, which keep the parts pressed closely upon the top of the valve, thus, we are informed, producing much more friction than the device above described.

The further claims regarding the present invention are, that it moves its weight only, is cheap, requires no alteration of machinery for its application, and may be very quickly substituted for the D valve. Using it, the engine can be reversed without shutting off steam, and it can be moved easily with one hand when surrounded by pressure. We are

also informed that the valve has been successfully tested for some time past. It will be placed in locomotives, steamers or land engines, and warranted for six months.

For further particulars, address Jacob Youngman or J. M. Bostian, Sunbury, Pa.

The Tay Bridge.

The firm of Hopkins, Gilkes & Co., of the Tees Side Iron Works, Middlesbrough, England, have entered into a contract with the North British Railway Company for the completion of the great engineering work known as the Tay Bridge, near Dundee. This, when finished, will be the longest bridge over a running stream in the whole world. The total length will be 10,321 feet, or nearly two miles, so that it is 1,127 longer than the Victoria Bridge, Montreal, which is 9,194 feet in length and has hitherto claimed the distinction that will henceforth be awarded to the Tay Bridge. There are, of course, bridges of considerably greater length than either, although none spanning a tidal river. There is, for example, the Texas and Mobile Bridge, on the Mobile and Montgomery Railway, which is fifteen miles in length; but the greater part of this bridge is carried over great morasses, where the engineering and other difficulties to be surmounted were not at all comparable to those met with in this case; and even after our American cousins have got all due credit for the big things they have done in this direction, the fact will still remain that the Tay Bridge is, in its way, perhaps the most remarkable structure in the world.—*Newcastle Chronicle*.

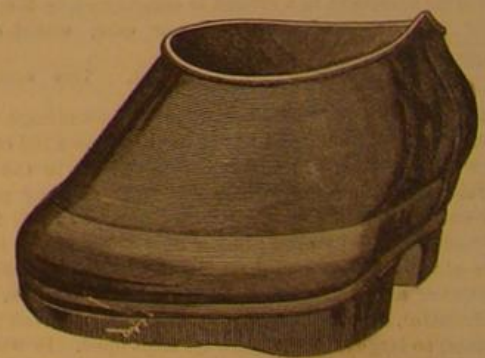
INDIA RUBBER SHOES FOR HORSES.

We can describe the invention illustrated in our engraving in no better or more concise terms than by stating that it is an india rubber overshoe for horses. It is made and lined in precisely similar manner to the articles of apparel worn by the human race, and, in fact, presents no points of difference save in its shape and its manufacture of the best quality of india rubber.

It is designed as a substitute for the iron shoe, and as a means of preventing the many maladies to which horses' feet are subject. The inventor informs us that horses suffering with cracked or contracted hoof, and similar painful hurts, are quickly cured by the substitution of the rubber covering for the unyielding metal shoe. The elasticity of the former allows the hoof to remain in its natural shape while protected from abrasion against pavements by the heavy rubber sole beneath.

The device is easily removed from or put on the hoof, and hence, while standing in the stall or turned out to pasture, the horse may be left barefooted. In winter time the covering serves as a protection against illness due to the common practice of mingling salt with the ice and snow in city streets, while the roughened surface of the rubber beneath serves to give the animal a foothold in slippery weather.

As compared with iron shoes, the cost of the rubber ones is about one third more, and their weight is some forty per cent less. Sixteen sizes are manufactured, so that accurate fits may be obtained. With reference to wear, the inventor states that the durability, owing to the fine quality of rub-



ber employed, is very great. The device has been successfully used for some time past, and, we understand, has received the endorsement of the New York Society for the Prevention of Cruelty to Animals.

For further particulars relative to sale of territory or for purchase of goods, address the inventor, Mr. Amzi J. Dean, No. 266 Nesbitt street, Newark, N. J. Patented through the Scientific American Patent Agency, July 14, 1874.

A BALLOON STEERING DEVICE.

Experiments have recently been made, at Woolwich Arsenal, England, with an invention designed to accomplish the long wished result of steering a balloon. It is the invention of Mr. Bowdler, and consists of two fans or propellers, and a rudder with simple hand gear, the entire apparatus weighing about 70 lbs. In our Fig. 1, C is a sheet iron propeller working on a vertical axis, and made to rotate by multiplying gear and winch at from 600 to 720 revolutions per minute, the object being to cause the balloon to ascend or descend without loss of gas or ballast. B is a similar propeller working on a horizontal axis at about the same speed, inasmuch as this may be required to act in any direction. A rudder, A, made of canvas, with strengthening bands, is fixed opposite the propeller, and is held in any desired position by ordinary rudder lines, while the propeller is made to revolve by hand and winch. This gear Mr. Bowdler did not consider was large enough to suit the balloon which the well known aeronaut, Mr. Coxwell, lent for the experiment, and which contained about 60,000 cubic feet of gas. He hoped, however, that a distinct indication of the effect of the propellers would be manifest.

The experiment was carried out under the personal direction and orders of Major Beaumont, R. E. The official programme was as follows: (1) The balloon to be balanced carefully, and when in a captive condition to be raised to about 150 feet, and lowered repeatedly by the vertical propeller in order to test its efficiency. (2) The balloon to be released, and as soon as the course be shown to be steady and the direction ascertained by means of Mr. Coxwell's indicator, maps, etc., the horizontal propeller to be worked at right angles to the course of the balloon, and its maximum effect thus obtained carefully noted. (3) The balloon then to be raised and lowered by the vertical propeller, without throwing out ballast or discharging gas. After attaching the gear to the side—as shown in the engraving—Major Beaumont, Mr. Coxwell, Mr. Bowdler, and a sergeant of the Royal Engineers entered the car and the first part of the programme was commenced, a series of small pilot balloons being sent off in succession to ascertain the direction of the wind and probable course of the balloon when liberated.

The balloon was fairly balanced and the vertical propeller worked, and the balloon raised to a height of about 40 feet, and lowered again. (See Fig. 2.) The vertical propeller, when worked hard, produced a decided effect; probably the maximum rate of ascent did not exceed 50 feet per minute,

but it was not far short of it. There was no great accuracy, speaking critically, in the arrangement of the conditions. For example, the line which held the balloon captive was held by hand, and thus every foot the balloon rose it had an additional foot of line to carry. This would tell on a high

the time disabled. Shortly after this the balloon was liberated for the trial of the horizontal propeller, and the remainder of the programme was visible only to those in the balloon.

Mr. Bowdler considered that his steering apparatus ought to be shown to have had an effect. This it had, but in the nature of things it could hardly be otherwise. The question is whether it gave promise of producing a sufficient effect to be useful, and this we cannot at present say it did.

The problem of how to develop sufficient power to alter and govern the course of a balloon is, says *The Engineer*, from which we extract the engravings, no easy one. The enormous bulk of gas required to support any given weight, and the fact that the balloon is bodily immersed in a moving medium, without access to any fulcrum by which the force of the air might be turned to account, as in the case of a ship on the water, constitute difficulties that are far from being surmounted. A hand propeller may produce an effect that is just appreciable on a still day; but when a balloon is liable, almost without notice, to find itself moving at twelve miles an hour, or much faster, it is evident that a power of a totally different class is necessary to be of any real use. We should be very glad to see something of greater promise tried in the fair and thorough way in which Mr. Bowdler's gear was tried.

Yellows in the Peach.

If you dig around a peach with the yellows, you will be first struck with a mushroomy smell. Picking out the roots, and examining them with a lens, you will see millions of thread-like fibers, which are the mycelia of fungi. These eat the young fibers, and leave only the main roots, through which all the nutriment of the plant has to be gathered; and as an old root is unable to do much more than draw in water, the tree becomes in a measure starved, and the leaves become yellow, just as they would be if growing in poor soil, which, though the plant might have plenty of roots, furnished nothing for the roots to eat. To have plenty of roots and no food is equivalent to having plenty of food and no roots. The effect on the plant is just the same. Remedies which look to the destruction of this root

parasite are employed. Hot water has done it, so has a weak solution of salt; others have found a solution of potash succeed. The exact nature of this fungus, so far as we know, has not been investigated to entire satisfaction. Fungi are very polymorphous. This one may enter into the circulation



BOWDLER'S BALLOON STEERING APPARATUS.—Fig. 1.



MR. BOWDLER'S BALLOON EXPERIMENT.—Fig. 2.

of the plant, and exist in that case as an apparently distinct species, extending through the tissue, and destroying it as it goes. This seems likely from some experiments by Mr. Thomas Taylor, of the Department of Agriculture. At any rate it is generally believed that a bud, or even a knife used in pruning a diseased tree, will communicate the disease to a healthy one.—*The Gardener's Monthly*.

PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

We give below abstracts of papers read before the Hartford Convention, concluding our report of the proceedings of that body. Under the head of the

MOLECULAR VOLUME OF WATER OF CRYSTALLIZATION.

Professor F. W. Clarke stated that, when water unites to form a hydrate or a crystalline salt, contraction ensues, and by studying that contraction we get at curious results. In the case of water of crystallization, Professor Clarke has studied over 30 salts, and in every case the molecular volume of the water is about 14. With water of hydration no such regularity is found. Evidently, then, when water unites with an anhydrous salt from water of crystallization, all the condensation which occurs is on the part of the water, the volume of the molecule of the salt itself remaining unchanged. Referring to the molecular heat of similar compounds, the same speaker said that it is commonly thought that similar compounds have equal molecular heat. This is only approximately true. In comparing about 20 series of similar compounds, Professor Clarke finds that the molecular heat increases slightly with the molecular weight, though in a very different ratio.

Professor Lovering exhibited a drawing of a new instrument which he had devised, by which vibrating flames reflected in a revolving mirror could be made visible to a large audience. Paymaster General Alvord, U. S. A., explained a table, from which it appears that the annual death rate of the officers of the army in the period of 25 years, from 1824 to 1848, was 27 per 1,000; the rate for the last 25 years, from 1849 to 1873, was 23 per 1,000, showing a decided decrease notwithstanding the civil war.

Professor T. Sterry Hunt, with reference to THE SEWAGE QUESTION.

mentioned a new English method which consists in the use of finely divided charcoal, obtained by charring seaweed or street sweepings. Only one fourth as much charcoal is required as of earth. The odorless and partially dried mixture with this charcoal, after use, is removed from time to time and charred by heating to redness in close vessels like gas retorts, the products of the distillation being water, ammonia, acetic acid, tar, gas, and charcoal, the last being augmented in quantity, and ready for immediate use again, though containing alkalis, earth, and phosphates, which give it a great fertilizing power. From the product of the distillation the chief materials obtained are acetate of lime and sulphate of ammonia, the latter being the most valuable of fertilizers.

The same speaker also described a new wet process of copper extraction, devised by himself and Mr. James Douglas of Quebec. When oxide of copper is brought in contact with protochloride of iron, this is decomposed, the iron being thrown down as peroxide, and the copper converted into a mixture of one third soluble protochloride and two thirds of dechloride, insoluble in water, but soluble in a strong and hot brine. From this solution metallic iron throws down the whole of the copper or metal, regenerating the protochloride of iron, which is now ready to dissolve a fresh charge of oxide of copper, and so on indefinitely, using the same solution over again, the consumption of metallic iron being about two thirds the weight of the iron. To prepare the ordinary sulphurous ores for this treatment, it is only necessary to calcine them at a low red heat. In this process the injurious elements of the ore, such as arsenic, antimony, and tin remain undissolved, and the metallic copper obtained is so pure that it can be made into fine copper by a single fusion.

Professor R. E. Rogers described a new

DIRECT VISION SPECTROSCOPE,

which consists of a thick plate of glass with parallel sides, united to one of the faces of an ordinary bisulphide of carbon prism, or a prism of dense flint glass. According to the amount of dispersion desired, the light is made to enter either on the end of the glass plate or on the opposite face of the bisulphide prism. The results obtained from this instrument are as follows: The dispersion of this compound prism is nearly four times greater than that of the ordinary 60° prism. The mean emergent ray is practically parallel to the incident ray. It does not deflect the ray from its original path. Many Fraunhofer lines are visible by this prism with the naked eye, while with the observing telescope all the prominent lines are clearly reversed, without the use of the slit or collimator, by merely throwing a strong beam of light by means of a mirror.

Professor C. V. Riley of Missouri, in a very interesting paper on

INSECTS,

described those more particularly associated with *sarracenia variolaris* (spotted trumpet leaf). It referred to the insect catching powers of those curious plants, the flytraps (*dionaea*) the sundews (*drosura*), and the pitcher plants (*sarracenia*), which have of late awakened renewed interest by virtue of the interesting experiments and observations on their structures, habits and functions, lately recorded by Professor Asa Gray.

The leaf of *sarracenia* is a trumpet-shaped tube, with an arched lid, covering, more or less completely, the mouth. The

inside is furnished with perfect *cheveux de frise* of retrorse bristles, commencing suddenly about an inch from the base, thence decreasing in size until, from about the middle to the mouth, they are so short, dense, and compact that they form a decurved pubescence which is perfectly smooth and velvety to the touch, especially as the finger passes downward. Under the hood, again, many of them become large and coarse. Running up the front of the trumpet is a broad wing with a hardened border, parting at the top and extending around the rim of the pitcher. Along this border, but especially for a short distance inside the mouth, and less conspicuously inside the lid, there exude drops of a sweetened, viscid fluid, which, as the leaf matures, is replaced by a white, papery, tasteless, or but slightly sweetened sediment or efflorescence; while at the smooth bottom of the pitcher is secreted a limpid fluid possessing toxic or inebriating qualities.

The insects which meet their death in this fluid are numerous and of all orders. Ants are the principal victims, and the acidulous properties which their decomposing bodies give to the liquid doubtless render it all the more potent as a solvent. Scarcely any other hymenoptera are found in the rotting mass.

Two species are proof against the siren influences of the destroyer, and in turn oblige it, either directly or indirectly to support them. The first is *xanthoptera semicrocea* (Guen.) a little glossy moth which may be popularly called the *sarracenia* moth. It walks with perfect impunity over the inner surface of the pitcher, and is frequently found in pairs within the pitchers soon after these open in the early part of the season, or about the end of April. The worm riots in the putrid insect remains, bores through the leaf, and burrows into the ground; there contracting to the pupa state, in a few days it issues as a large two-winged fly called *sarcophaga*.

Professor Riley concludes: That *sarracenia* is a truly insectivorous plant, and that by its secretions and structure it is eminently fitted to capture its prey.

That those insects most easily digested and most useful to the plant are principally ants and small flies, which are lured to their graves by the honeyed path, and that most of the larger insects fall victims to the peculiar mechanical structure of the pitcher.

That the only benefit to the plant is that the liquid manure, resulting from the putrescent captured insects, mostly descends the root stalk, and probably through tubular cells, passing through the petiole into the root.

That *sarcophaga* is a mere intruder, the larva sponging on and sharing the food obtained by the plant, and the fly attracted thither by the strong odor. There is nothing to prove that it has anything to do with pollination.

That *xanthoptera* has no other connection with the plant than that of a destroyer, though its greatest injury is done after the leaf has performed its most important functions.

That neither the moths nor the flies have any structure peculiar to them, that enables them to brave the dangers of the plant, beyond what many other allied species possess.

In a paper on the

COTTON WORM,

Professor A. R. Grote concluded that it is not indigenous with us, but an annual; not a denizen, but a visitant, unable to contend with the variations of our climate; and he believes that the process of artificial extermination may be simplified by limiting the period of successful attack and doing away with certain proposed remedies. The agent of destruction must be directed against the first brood in each locality; and concerted action on the part of the planters, where the remedy is to be applied, will be necessary.

THE CLOSING EXERCISES,

which followed the conclusion of the reading of the papers, consisted in passing resolutions accepting the invitation to make Detroit the next place of annual meeting, and fixing the time as the second Wednesday in August. Resolutions were also passed to take measures for representing to Congress the importance and desirability, in the opinions of the Association, of having a new census taken in 1875 with reference to the Centennial celebration; and to take measures for urging upon the legislature of Massachusetts the need of a new geological survey of that State. The following officers were then elected for the coming year: President, Professor J. E. Hilgard, of Washington; vice president for section A, Professor H. A. Newton, of New Haven; vice president for section B, Professor J. W. Dawson, of Montreal; General Secretary, Professor S. H. Scudder, of Boston; permanent secretary for five years, F. W. Putnam, of Salem, Mass.; treasurer, W. S. Vaux, of Philadelphia; secretary of section A, Professor S. P. Langley, of Pittsburgh; secretary of section B, Professor N. S. Shaler, of Newport, Ky.

NEW TREATMENT FOR THROAT AND NOSE DISEASES.

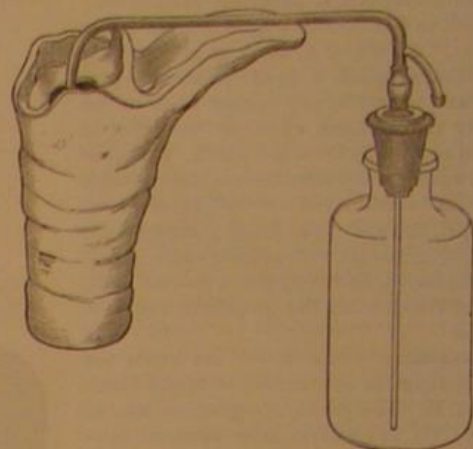
We have been much interested, lately, in an examination of a comparatively new system of treatment of diseases of the throat and nose, maladies probably the most prevalent in the variable climate of our Northern States during the fall and winter months. Physicians who employ the old-fashioned probang are well aware of the difficulty in reaching therewith the very sensitive parts to which local application of a remedy is necessary; and as a substitute for this uncertain instrument, apparatus is by some employed, by which the medicine, in a finely divided state, is blown against the proper spot.

The system to which we refer is the last mentioned process, brought to a remarkable degree of certainty and perfection through a series of entirely novel inventions, in the shape of peculiarly constructed instruments, which are the result of long acquaintance with and experiment upon the dis-

eases in question, by Dr. Otto Füllgraff, the founder and manager of the Bond Street Homoeopathic Dispensary, and an eminent practitioner of this city.

By means of this apparatus, the surgeon can direct a powerful spray of liquid or cloud of powder, infallibly upon the part to be treated. Connected with the atomizing arrangement are tubes of vulcanized rubber and nickel-plated metal, provided with movable tips of various shapes and bent at different angles, so that the skillful operator, aided by ingeniously contrived reflectors, can direct his medicine directly to the vocal cords or into cavities impossible to reach by any other method.

An idea of this operation may be obtained from the an-



nexed engraving. From the bottle which holds the remedy a metallic piece arches over the cork and then passes at right angles over the tongue, at the root of which it is shown making another angle and passing over the epiglottis down into the larynx; so that the mediated fluid, forced by the air driven into the bottle by the compression of a bulb attached to the small projecting tube, is impelled directly into the larynx, trachea, and bronchial tubes. The end of the instrument terminates in a movable tip, which may be unscrewed, and another substituted, so as to throw a spray of finer or coarser particles.

Through this apparatus many important cures have been recently effected, notably in cases of well known vocalists, suffering from diseases of the throat, nasal catarrh, etc., due to our changeable climate. The instruments are, of course, not patented, and are, therefore, open to the examination and imitation of the profession. They have probably been the means of averting an immense amount of suffering among the poorer classes of this city, through the dispensary above alluded to, where, for the past twenty years, Dr. Füllgraff has, with that lack of ostentation which marks the true philanthropist, gratuitously given to hundreds of thousands the benefit of his skill. The institution now treats a larger number of cases than even the more pretentious dispensaries, largely subsidized by the city and State, 38,830 poor people of every nationality having been aided, surgically and medically, during 1873, directly at the dispensary; 5,589 outdoor visits were made by the medical staff, and 98,601 prescriptions given—and all this without fee or hope of reward. It is a grand and genuine charity, and, while it is greatly to be regretted that its pecuniary support comes more from the private practice of its generous founder than from city and State coffers, the institution is one of which, as a community, we may well be proud.

The Worker's Friend.

"Partly by the information I have received from the SCIENTIFIC AMERICAN, and partly by the advice it has contained in reference to the benefits of study, I have been raised from the position of a laborer in a lumber yard, at \$6 a week, to that of foreman, at a salary of \$1,200 a year. I therefore consider the SCIENTIFIC AMERICAN to be the worker's best friend."

Such are the casual remarks of one of our correspondents in a recent letter. They are an example of hundreds of similar expressions which we receive from various parts of the country. It is always a gratification to us to be thus assured of the usefulness of our journal in the hands of the great body of practical workers to whose interests it is devoted.

Premium for the Best Circular Saw.

The Board of Commissioners of the Fifth (1874) Cincinnati Industrial Exposition offer a special premium of \$100 in gold for the best circular saw. The competition is to be determined under conditions as follows: All saws competing shall be of uniform diameter, namely, 56 inches. They may have either solid or inserted teeth. The gage to be at the option of the exhibitor. The eye of the saw to be 2 inches diameter; the pin holes $\frac{1}{4}$ inch, and 3 inches from center to center. Each saw is to be submitted to a thorough practical test, upon a left hand mill provided for the purpose. Diagram cards are to be taken from the engine during the trial of each saw, by a disinterested expert, selected by the jurors. The test is to be made during the week beginning September 21, 1874. Other details of the examination are to be determined by the jurors.

PRIZES FOR HAND TURNING.—The Company of Turners of London, in continuation of their action in former years, propose to give, in 1874, their silver medal and the freedom of the company and of the city of London to any one workman or apprentice in England who may send in the best specimens of hand turning for the year. Last year the prizes were awarded for turning in ivory and stone; this year the material to be used will be brass or gun metal.

VENTILATION OF RAILWAY TUNNELS.

To ventilate a building containing various apartments, with opening doors and windows that interrupt or modify the air current, is somewhat difficult; but to thoroughly purify the atmosphere of a railway tunnel, which is a single closed apartment, is one of the most easy matters with which the engineer has to deal. The air in the long railway tunnel under the city of Liverpool is changed every ten minutes by means of a large steam fan, placed near the center.

A novel method has lately been adopted on a portion of the Underground Railway in London, which is described in a recent number of *Engineering* as follows:

"A very careful investigation of the condition of the air in the Metropolitan Railway covered way was undertaken conjointly by Messrs. George H. Bachhoffner, Henry Letheby, and J. Whitmore, and the result of their investigation showed that, while the air of the tunnel was sufficiently impregnated to impart disagreeable and, in some cases, inconvenient sensations, no source of danger could possibly exist. With regard to carbonic acid, a number of careful experiments showed that, in the railway tunnels, during the busiest period of the day, when its quantity attained a maximum, there were only 6.1 parts to 10,000 parts of air in volume. In many crowded places of public resort, such as churches, theaters, law courts, etc., the quantity of carbonic acid reaches the proportion of 32 parts per 10,000; and in Manchester, during foggy weather, it is often 8 parts per 10,000 in the streets. The presence of carbonic oxide can be scarcely detected. This result of this investigation proved conclusively that no danger from inhaling the air in the tunnel could possibly exist.

The section of the Metropolitan Railway lying between the Gower street and Portland road stations, a length of half a mile, has no communication with the outer air between the two points just named.

A means presents itself, however, for improving the ventilation of this length of the line through the fortuitous circumstance of the Pneumatic Dispatch Company's tube crossing the crown of the Metropolitan Railway arch between Gower street and Portland road. This tube connects the Euston square terminus with the company's pumping station at Holborn, whence a second section of the tube is carried on to the General Post Office. The Euston-Holborn tube, which is 3,080 yards in length, is of π section, 4 feet 6 inches high, and 4 feet in width. On the floor of the tube, rails are laid, upon which run carrier wagons, 10 feet 4 inches in length, and weighing each 22 cwt. The ends of these carriers conform to the shape of the tube, and a close contact with the sides of the latter is always maintained by means of rubber packing. These carriers—either empty or loaded with letters and parcels—travel between Euston, Holborn, and the General Post Office. The motive power, which is located at Holborn, consists of an engine with a pair of 24 inch cylinders, of 20 inch stroke. This engine drives a fan 22 feet in diameter, at an average speed of 160 revolutions per minute. By this means a pressure of about 6 ounces per square inch is obtained, available either for forcing the carriers from Holborn to Euston, or on the return journey for exhausting the tube, and thus creating a sufficient difference of pressure against the ends of the carriers. The traffic between Holborn and the Post Office is conducted in precisely the same manner.

The relative positions of the pneumatic tube and the Metropolitan Railway tunnel are, as we have mentioned, such that openings could easily be made between the roof of the latter and the floor of the former, for the ventilation of the railway tunnel.

This idea has been carried out very successfully by Mr. S. De Wilde, resident engineer of the Pneumatic Dispatch, with the approval of the Metropolitan Railway Company, and, as at present worked, a very sensible improvement in the ventilation of the tunnel is effected. Two rectangular openings, each 6 feet by 2 feet, are cut through the roof of the tunnel into the tube, and these openings are closed by valves hung upon trunnions, and so balanced as to open freely inwards. When the carrier is on its way from Euston to Holborn, and after it has passed the tunnel, the valves are opened by the passing carrier, the air is drawn in from the tunnel at the rate of about 1,000 cubic yards a minute, until the carrier reaches Holborn, when the action of the fan is reversed, and a pulsation of air is sent through the tube, until it strikes the valves, and closes them.

It will be worth while for the Metropolitan Railway Company to consider whether they cannot ventilate this section of their line more efficiently and a great deal cheaper than by the help of the Pneumatic Dispatch fan. The length of the line between Gower street and Portland road is about 900 yards, and the cross section of the tunnel is 450 square feet; its capacity is thus 1,215,000 cubic feet. Supposing this amount of air to be changed every hour, 20,250 cubic feet would have to be dealt with per minute. If openings no larger than those now leading into the pneumatic tube were adopted, a velocity of 22 feet per second through these openings would change the whole of the air every hour as above stated; and the pressure required to give this velocity, is only 0.122 ounces per square inch, the excess of pressure being absorbed principally by the friction of the tube. Even supposing that a Siemens steam blast be used for the purpose, it would be found more economical than the system now proposed. With this jet, the volume of air that can be exhausted by a volume of steam reduced to atmospheric pressure is 1.37 to 1, that is to say that, to exhaust 20,000 cubic feet of air per minute, 14,600 cubic feet of steam at atmospheric pressure would be required, corresponding to 9 pounds of steam per minute, or 540 pounds per hour, and representing a consumption of about 60 pounds of coal per

hour. As we have said, this would not prove the most economical means of ventilating the tunnel, but the first cost of its establishment would be confined to the necessary connections and a small steam boiler. On the other hand, if a fan were placed close to the tunnel, an engine of three horse power, consuming from 10 to 15 pounds of coal per hour, would be ample for the purpose."

In view of facts like these, we hope that railway passengers, who find the atmosphere of our long railway tunnels sometimes disagreeable, will remember that the nuisance exists, not because it is difficult to overcome, but solely because railway companies are so careless and parsimonious as to refuse to burn a few pounds of coal, to promote the comfort of passengers.

Take, for example, the Erie Railway tunnel, at Jersey city, not quite one mile in length; was there ever a more smoky, foul, or disagreeable place for passengers to go through? The reason is obvious. Both tracks of the railway tunnel are constantly occupied by locomotives belching forth clouds of smoke, and the company employs no special means for ventilation. The area of the Erie tunnel is about the same as that of the London Metropolitan Railway, namely, 450 feet cross section, but it is twice the length of the Gower street station tunnel.

On the basis of the estimate given by *Engineering*, it would require the consumption of from 20 to 30 lbs. of coal per hour to ventilate the Erie tunnel, by an hourly change of its entire contents, while from 40 to 60 lbs. of coal would ventilate its entire length every half hour.

It will also be seen, from the foregoing, how utterly absurd is the bugbear which property owners and others have tried to raise against the construction of the Broadway Underground Railway in this city, namely, that its atmosphere would be bad. The truth is that the sectional area of the Broadway tunnel will not exceed that of the London Underground Railway. Calling the area 450 square feet, and the tunnels between the stations half a mile in length, the Broadway company will, according to the estimate of our cotemporary, be able to renew the entire contents of its tunnels every fifteen minutes on a fuel consumption of 40 to 60 lbs. of coal per hour, costing, say, 10 or 12 cents. This would probably give a better ventilation than is ordinarily found in our dwellings, offices, and stores.

Railroad Train Timer.

An ingenious invention has lately been successfully tested on the Vandalia Railroad, Ind., which records the motion of railway cars. There is a locked iron box, attached to one side of the car and containing a clock. The mechanism of the latter causes a small drum, on which is wound a sheet of paper, to travel at a constant rate. With the axle, by means of rods and gearing, a pencil touching this paper is connected. As the pencil is moved slowly across the paper, by its mechanism governed by the axle, and as the paper is slowly moved forward, the pencil point inscribes a diagonal line back and forth. The paper is ruled in very small sections, every fourth line being dotted and representing one mile; so that, supposing the car goes a mile in four minutes, the line will cross just four sections diagonally from one dotted line to the next one. If the car stops, the line crosses the paper directly and shows the number of minutes that the train is at rest.

The names of the stations are written at the proper places on the paper, and thus the exact rate of speed made at any point on the line can be subsequently noted. The apparatus thus affords an excellent check on the train officials, as, if the train be run ahead or behind time, the fact is sure to be detected.

The St. Joseph, Mo., Exposition.

An industrial and agricultural fair is to be held in St. Joseph, Mo., from September 7 to 12, inclusive. The grounds extend over an area of 100 acres, and form the site of large and commodious buildings, the main hall of which covers 30,000 square feet, and the machinery hall, 16,000 square feet, of surface. There is also a fine race course and ample accommodations for live stock. No entry fee is charged, and liberal arrangements have been made with connecting railroads.

The money premiums aggregate the large sum of \$25,000, and are offered for almost every conceivable object and process. There are also special prizes, mainly awarded by the citizens of St. Joseph, two of which, at least, are evidently intended to benefit the community through the advantages of brisk competition. One is offered for the best calico dress made by any young lady under the age of twenty years, and the other to the mother of the best looking baby between the ages of one and two years. The individual who is about to undertake the arbitration of the last mentioned question has our cordial sympathy.

The Ruins of Farkin.

The Rev. Dr. H. D. Barnum, missionary in Turkey, in a recent letter to the *New York Observer*, gives an account of a visit he lately made to the ruins of Farkin, in Eastern Turkey, near the border of Persia. He says: *En route* to Van we spent several hours with great interest among the ruins of Farkin. The present town is little better than any of the other towns of Koordistan; but it is surrounded by a very fine ancient wall, and contains very imposing ruins, which for picturesqueness of effect fairly rival the Coliseum and the Forum at Rome. The most noticeable are a large cathedral and the elegant standing arches and pillars of a church, built 1,400 or more years ago, in memory of the Christian martyrs who were put to death by the King of Persia. There is likewise a very fine mosque or late date, also in

ruins, and a palace, all of which combine to form a picture, the like of which is seldom seen in any land.

Spiral Bevel-Edged Arrow Heads.

We published not long ago an engraving of an Indian arrow head, with spiral bevels to give rotary motion to the arrow during its flight. The specimen was from the collection of Dr. Olmstead, who believed it to be unique. As a result of that publication, we have received several similar specimens; also letters from other individuals who are in possession of specimens. In the collection of 250 arrow heads belonging to Mr. A. J. Schultz, of Dayton, Ohio, there are six which have the bevels. From these evidences it appears that the rotating arrow was a not uncommon projectile with the North American tribes.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the *SCIENTIFIC AMERICAN*. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs, drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees, and constructors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the *SCIENTIFIC AMERICAN* is obvious. Every issue now exceeds 42,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the *SCIENTIFIC AMERICAN*, the parties ordering having seen the article illustrated or advertised in these columns. Address

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NEW BOOKS AND PUBLICATIONS.

MECHANICAL HUMOR: a Collection of Original Anecdotes connected with Engineering and Mechanics. By J. Richards, Mechanical Engineer, Author of "The Principles of Shop Manipulation," etc. Price \$1. Philadelphia, Pa.: George Richards, Franklin Institute Building.

Mr. Richards has collected in this volume several readable sketches and anecdotes of workshop life and its peculiarities, accidents, and remarkable occurrences. The last tale in the book, called "Struck by a Sea," is a good piece of descriptive writing.

AN INTRODUCTION TO THE STUDY OF GENERAL BIOLOGY, Designed for the Use of Schools and Science Classes. By Thomas C. McGinley, Principal of Croagh National School, Ireland. With 124 Illustrations. Price 75 cents. New York: G. P. Putnam's Sons, Fourth avenue and 23d street.

The rapid increase of our knowledge of the initial forms and phenomena of life, due so largely to the labors of Huxley, Carpenter, and Huxley, has awakened great interest in this most important branch of natural science; and there is a widespread demand for elementary and accurate text books of the subject, which Mr. McGinley has responded to in a terse, well written treatise, carried down to the latest date. We commend it to the notice of instructors in natural history.

THE LEADER, a Collection of Sacred and Secular Music for Choirs, Conventions, and the Home Circle. By H. R. Palmer and L. O. Emerson. Price \$1.38. Boston, Mass.: Oliver Ditson & Co., 277 Washington street.

This volume adds one more to the number of books of dilute music which encumber the shelves of our school and other libraries. Most of the songs contained in this book would not pass muster as a school girl's first attempts at harmony; and the few meritorious selections in it (Mendelssohn's "May Bells" and one or two more) are garbled and disfigured to suit the "taste" of the compilers.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From July 31 to August 13, 1874, inclusive.

BOLT AND NUT LOCK.—I. D. Gayer, New York city.
CAR COUPLER AND BUFFER.—O. Pooley, Buffalo, N. Y.
CAR REPLACER.—E. Newcomb, Westbrook, Me.
CLOTHES WRINGER.—C. M. Howlett, Auburn, N. Y.
DENTAL ENGINE.—N. Stow, Binghamton, N. Y.
ELLIPTIC SPRING.—E. Chittenden, New York city.
EMBROIDERY ATTACHMENT.—G. M. Ramsay, New York city.
FORGING, DRILLING, & RIVETING MACHINE.—R. H. Thurston, Hoboken, N. J.
FEEL FOR METALLURGY.—C. E. Lester, New York city.
GENERATING POWER.—C. C. Walcott et al., Washington, D. C.
HARVESTER.—D. M. Osborne (of Auburn, N. Y.), London, England.
ILLUMINATING CLOCK DIALS, ETC.—H. O. Cook, Brooklyn, N. Y.
MAKING CHAIN, ETC.—J. Seiden, Erie, Pa.
MAKING FISH HOOKS.—William Court et al., Brooklyn, N. Y.
PAYMENT.—P. Ziegler, San Francisco, Cal.
PORTABLE FOUNTAIN.—G. J. Wesch, New York city, et al.
SELF-SUSTAINING MOTIVE POWER.—G. Rischmuller, San Francisco, Cal.
SEWING MACHINE FEED.—G. Merrill, New York city.
SHAFT COUPLING AND PELLET HUB.—A. Brehmer (of Philadelphia, Pa.), London, England.
SWIMMING APPARATUS.—F. Tryon, Brooklyn, N. Y.
UMBRELLA.—C. A. Thompson, East New York, N. Y.
VEHICLE WHEEL.—J. H. Small (of Buffalo, N. Y.), London, England.

Recent American and Foreign Patents.

Improved India Rubber Horseshoe.

Amel J. Dean, Newark, N. J., assignor to himself and George D. Dean, same place.—This is a rubber horseshoe having an upper extending to the ankle, and drawn in on the rear part to overlap the heel. A full description with illustrations will be found on page 166 of this issue of the SCIENTIFIC AMERICAN.

Improved Horse Collar and Harness.

Martin Habbell, Mount Kisco, N. Y.—In this device the harness are pivoted adjustably at the top, and are connected at the lower part by a pivoted adjustable latch, which slides, with its forked and notched end, over a guide bolt, and is locked thereon by a spring pawl.

Improved Machinery for Dressing and Finishing Hides and Skins.

John Pullman and John H. Edmunds, Womersley, England.—This invention relates to improved machinery for "finishing," "skinning," and "scudding" hides and skins, and for staking and grounding leather. The machine consists of a suitable frame, in which is mounted a shaft, on which a long knife or a rubber is carried. Motion is imparted to the shaft, and to the knife or rubber which it carries, from a main shaft suitably disposed. The skin is laid upon a traveling apron, by which it is fed between a pair of rollers in proximity to the knife shaft and parallel therewith, the skin, after having passed through these rollers, being held by the operator against the knife or rubbers. Means are provided to stretch the skin and keep it flat when on the apron, and prevent it falling into folds or wrinkles in passing between the rollers.

Improved Means for Adjusting Knitting Burrs.

Geo. Campbell, Cohoes, N. Y.—This invention consists of an arm which supports the rotating loop, or stitch adjusting or discharging burr, of a knitting machine. It is fitted on a vertical screw stud of the permanent arm, and has a thumb nut below and a jam nut above, together with a steady pin in one of the arms working freely through the other, whereby the vertical adjustment of the burr relatively to the needles, and to the other burrs, can be easily and accurately effected, and the arms be rigidly and permanently fastened.

Improved Button Hole Bouquet Holder.

J. Albert Kimball, New York city.—A hooked plate is attached to the under side of the lapel of the coat, just below the button hole, through which the stems of the flowers are to be passed. An elastic strap is then passed around their stems, and secured by a loop passed over a projecting hook on the plate.

Improved Blacksmith's Tongs.

Daniel Kunkel, Oregon, Mo.—This is an improved instrument for use for a drill extractor, a blacksmith's tongs, a vice, a wrench, and for various other uses. It consists in a pair of pivoted jaws, arranged in suitable frames with a screw shaft, and so combined that the jaws are worked by moving the shaft out or in.

Improved Hog Elevator.

William Kelly, Susquehanna Township, Dauphin county, Pa.—Two posts are set in the ground and cross bars are passed through mortises in them. The upper sides of the cross bars receive longitudinal bars, a pair of which is connected with each pair of cross bars. The longitudinal bars are notched upon their upper edges, to receive the gambrels when suspending the carcasses. The upper ends of the posts are connected by a beam, in which is a pulley, around which passes a rope; in one end is an eye, to receive a hook attached to the gambrel. The rope is passed around a bar, which is pivoted in a mortise in the lower part of the post. With this construction, by raising the outer end of the bar, the end of the rope runs down, so that its eye may be placed upon the hook. Then, by lowering the free end of the bar, the animal will be raised, so that the gambrel may be turned to rest upon the bars.

Improved Cotton Press.

William H. Walker, Charleston, S. C.—The follower works up against a stationary press head, and is connected by rods with the crosshead. The under side of the latter is cam-shaped, and rests on friction rollers in the upper ends of segmental wheels, turning on axes, and having the power applied at the lower end for working them. Slotted heads connect with the wheels by pins in the slots, the heads being worked by an engine, to the rod of which they are connected, and the slots are curved so that the diminution of the throw of the head, which takes place as the wheels approach the vertical lines of the pivots, is to some extent compensated by the pivots being forced up said curves.

Improved Fluting Iron.

Charles Anderson, Boone, Iowa.—The upper surface of the bed piece is an arc of a circle, with grooves therein of any desired form. The lower side of the upper portion of the device is grooved to correspond. In this upper portion is a cavity to receive a heated flat iron, so as to allow the heat from the flat iron to be transmitted to the fluter indirectly through a stratum of air, and thus to be tempered.

Improved Wind Wheel.

George Candee, Paddy's Run, Ohio.—The wings consist of a frame and panel, the said panel fitting snugly into said frame. The ends of the panel are pivoted eccentrically to the ends of the frame. A weight of sufficient size is arranged to hold the panel in line with the frame, under ordinary circumstances; but should the wind greatly increase in force, the panel will turn upon its axis, presenting its edge to the wind, the weight bringing it back to its place as soon as the force of the wind abates. The wings are held against the wind by another weight, and mechanism is provided so that, should the wind increase in force, stop blocks will be pushed back, raising the weight. The wheel will thus be stopped by an excess of wind, and will start again automatically as the wind abates. There is also a vane with suitable wings, adapted to serve as a governor, and so arranged that, as the wind increases in force, the outer ends of the wings are forced back, which raises a belt shifter and prevents the machine from being driven any faster by the increased velocity of the wind wheel. Should the wind still increase in force, the other devices are operated to throw the wings of the wind wheel out of the wind. As the force of the wind abates, the belt shifter drops downward, which increases the relative velocity of the machinery.

Improved Car Brake.

Stephen C. Taft, Franklin, Mass.—Triangular brackets are attached to the truck frame, the angles of which are down, and directly below one of the axles. There is a friction wheel on a shaft, the latter entering a bent lever attached to one bracket. This shaft is free to revolve, one end in the bent lever and the other in the bracket. A chain wheel is fixed on another shaft, which shaft revolves in the brackets. A loose friction chain passes around the chain wheel attached to the lever. A rod is attached to an arm on the chain wheel shaft, which extends to the locomotive, and is connected with a windlass shaft and wheel, which is under the control of the engineer, by means of which he can apply the brakes to all the cars in the train. When the rod is drawn toward the locomotive, the friction chain is tightened on the wheel, which draws on the bent lever. One end of the friction wheel shaft being confined in this lever, this movement will raise the friction wheel, and cause it to come in contact with the axle. The axle being revolved rapidly will cause the friction wheel and shaft to revolve, winding up chains, one of which connects with the brakes of the cars in front, and the other with the brakes of the rear cars. As the wheels cease to revolve, the friction wheel will cease to act, and the cars will stop. The back motion of the rock shaft is produced by a spiral spring.

Improved Treadle.

James W. Staples, Biddeford, Me.—The treadle rod is pivoted to the sewing machine table, and hangs down to a point a little above the frame connecting rod, where it is provided with a foot piece. A bell crank is pivoted at its angle on the connecting rod, and connected by one arm by means of a rod to the crank, while the other arm is attached to the treadle rod. The driving pulley turns in a plane at right angles to that in which the treadle rod swings, and a link is employed for connecting the bell crank with the rod attached to the crank, to allow the former to vibrate in two directions.

Improved Devices for Preventing Children from Falling Out of Windows.

Gabriel Kontzeberg, New York city.—Horizontal rods are placed across the lower part of the window, and supported in wooden blocks. Each block has a central perforation for the rod, which is cut exactly to the width of the window, the blocks being placed between the sash-guiding strips. A sufficient number of blocks and rods are arranged in the window to prevent any possibility of accident or danger to the children looking out. The uppermost block is secured, so as to bind firmly the whole series of blocks together. By detaching the fastening device or sash, the uppermost blocks may be raised and carried on the rod toward the center, so that the upper rod may be readily taken out of the sash strips, and then the other rods with their blocks raised from their connecting blocks and detached from the window.

Improved Call Bell.

Samuel G. Levey, New York city.—This invention consists of a movable rack for holding advertising cards or bills, connected with a call bell for hotels and the like places, and provided with mechanism for moving it, so arranged that each time the bell rod is operated for sounding the bell it will cause the rack to shift the breadth of one or more of the cards or bills, to change them about and present different ones to view, in a manner calculated to attract attention.

Improved Telegraph Insulator.

Chas. L. Le Baron, Pensacola, Fla.—This invention consists in a peculiar construction and mode of fastening telegraph wire insulators, whereby security and facility of appliance may both characterize the same device.

Improved Cooking Lamp.

George P. Houston, Washington, D. C.—This invention relates to and consists in means by which alcohol may be utilized as fuel upon excursions, hunting, or other expeditions, and in localities or seasons where but little fire is desired. This is accomplished by means of a folding stand, constructed to receive the cooking vessel and heater in a novel and convenient manner.

Improved Tool for Charging Piles of Railroad Rails and other Iron into Furnaces.

Smith W. Kimble, Springfield, Ill.—This invention relates to and consists in means for charging railroad rail piles into heating furnaces with convenience, facility, and economy of human labor.

Improved Piano Sound Insulating Attachment.

Wm. R. Miller, Baltimore, Md.—This invention relates to a novel mode of applying a non-conductor of sound to a piano, so as to prevent its diversion and partial escape by way of the legs.

Improved Pipe Mold Drying and Casting Pit.

Benj. S. Benson, Baltimore, Md.—This improvement relates to the floor of the oven and casting pit, and consists in providing the plates or sections which compose the same, with a series of apertures, peculiarly arranged for the upward passage of the hot blast to act on the pipe mold, both interiorly and exteriorly.

Improvement in Metal Pipe Manufacture.

Benj. J. Benson, Baltimore, Md.—The object of this invention is to provide an improved pit or oven for drying pipe molds and casting pipe therein, together with improved appliances or apparatus connected therewith for hoisting, carrying, adjusting, supporting, and locking or fastening the mold flasks.

Improved Combined Looking Glass and Photographic Frame.

Isaac N. Shatto, Newport, Pa.—An inner frame is hinged to the outer frame. The hinged frame has the glass inserted in it, and is provided with a back, which is covered with velvet. The main frame is also provided with a back and with a glass, between which and the back photographs or records are to be placed. By this construction, the device, when closed, presents no appearance of being anything but an ordinary looking glass.

Improved Mill Burr Dress.

John D. Miner, Moffett's Creek, Va.—This invention relates to means whereby a mill burr may be dressed so as to prepare the grain for flouring at the eye of the stone, and thus save a large percentage of the power ordinarily required under like circumstances, as well as permit the mill to be operated by twenty-five per cent less water.

Improved Cream Suet Compound.

John Hobbs, Boston, Mass.—This invention consists in a novel and valuable process, by which tallow may be so prepared and intermixed with partially churned cream that the product will subsequently granulate and assume a waxy appearance. It will then have the odor and flavor of cream, while it possesses the property of remaining solid up to a temperature of 90°, and of allowing a clean cut at all times.

Improved Low Water Indicator.

Charles N. Myers, Chicago, Ill.—A float controls the valve by which the whistle or alarm is sounded when the water becomes too low. The valve rod is extended horizontally, and supported in a socket formed in one side of the float case, and in the fork of an arm of an elbow lever connected with the float. This forked arm moves or slides the valve rod, when the float rises or falls, by engaging fixed collars on projections on the rod. The rod is also adapted for application of a device for turning it and grinding the valve to its seat.

Improved Surface Planer.

William C. Margedant, Hamilton, Ohio.—This invention relates to surface planers, and consists in causing the apron, which prevents the collection of shavings on the rollers, and the bonnet, which catches the shavings and throws them on the apron, to serve together as an upper table.

Improved Vehicle Rein Guard.

William Levy and William H. Christian, Ashland, Pa.—This invention relates to harness, and consists in means whereby the entanglement of driving reins with swingle trees, and many other accidents, may be effectually prevented.

Improved Machine for Molding Pipe Molds.

Benjamin S. Benson, Baltimore, Md.—This invention is an improvement on the machine for preparing the molds for casting metallic pipes, for which letters patent No. 53,178 were granted, September 3, 1861. The improvement relates to an adjustable counterbalance for the flask holder, whereby an equilibrium is maintained during the vertical movement of the latter; also, to the arrangement of radial revolving fingers in the sand hopper, to act in regular succession, to throw a constant and equable stream of sand into the flask; also, to a revolving cone for equalizing the distribution of sand within the hopper; also, in a spring balance or weighing attachment for determining, in advance, the weight of the molds.

Improved Fertilizing Compound.

Benjamin G. Carter, Oatlands, Va.—This invention relates to fertilizing compounds that are intended to take the place of stable manure, yielding to the plant all those elements of its composition in which the soil is liable to be deficient. It contains, in a cheap and easily transportable form, all the ingredients which give value to stable manure.

Improved Combined Ventilator and Chimney.

Walter H. Hinkley and Charles J. Dibrell, Dallas, Tex.—This invention consists of an iron-lined inner flue, secured within an outer casing with suitable bottom and top perforations for establishing a ventilating air current around the flue. The casing is securely attached to the ceiling and roof, and supported on suitable hangers or straps. A detachable extension flue is set into the upper end of the inner flue, and provided with rain-protecting caps or sheds at its top and above the upper perforated end of the ventilator.

Improved Hot Air Register.

Edward A. Tuttle, New York city.—This invention consists of the moving device for operating the fans of a register. It forms part of the register front or top, and is fitted, arranged, and secured in the stationary part by lugs in front of and behind flanges on which the movable part slides to work the fans. The said lugs and the flanges are so contrived that the parts subject to wear are hidden from view. The said moving part is connected with the fans, so that, when all parts are adjusted in place, its escape through the notches, by which the lugs going behind the flanges are introduced, is prevented.

Improved Lid for Closing Gas Retorts, Sugar Filters, etc.

James Dunneith, New York city.—This is an improved lid for gas retorts, sugar filters, and other vessels that require to be closed airtight, and in such a way that they can be readily opened and closed, as required. By suitable construction, should tar, coke, or other substance get upon and adhere to the mouth of the vessel, a few turns of the lid back and forth will bring said lid to its seat, and the said substance, instead of doing any harm, will be a positive benefit by serving as a seat to the lid. Afterward by turning the lid in the direction to cause the rollers to roll up inclined beads, the lid will be forced firmly into its seat. This construction also enables the lid, should it become worn, to be readily ground to its seat, so as to always shut airtight.

Improved Corn Planter.

James W. Simpson, Dry Ridge, Ky.—The wheels carry the axle with them in their revolution when turning forward, and allow the axle to be stationary when the wheels are turned backward. To the axle are attached cams, which, as the said axle revolves, strike against a bar and push it forward. In the upper arms of bars, connected with the bar last mentioned, are formed holes to contain seed enough for a hill, and in such positions as to enter the hoppers to receive the seed as the bar moves back, and to pass out of said hoppers, and over holes in the platform as the bar moves forward. As the seed drops through the holes in the platform, it is received upon lower arms of the second bars, and held until the first bar moves back, when it drops to the ground. The driver, from his seat, by operating a lever, can raise the furrowing plows from the ground when desired. The covering plows are placed a little in the rear, and at one side, so as to fill the furrows opened and cover the seed. The covering plows may be raised from the ground with and by the furrowing plows. Small V-shaped barrows are drawn in the rear of the covering plows. The same movement of the lever raises all the plows and the barrows from the ground. By operating another lever, the axle may be turned by hand to adjust it with respect to the dropping device, and to the wheels; and by means of a third lever, the dropping device can be operated by hand, or held from operating, as may be desired.

Improved Cotton Press.

John H. Simonsen, East Norwich, N. Y.—The followers are fitted to slide up and down inside of the case, the lower one having the long projections extending through slots, to be connected to racks for being raised and lowered by gears. The upper one has the short projections extending through slots, to be connected to racks which are also operated by the gears. The racks move the heads in opposite directions by one and the same movement of the wheels. The latter are geared with the driving shafts by a pair of eccentric toothed wheels, so adjusted that the leverage of the power increases progressively as the work progresses and the resistance increases. The driving shaft is worked by a hand lever, pawl, and a ratchet wheel. The ratchet wheel is made eccentric to increase the gain of leverage. The projections of the other follower connect with racks by sliding under hooks, by which the follower is pulled down. They have a hook projecting over the said hooks, by which the follower is raised when the racks are forced up. The racks also have a hook, by which they engage with the cross bars when raised up to be held properly for the projections to engage with them when the follower is moved back over the press when it is filled.

Improved Spring Rocking Chair.

Stephen Fallon, Brooklyn, N. Y., assignor to himself and Joseph A. Hodgson, of same place.—The base frame consists of two side frames connected at their upper middle parts, and at their rear parts by rounds. To the seat frame are attached two or more springs, which are coiled around, and their other ends are attached to the round, the ends of which work in sockets in the frame. Thus the springs form the only connection between the seat and frame, so that the seat is both supported and rocked on them. By withdrawing a pin and turning the round, the tension of the springs may be increased or diminished, as desired.

Improved Fluting and Smoothing Iron.

Benjamin F. St. John, Shelbyville, Ind.—The handle has a base with a flange, which latter surrounds the smaller upper section of the iron when the handle is attached. The upper section is cast on and forms a part of the iron. A spring hook, attached by a pivot pin to the handle, works through a hole in the front of the flange and enters a hole in the upper section. At the rear end, the handle is attached by means of a pin in the upper section and a hole through the flange.

Improved Sewing Machine.

John Speirs, New York city, assignor to himself and Henry F. Cox, same place.—This is a novel means for operating the looping hook of that class of sewing machines in which an under looping thread is used. It consists in the mechanism for imparting a rocking lateral movement to the looping hook, for moving the hook to and from the needle in a longitudinal direction.

Improved Paper Bag Machine.

Truman Hotchkiss, Stratford, Conn.—This machine is for making satchel bottom bags of various sizes. The paper is drawn down over the guide roller, and forced along under the movable shear, over the stationary one, to a table in front of the forming roller and the folding roller. One margin of the paper strip also passes under the pasting roller to receive the paste, by which the edges, joined in the forming of the tube, are pasted. It also passes between the former and folder and under the presser bar. As soon as the end of the paper strip comes to a gage, it stops and is cut off by the fall of a cutter. The folders then commence to turn, and at the same time the pressure bar springs down and presses the paper against the forming roller, so that it will be drawn in between the folding rollers and folded. By the same operation, the margin of the paper at the knife is drawn under the pasting roller on the cutter and pasted, for securing the folds of the bottom of the bag. When the roller folders have made one revolution and formed the tube and united the edges, they rest, while the sliding horizontal end folders go forward just in front of the end of the former, and fold in two sides of the extension of the tube beyond the former to form the bottom. Then the vertical sliding folders move forward and fold in the other two sides, and complete the bag. An ingenious device, lastly, flattens the bag down at the sides, and folds the bottom down flatwise on the upper side, so that it will pack into bales or boxes economically, without injury to the bottom.

Improved Corn Husking Machine.

Edward Ellison, Waverly, Md.—This invention relates to means whereby corn may not only be denuded of the husk, but at the same time relieved of the stem, and whereby the ear, the leaves of the husk, and the excised stem may be discharged separately, the leaves being left in a state ready to be used for mattresses and kindred purposes.

Improved Floor Clamp.

James Carille, Springfield, Mass., assignor to himself and J. H. Haskins, same place.—This invention consists of a pair of gripping levers pivoted to a hand lever, or to a pressure plate or board on it, for acting upon the edge of the flooring. It is arranged in connection with cam grooves in a plate also attached to the lever, so that the grippers being placed on the joist with the points near the lower edge, and the hand lever above, with the pressure plate against the flooring, and the hand lever being pressed forward in the direction to clamp the flooring together, such action will cause the grippers to bind firmly against the joist, and hold for a fulcrum for the hand lever and will let go and release the hand lever when the latter is moved back after pressing the flooring.

Improved Staging Clamp.

Charles E. Richards, Orange, Mass.—The clamps are made of iron rods one half inch, more or less, in diameter. The bodies are of a length equal to the breadth of the ledger boards, and are bent at right angles to pass across the edges of the same and the sides of the poles. They are bent again at right angles to overlap the outer side of the poles, and their ends are bent inward at right angles, and are made sharp so as to be driven into the said outer side of the poles. They are also arranged diagonally across the inner side of the poles, and their ends are bent inward in opposite directions to overlap the outer side of the poles from the opposite sides, so that the strain will come against the said poles. The ledger boards are kept from slipping in the clamps by wedges. By this construction, the scaffold is put up without the use of nails.

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J. E. H. will find results of experiments on the tensile strength of steel in Trautwein's "Engineer's Pocket Book."—F. C. B. will find directions for making pickles on p. 181, vol. 27.—H. W. C.'s queries as to elevator belts and mill gear are incomprehensible.—J. M. E. will find descriptions of pontoon and other bridges in Mahan's "Civil Engineering."—W. P. D. will find directions for preserving entomological specimens on p. 404, vol. 29.—W. P. can repair his damaged looking glass by the process described on p. 300, vol. 30.—G. L. H. will find a recipe for paraffin varnish on p. 91, vol. 31.

E. H. Jr. asks: What is the proper length of the inside of a link for an engine of 18x24 inches, whole throw of valve being 1/2 of an inch? A. There is no general rule. Make it of such a length that it seems well proportioned to the other details.

C. H. C. asks: What is the theory or philosophy of the improvement of a violin by age? Is it the use of the instrument, or its age, or both, that produces the improvement? A. Violins doubtless improve by age, as they become better seasoned; and the superiority of a few very old violins is due to their excellent manufacture.

G. I. E. asks: Will a siphon pump answer the same purpose as a steam pump? Will a siphon pump lift the water 28 or 30 feet and deliver it 20 feet? Will it take as much or more steam to run the siphon as a regular steam pump? We use a steam pump, 300 feet from mill, to draw water from well and through it to mill, sufficient to make steam for a 20 inch cylinder engine. We take steam from mill to steam pump. A. We think that your present arrangement will be more satisfactory than the one that you propose.

W. H. asks: How is the common governor of a horizontal stationary engine made to govern the steam as it goes through the pipe to the cylinder? A. Either by closing or opening the throttle valve, as occasion may require, or by changing the period of admission of the steam to the cylinder.

How many lbs. of coal would be required to reduce 40 tons of $2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$? A. It would depend somewhat upon the process. You should consult a good work on metallurgy.

C. F. S. asks: Can I use a round belt to run at quarter twist from a 24 inch pulley (running at 100 revolutions per minute) to a 16 inch pulley? A. Yes. As to your other question, consult a manufacturer.

W. R. H. asks: When is it 12 o'clock, when the clock strikes the first stroke, or when it strikes the last stroke? A. At the commencement.

A. Z. says: I made a tin blower, 10 inches in diameter, with 4 fans, square at ends; the fans measure 9 inches from end to end. I have a 2 1/2 inch pulley on fan shaft, and a 4 inch fly wheel on foot lathe, from which I take the belt. I run the fan as fast as I can, but it does not blow worth a cent. The opening in side is 2 inches, outlet is 1/2 of an inch. What is the matter with it? A. Probably you have made the fans so that, instead of forcing out the air, they just keep it in motion within the case.

S. says: 1. I have a hydraulic press, the pressure on the ram being 2 1/2 tons per square inch. How much pressure is there on the walls of the cylinder? Does the pressure vary on the walls of the cylinder as the ram is being pushed out? A. The pressure per square inch on the side of the cylinder at any time, is approximately the same as that on the ram. 2. By what rule do you ascertain the necessary thickness of cylinder to withstand any given pressure? A. You will find rules for proportioning thick cylinders in the SCIENTIFIC AMERICAN for June 21, 1873.

S. & M. say: We have a 6 inch pipe in a 60 foot well. Can we attach a 2 1/2 inch cylinder and pump water as easily, as if we used a 1 1/2 inch pipe? A. Yes, under ordinary circumstances.

A. A. J. says: In a large steam saw mill, we have to take water from a swamp, and a great deal of mud is pumped into the boilers and fills the gage cocks and steam gage with finely powdered earth, which also gets into the cylinder and completely fills the ends up, notwithstanding that we have a pipe leading from the main pond to a large wooden tank, which the water goes into and from which we take the water. What is the best means of purifying the water? Do you think it could be filtered, and what would be the best kind to make? We use about 2,000 gallons per day. A. You could readily filter that amount by means of a filter bed composed of gravel and sand. By having two tanks, from which to draw on alternate days, the water might be purified sufficiently by simply allowing the heavy particles to settle at the bottom.

A. P. A. asks: Is it possible to store up motive power in compressed air? How far can atmospheric air be compressed by mechanical power? What amount of power can be evolved from compressed air, proportionally to the size of receptacle containing it? A. Air can be compressed and used as a motive force, in exactly the same manner as any other permanent gas. We have heard of its being compressed to 300 atmospheres.

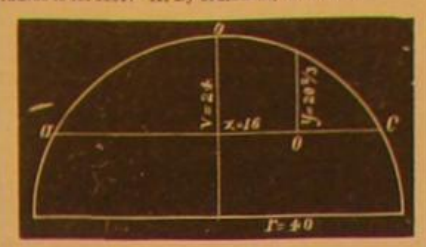
What is the name of the metal whose existence in the sun was discovered, through the spectroscopic, before its discovery in our planet? A. We never heard of it.

W. S. B. asks: What force can be resisted with a lever 4 feet long, placed upon a shaft 6 inches in diameter, with a pinion 12 inches in diameter? It is to work similarly to a sawmill carriage, only to be applied vertically. A. Neglecting friction, the pressure produced by the pinion on the rack will be 8 times as great as that applied to the lever.

M. J. B. asks: Is six inches of air space, lined with two coatings of heavy manilla paper, between the double wooden walls of a refrigerator room as efficient as a non-conductor as the same space filled with hair? Is it equal to three inches of hair? A. Dry air will be the best.

T. McK. says: I desire to construct a kaleidoscope in such a manner as to enable me to photograph the numerous designs therein produced. I propose to make it 25 inches long between the object and design, and the plate holder, the photographic lens to be midway between the ends and enclosed in the case. 1. Can I obtain light enough through the ground glass of the object end, to take a good picture? A. Yes. 2. What kind of lens must I use? A. A good achromatic glass of about 12 inches focus. 3. Is it necessary, in taking photographic pictures, to expose the lens of the camera to all the light possible, or can a picture be taken with the lens enclosed or shielded from all light, except that from the object photographed, if that object be well lighted? A. No light should fall on it except that from the design.

J. B. S. asks: What is the best practical method of finding the lines for a curved rib, when the radius is 100 feet? A. By ordinates, as follows:

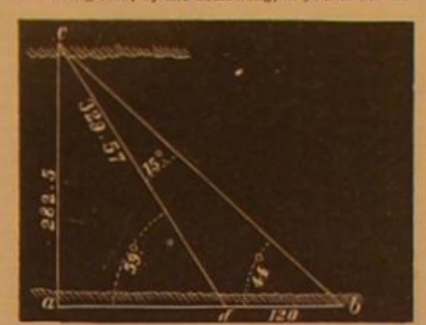


(1) $y = \sqrt{R^2 - x^2} = \sqrt{100^2 - 16^2} = \sqrt{9872} = 99.36$
 $y = \sqrt{10000 - 256} = \sqrt{9744} = 98.71$

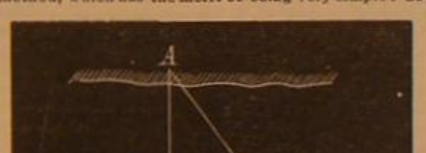
In the segment a b c, the height at the center, or the versed sine, is 24 feet, and to trace out a curve whose radius shall be, say 40 feet, take any point, as o, and draw an ordinate, y, at right angles to the chord, a c. The length of this ordinate depends upon the distance, x, that it is from the center of the segment, and is equal to the square root of the difference between the square of the radius and the square of the distance, less the difference between the radius and the versed sine, as expressed by the formula (1). Thus the length of any number of ordinates may be found, and the curve traced; and in the same relative manner the curve for the segment of a circle of any radius may be found.

What is the best method of saw-kerfing a piece to fit any required circle? A. No good work of this kind can be made by saw-kerfing; but the best will be when the saw is held radial to the curve.

How can I measure across a large stream for the purpose of building a bridge? A. There are various methods of doing this; by the following, if you have an instrument to measure angles, you may obtain either the direct or the oblique span: Stake out the line, a b, parallel with the course of the river, and measure d b=120 feet, the angle c b d=44°, and the angle c d b=59°. Place a stake, a, at a point observed to be where a line at right angles to a b will cut c. Then $59^\circ - 44^\circ = 15^\circ$ = angle d c b. Then as the sine of 15° is to 120, so is the sine of 44° to 229.57=d c. And as radius is to 229.57, so is the sine of 59° to 202.5=a c. If you cannot command the use of surveyor's instruments capable of measuring angles, the problem may be solved by the following method, which has the merit of being very simple: Set



two points, A and B, one on each bank of the river, as the points, the distance between which is required. Upon the ground stretch a line from B to D, so as to range with the point, A, on the opposite bank. At some convenient place, where the surface is nearly level or nearly in a plane, stretch a line, as D F and A B, or near it, in the line B D, as at C, set a stake, and from it stretch a line to and beyond G, parallel to the line D F. The angle C D F need not be a right angle, but the distances C D and G E must be equal, so also the lines C G and D E must be equal. Now select the point F in the line D F, so that it will be in range with G and A. These points definitely established by stakes set in the ground, they afford homologous triangles, by a comparison of which the desired distance from A to B may be ascertained. For example: The triangle E G F is homologous with the triangle D A F, having all its respective lines and angles in proportion. Therefore, $E F : E G :: D F : D A$; and from this, $D A = \frac{D F \times E F}{E G}$ or the distance D F multiplied by the distance E G, and the product divided by the distance E F, the quotient will equal the distance D A. Having this, and deducting the distance B D, the residue equals the distance A B. Example: Let C D=25 feet and D E=80 feet, and upon trial let it be found that E F=40 feet; then, $40 : 55 :: 120 : 165 = A D$, and $165 - 25 = 140 = A B$. Also, as the triangle A B G is proportionate to the triangle G E F, therefore, $40 : 55 :: 80 : 110 = A C$.



Is the annexed rule correct for finding the radius when the chord and versed sine are given? Rule: Add the square of half the chord of the arc to the square of the versed sine, and divide this sum by the versed sine. A. No; there is an error in your statement of the rule. You must divide by twice the versed sine.

F. S. C. says: Sidney Whiting, describing the royal carriages in the sun, says: "In form, too, the carriages were conchial, and were furnished with wheels without tyres; for by a peculiar contrivance, each spoke possessed an elastic spring just at the point of its articulation with the nave, so that at every evolution an onward motion was imparted, independent of any power the driver himself might exert." Can such a thing be arranged so as to be practicable? A. We cannot answer for what takes place in the sun; but on the earth, we are confident that no peculiar contrivance will enable power to be utilized without the expenditure of power.

E. W. St. J. says: I am running an engine and I have been troubled about the pump in raising water. I have been pumping about as high as the pressure of the air will raise it, and had no trouble until I tried to pump from a barrel that was supplied with water from another well by means of a steam jet pump. Now the barrel is placed in the old well, some two or three feet higher up than where I pumped from before; but I cannot make the suction pump raise the water from the barrel to the engine room. It seems as though it ought to pump better now, as the water is two or three feet higher up than it was before. The water from the new well is not pure. It is of a light color, and gets this from the blue clay in the well, and the water from the jet pump is warmed by the steam. What is the trouble with the water or the pump? A. The warm water seems to be the cause of the trouble.

S. H. C. asks: At what part of the stroke of the piston should the steam be cut off, in a Corliss engine, to be the most economical? A. Let your engine do the required work, and then set the cut-off as near the beginning of the stroke as possible.

E. asks: Is glass a conductor or a non-conductor of heat? A. Glass is one of the poorest of heat conductors.

J. S. asks: Is there a patent instrument by which the correct distance of an object can be told without measuring? A. We know of no such machine.

J. G. H. says: I have been running an engine; and to get speed to thresh wheat, I used to increase the driving pulley, which I did by putting on wood, from 2 1/2 inches in diameter up to 4 1/2 inches. The engine is rated at 4 1/2 horse power, and works very well while attached to the thrasher, and runs steadily; but in running alone it runs very irregularly, and sometimes will stop. The governor seems to act freely, and the engine works well when attached to or doing work. Why will it not run as well when doing nothing but pumping? A. The trouble may be either with the governor or the pump. We could not give a positive opinion, from your account.

H. asks: What are meant by the following, viz.: engine lathe, Monitor lathe, friction pulley, and blowing cylinders? A. An engine lathe is a lathe having a face plate and generally a short bed, being suitable for chucked work. A Monitor lathe is one with a revolving rest, having several tools fastened in it at the same time; it is generally used for small work. A friction pulley is a pulley which drives or is driven by the friction caused by its face being forced against another face. A blowing cylinder is the air compressor in blast engine, used in iron-smelting, etc.

T. H. W. asks: How can I best anneal iron boiler tubes, so as to make necessary flanges on the ends when inserting them? A. Heat them to a red and allow them to cool in fine ashes or slaked lime. 2. Would not some method by which the tubes of locomotive boilers could be removed or replaced more readily than by the present system, be valuable? A. Yes.

1. Can fulminate of mercury, about an ounce in quantity, be safely sent through the mails? A. It would be highly dangerous and criminal to send it by mail. 2. How is it made? A. See p. 99, vol. 31.

When small brass work is finished in a lathe or with a file, with what should it be coated to preserve its polish? A. With lacquer.

J. B. says: I have no appetite, and am quite weak, with cold sweats every night. What should I do? A. Take a grain citrate of iron and quinine pill every night before retiring.

C. R. asks: Can boiled starch be kept fresh for some time, without getting sour? A. Yes, from two to four days, by adding sulphate of copper.

F. C. K. asks: Is there any process for rendering woolen cloths impervious to water? A. Cloth is rendered waterproof by simply passing it through a hot solution of weak glue and alum. To apply it to the cloth make up a weak solution of glue; and while it is hot add a piece of alum (about 1 oz. to 2 quarts), and then brush it over the surface of the cloth while it is hot, and then dry it. Cloth in pieces may be run through this solution and dried. By adding a little soap, the goods will feel softer. Woolen goods are prepared by brushing them first on the inside, and then with the grain or nap of the cloth. It is best to dry this first in the air, and then in a store room at low heat. Cloth thus prepared is impervious to water, but pervious to air.

C. B. N. asks: What do brewers use to make beer sparkle when filled into the glass? It is evidently due to carbonic acid gas; but what is the process by which beer is charged with this gas? A. The effervescence you speak of is due to carbonic acid generated by fermentation.

G. J. E. says: Conch and similar shells, when held close to the ear, produce sounds similar to that of the Gulf heard from a distance. What is the philosophy of this? A. It is caused by irregular concentration and reflection of sound.

N. A. W. asks: What is the resulting compound from mixing an acid and an alkali, and its known or probable effect on the human system? A. A complete answer to your question would require too much space. The compound resulting from the combination of an acid with a base is what is known as a salt, of which there are many hundreds. Their effects on the human system are as numerous and as varied; for instance, muriatic acid and soda combine to form common table salt, comparatively harmless, while hydrocyanic acid and potash forms one of the most deadly poisons known.

Is light bread, made by using an acid and an alkali, wholesome? A. The utility of yeast, baking powder, etc., as used for the leavening of bread, is due to the quantity of carbonic acid gas generated by them under certain circumstances. That amount of gas taken into the stomach is not injurious. The small quantity of the alkaline salt formed seems to aid rather than retard the digestion of the food containing it.

J. S. asks: What is the color of the pure juice of lovage? A. "Ligusticum italicum" (lovage) is an umbelliferous plant, growing wild in Southern Europe, and often cultivated in gardens. The whole plant has a strong, sweetish, aromatic odor, and a warm pungent taste. When wounded it emits a yellow, opaque juice, which concretes into a brownish, resinous substance, not unlike opoponax. The roots, stems, leaves, and seeds have all been employed, but the last have the aromatic properties of the plant in the highest degree. —United States Dispensary.

E. F. B. asks: When will a balloon rise more easily, when the air is heavy or when the air is light? A. The ascending power of a balloon does not depend upon the state of the atmosphere; for, as the barometer sinks, the gas expands or increases in volume in exactly the same ratio as the air.

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

G. W. J.—It contains no silver. It is a flint coated with oxide of iron.—H. D. B.—We cannot spare the time to make an organic analysis. Your specimens resemble buttons made of pressed paper, and a hard, gummy substance, with a waterproof black varnish upon the outer surface.—A. M. B.—Nos. 1 and 2 contain no silver; they are principally silica and iron. No. 3 is red jasper; No. 4 is mica, hornblende, and iron. No. 5 gives every indication of an ore containing a good percentage of manganese; also iron. No. 6 is feldspar. No. 7 is carbonate of lime, silica, and traces of iron. No. 8 is a variety of fine blende, with sulphide of iron. No. 9 is iron silica, alumina, etc. No. 10 is hematite.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

- On Storms. By S. A. M.
- On Perpetual Motion. By F. V. F.
- On Mesmerism. By G. H.
- On an Ice Box. By C. E. K.
- On Beveled Arrow Heads. By A. E. D.
- On a New Motor. By D. D. P.
- On Some Magnetic Experiments. By A. F. O.
- On Steam Cars. By F. G. W.
- On Steam Locomotion. By M. G.

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 enquiries analogous to the following are sent: "Please to inform me where I can buy sheet lead, and the price? Where can I purchase a good brick machine? Whose steam engine and boiler would you recommend? Which churn is considered the best? Who makes the best mulch? Where can I buy the best style of windmills?" All such personal enquiries 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

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AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

30,651.—HARVESTER.—S. W. Tyler. October 28.

EXTENSIONS GRANTED.

29,694.—CLOTHES DRYER.—D. K. Hickok.
29,707.—CULTIVATOR.—T. W. McDill.
29,727.—SHAPING AND MOLDING MACHINE.—H. D. Stover.
29,728.—PLANING MACHINE.—H. D. Stover.

DESIGNS PATENTED.

7,627.—OIL CLOTH.—J. B. Violet, Paris, France.
7,628 & 7,629.—ROSETTES.—A. H. Austin, New York city.
7,630.—COFFIN HANDLE TIP.—G. W. Bunnell, Meriden, Ct.
7,631.—DOOR HOLT.—A. W. Hirschfeld, Meriden, Conn.
7,632.—VELL.—S. M. Meyenber, Paterson, E. J.
7,633.—BOOT JACKS.—M. E. Nichols, Clarksville, Mo.

TRADE MARKS REGISTERED.

1,925.—GROUND CORN.—Pearl Homing Co., Baltimore, Md.
1,926.—TERRA COTTA.—R. Ellis & Co., New York city.
1,927.—SODA WATER.—Harrison et al., Davenport, Iowa.
1,928.—GAS MACHINES.—Keystone Safety G. M. Co., Phil.
1,929 & 1,930.—SUGARS.—F. O. Matthiessen et al., Jersey City, N. J.
1,931.—DYE STUFFS, ETC.—Weeks et al., Boston, Mass.

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 application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (34 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
AUGUST 3 TO 13, 1874.

3,735.—P. J. Devlan, Jersey City, N. J., U. S. Improve- ment on treating sponge, called "Devlan's Process of Treating Sponge, for Different Purposes." Aug. 3, 1874.	
3,736.—H. Bolton, Elizabethtown, Ont. Improvements on washing machines, called "Bolton's Improved Washer." Aug. 3, 1874.	
3,737.—C. C. Kinney, Doreham Township, Oxford county, Me., U. S. Improvements on sash holders and fasten- ers, called "Kinney's Sash Holder and Fastener." Aug. 3, 1874.	
3,738.—H. Woodward and M. Evans, Toronto, Ont. Im- provements on the art or process of obtaining arti- ficial light by means of electricity, called "Woodward and Evans' Electric Light." Aug. 3, 1874.	
3,739.—W. Lockwood, Elfrid Township, Middlesex county, Ont. Improvements on using platforms and hoist- ing machines, called "Lockwood's Improved Rising Platform and Hoisting Machine." Aug. 3, 1874.	
3,740.—S. H. & D. W. Davis, Detroit, Mich., U. S. (Ex- tension of Patent No. 252, New Brunswick). Freezing and preserving apparatus to be used in freezing and preserving fresh fish, fresh meats, and other like arti- cles. Aug. 3, 1874.	
3,741.—B. Sloper, New York city, U. S. Improvements on gas machine, called "Sloper's Automatic Water Gas Generator." Aug. 4, 1874.	
3,742.—D. S. Cornell, Warwick Township, Lambton county, Ont. Extension of No. 61, for a self-cleaning and adjusting gate hanging. Aug. 13, 1874.	
3,743.—J. R. Brown, Philadelphia, Pa., U. S., assignee of R. W. Wetherill, Chicago, Ill., U. S. Improvements on burglar alarms, called "The Keystone Portable Burglar Alarm." Aug. 13, 1874.	
3,744.—D. C. Grant, Houghton, Mich., U. S. Improve- ment on ice plow and ram attachments for vessels, called "Grant's Ice Plow and Ram Attachment for Vessels." Aug. 13, 1874.	

3,745.—D. E. Cooke, Brantford, Ont. Improvements on
refrigerators for preserving meat, butter, etc., called
"The Gould Refrigerator Trussed Rack." Aug. 13,
1874.

3,746.—H. Vandewater, Phelps, N. Y., U. S. Improve-
ments in turbine water wheels, called "Vandewater's
Improved Turbine Water Wheel." Aug. 13, 1874.

3,747.—Wm. Miller, Boston, Mass., U. S. Improvements
on methods for equalizing or distributing pressure,
called "Miller's Method of Equalizing or Distributing
Pressure." Aug. 13, 1874.

3,748.—G. W. Millner, Charlottetown, Prince Edward
Island. Improvements on pipe vices, called "Millner's
Pipe Vice." Aug. 13, 1874.

3,749.—A. L. Trudel, St. Antoine de Tilly, P. Q. Nou-
veau system de propulsion des chaloupes, bateaux, etc.,
dit "Le Propulseur Trudel." (New system of propel-
ling boats.) Aug. 13, 1874.

3,750.—C. Buchner, Tilsonbury, Ont. Improvements on
a machine for washing clothes, called "Buchner's Im-
proved Champion Washer." Aug. 13, 1874.

3,751.—R. Gadonas, Montreal, P. Q. Improvements on
gags for center bits, called "Gadonas' Bit Gage,"
Aug. 13, 1874.

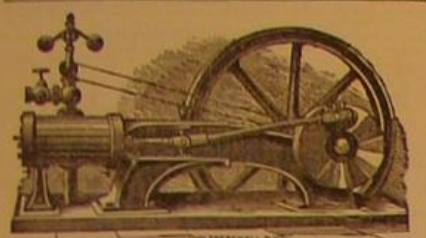
3,752.—L. S. Colburn, Oberlin, O., U. S. Improvements
on files, called "Colburn's Improved File." Aug. 13,
1874.

3,753.—E. Caswell, Lyons, N. Y., U. S. Improvements
on a carriage and wagon hub borer, called "Caswell's
Hub-Boring Machine." Aug. 13, 1874.

3,754.—T. A. Savard, Quebec, P. Q. Ameliorations aux
horloges ordinaires, dites "Le Cadran Universel Sa-
vard." (Improvements in clocks.) Aug. 13, 1874.

3,755.—T. Burns, Ansonia, Iowa, U. S

HOOKWATER ENGINE.
The lowest-priced good Engine ever constructed. Boiler and Engine made of the best charcoal iron. Compact, substantial, economical, and easily managed. Boiler, Governor, Pumps, and all trimmings complete for running at low price of \$3 Horse Power... \$251 50
Delivered on Cars, Boxed, at Shops.
FOOS & JAYNE,
109 LIBERTY STREET, NEW YORK.



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MANUFACTURERS OF

First-Class Stationary Engines,

- First—With single slide valve cut-off by lap at X stroke.
Second—With indirect cut-off valves arranged to close at any part of stroke.
Third—Steam jacketed cylinders, fitted with patent automatic cut-off valve gear and governor, guaranteed to run on 3 lbs. of coal per indicated horse power, or to make 50 barrels from 1 ton coal.
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CLEVELAND IRON INDUSTRY AND ITS FOUNDERS.

The rapid growth of the iron manufacture in the North Riding of Yorkshire, England, is one of the most remarkable features of the history of the trade. It commenced in 1850; in the next year 187,950 tons of iron were taken out of the mines; in 1856 the yield was 1,690,000 tons; and in 1870, 1,695,377 tons of pig iron was made in the district. Under this remarkable development, it is natural to expect that large fortunes have been made, new towns sprung up, and industrial establishments of all kinds organized. Middlesbrough, a town in the center of the trade, has aggregated a population of 40,000, while the whole district has increased from 20,000 to 250,000.

Bolckow and Vaughan have always been the chief iron-producing firm in the Cleveland district. They employed for many years not less than 10,000 hands, paying \$5,000,000 a year wages, and running a large proportion of the 150 or 160 blast furnaces in the neighborhood. The business is now in the hands of a stock company.

Mr. Bolckow, who was elected, in 1868, to represent Middlesbrough in Parliament, was born at Sulten, in Mecklenburg, Germany, in 1806. In 1821, when only fifteen years of age, his parents placed him in a merchant's office at Rostock. Here young Bolckow's intellect was developed, and his powers of perception exercised. He had resolved to surmount the difficulties which threatened his further progress; and if knowledge were power, then he would obtain it. It was clear there was no royal road, and individual effort was his only hope of success. He accordingly made the best investment of his capital, which was his mind. He had resolved to make a mark in the world.

In 1837 he commenced business operations in conjunction with an intimate friend and companion, at Newcastle-on-Tyne, and was known as a man who had a high regard for commercial morality, and as possessing remarkable business qualifications. His position enabled him to exercise the splendid abilities with which he was endowed; and at the age of thirty-four, in the meridian of human life, he decided to go in search of a larger field for his labors. Middlesbrough was selected as the center of his operations, and he was fortunate in meeting with the late Mr. John Vaughan, a practical iron maker; and the two entered into partnership in the iron trade. Their capital was not large, therefore their operations were limited, and it required great prudence in the carrying out of their arrangements. The firm erected blast furnaces on a very small scale, in 1841, and commenced the manufacture of iron. The ironstone had to be conveyed a considerable distance, which necessarily increased the cost of production. Just, however, as the matter was claiming the serious attention of the new firm, Mr. Vaughan discovered the Cleveland ironstone. The two partners were delighted with the discovery, but they did not allow their feelings to overcome them. They had an object in view, and firmly united to perform it, the one undertaking the commercial management, and the other the practical part of the business. The firm continued to prosper, and as each year passed additions were made to their works; and although most of the firms were increasing their capital, few, if any, were doing this so rapidly as Messrs. Bolckow and Vaughan. It was their good fortune to prosper so that in the course of a short time they were enabled to multiply their works. Their policy appears to have been to make the most of their limited capital, to win the confidence of all with whom they came in contact, to increase their circle of friends, and, while exercising patience, to be industrious and frugal in their expenditure.

As an employer Mr. Bolckow was generally respected.

Anxious at all times to promote the well being of his workmen, he never lost an opportunity of doing good. He often expressed his regret at the improvident habits of his workmen, and endeavored by every legitimate means to impress the desirability of a different course being pursued. It is recorded that he had an intense desire to see every public house closed in the district, and frequently used his efforts to prevent the sale of intoxicating liquors. Whatever may have been his expression on this subject, it is certain his habits were temperate, and he has ever taken a prominent part in the promotion of social, moral, and religious reforms, having for their object the advancement of mankind.

Anxious to improve the educational facilities of the town, he erected schools at a cost of \$35,000, for the accommoda-

tion of 1,000 children. Nor is this the only act deserving our admiration. Every charitable institution in connection with the town has had its funds augmented by his liberal subscriptions. The greatest act of munificence, however, was the gift of a park to the people of the town wherein he had acquired his wealth. This cost upwards of \$100,000; and in thus granting so large a portion of his profits, it is an evidence that he was not unmindful of the masses who had contributed to his immense wealth.

The Odorless Excavating Apparatus.

We notice, with pleasure, that the odorless excavating apparatus, illustrations and descriptions of which were published on page 255 of our Volume XXIX., is meeting with a success which appears to substantiate fully the important claims made by its introducers. It has received full indorsement in the reports of the Boards of Health of Washington, Baltimore, and Philadelphia, and is now in constant employment in the cities of Boston, Providence, Pawtucket, New York, Brooklyn, Wilmington (Del.), Baltimore, Washington, Georgetown (D. C.), Charleston (S. C.), Savannah, Memphis,

and New Orleans. The safe removal of soil is a matter of such sanitary moment, especially in large communities, that inventions for the purpose, proving really meritorious, deserve careful public consideration.

Manufacture of Plate Glass.

The manufacture of plate glass, as now conducted by the Thames Plate Glass Company, at Blackwall, London, is as follows:

The principal successive operations necessary to convert a mixture in the pot into a finished sheet of plate glass are six in number, and may be described under the heads of melting, rolling, annealing, grinding, smoothing, and polishing. The pots are of Stourbridge clay, made on the premises, and are filled with the mixture, the chief ingredients of which are silica, sand carefully dried, lime, sulphate of soda, broken white glass, and a little arsenic. The sand is obtained from Germany. After remaining in the furnace for about sixteen hours, the contents of the pot are fit for removal. The molten mass is then run over the surface of the rolling table, and the roller passed quickly over it. The glass commences to solidify almost immediately; and while in a thick tenacious condition, and of a rich golden tint, is rapidly transferred into the annealing furnace. The rough sheet, as it may now be termed, is taken from the annealing furnace to the grinding room: of these there are several, containing about a dozen grinding stones, or, more properly, beds or tables, upon which the plate is laid flat. The grinding frames consist of wooden boards joined together and armor-plated, so to speak, at intervals over the rolling or grinding surfaces with strips of wrought iron. These strips, when first screwed on to the frames, are half an inch in thickness, and when removed measure less than one eighth inch. The frames are mounted upon a spindle, and a see-saw, semi-rotary movement is imparted to them by shafting running underneath the beds. They are also capable of being shifted by a simple slot connection so as to work over any part of the surface of the sheet as required. The grinding beds are of stone, and measure about 16 feet by 11 feet. The materials used as the grinding agents are coarse sand, fine sand, and emery. A jet of water plays on the surface of the sheet during the whole of the operation.

Between the grinding and polishing processes there is an intermediate process called smoothing, in which two sheets of glass are employed. One is laid over the other and caused to move over it

in a manner similar to that in grinding. Emery is placed between the two surfaces. On entering the polishing room, the attention of a visitor is at once arrested by the reddish tinge of everything, extending to the dresses of the men and women engaged therein. This is due to the use of the red oxide of iron which is the polishing agent. The sheet to be polished is laid flat on a table, so as to be perfectly flush with the edges. The rubbers are of flannel and mounted on a frame, which carries them backwards and forwards over the sheet. The table, at the same time, has a lateral reciprocating motion, so that the whole surface of the sheet comes successively under the action of the rubbers. The largest plates measure about 15 feet by 10 feet, and the maximum thickness is about 1½ inches. One eighth of an inch is allowed for loss in the operations we have described. A nest of six boilers, and three vertical steam engines, two of 70 horse power and one of 60 horse power, supply the necessary motive power.

On September 2, the volcano Etna, in Sicily, was in violent eruption, which showed no signs of abatement.



H. W. F. BOLCKOW, OF MIDDLESBROUGH.

Scientific American.

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PROFESSOR TYNDALL'S ADDRESS BEFORE THE BRITISH ASSOCIATION.

A most remarkable speech from a most remarkable man. Masterly in thought, profound in learning, keen in logic, it is startling in the boldness and vigor with which its author declares his faith in a materialistic doctrine and in the hardihood with which, asserting that forms of religious opinion have ever impeded Science, he claims for the latter unrestricted rights of research, while relegating the former to the sphere of the emotions. Such is Professor Tyndall's address delivered at the recent session of the British Association for the Advancement of Science at Belfast; and its utterances, if we mistake not, will arouse as acrimonious debate and call upon the head of the author as fierce denunciation as did the publication of his famous opinions on the "prayer gage." The time and place incident to the delivery of the discourse give to it additional weight; for in addition to its being the personal views to which he, as an eminent scientist, has been led by lifelong thought and study, it is an *ex cathedra* pronouncement of the President of the greatest and most influential of British scientific associations, which, unless distinctly repudiated, renders that body, in the eyes of the world at least, more or less responsible for its promulgation.

To understand the position which Professor Tyndall has taken in this sudden invasion of the neutral territory lying between scientific and religious thought, the reader finds himself called upon to reconcile views which at first sight appear at wide variance. "Abandoning all disguise," says the speaker, "the confession that I feel bound to make before you is that I prolong the vision backward across the boundary of the experimental evidence, and discern, in that Matter which we, in our ignorance, and notwithstanding our professed reverence for its Creator, have hitherto covered with opprobrium, the promise and potency of every form and quality of life."

This, standing alone, is unquestionably the most open materialism; but its force is modified when the assertion follows that "the whole process of evolution is the manifestation of a Power absolutely inscrutable to the intellect of man. As little in our day as in the days of Job can man by searching find this Power out. Considered fundamentally, it is by the operation of an insoluble mystery that life is evolved, species differentiated, and mind unfolded, from their prepotent elements in the immeasurable past. There is, you will observe, no very rank materialism here."

There is no negation of a creative power, while the affirmation of a sustaining cause repels the notion of atheism. The challenge is hurled at the theologians, the advocates of the science of divinity, and not the simply religious whose nature impels them to the belief in and leads them to love and reverence for their Creator.

Professor Tyndall demands for Science freedom of thought in every department of knowledge. He denies, in fact, the right of theology to compel us to accept in blind faith truths susceptible to the investigation of our own reasoning faculties.

In thus noting the views of a distinguished thinker, we chronicle an event of no common importance: albeit it is one of which the wisdom will be widely questioned, and the expedience (of directly bringing into popular controversy thoughts likely to disturb the faith of many) denied, even by believers. It must not be lost sight of that the large majority of people never think, but receive the faith of their ancestors unquestioningly; others are incapable of thinking for themselves, others too indolent and careless regarding the whole subject. These have regarded the agitations of the great theories of evolution and the like, which have deeply moved the scientific world, with indifference, and classed them with the older doctrines of Comte, Spinoza, and similar writers, which they abhor as atheistical and subversive of all religion and piety. On such people, the unmistakable utterances of Tyndall, dispersed broadcast by the public journals and not buried in technical publications, must have their effect; but whether the seed thus sown will fall on good ground and produce broader, wider ideas of the ineffable greatness of the Creator, or be choked by the tares of a belief undermined, resulting in skepticism and infidelity is a question which every individual must answer according to his own conscience.

A WOMAN WITHOUT BONES.

The social developments across the water show a lamentable state of affairs due apparently to no other cause than a deficiency of backbone in one or two individuals.

When such disastrous consequences proceed from the weakening of a part only of the human framework, we sincerely trust that there may be no spreading of the disease lately developed across the ocean in the person of an Irish woman, who lived to see her entire skeleton waste away until it was but a fourth part as heavy as a new born babe.

The case occurred in Dublin, and may truly be called extraordinary. The victim, forty-five years old, was a patient in an insane asylum. For five years she was confined to her bed, complaining of no pain, but gradually becoming weaker, while dwindling in stature until she lost half her height.

As the disease progressed, her limbs were coiled up in every possible shape, the bones becoming extremely light, soft, fragile, and atrophied in every respect. At death, all that was left of her skeleton, including the skull, weighed two pounds and a half. The number of fractures was prodigious. The ribs were in a hundred fragments. The head of the humerus was bent; the fibulae were curved; the thigh bones and pelvis were huddled together; the bones of the vertebrae were thinned and worn away across the front of their bodies; the lower jaw was atrophied and broken into three pieces; the base of the skull was cribiform all through. Had she lived a little longer, it was thought that not a vestige of a bone would have been left in her body. What ailed her no one could tell, the disease being almost unheard of and difficult to diagnose, treat, or even name. Professor R. W. Smith, of Dublin University, who brought the case before the Pathological Faculty, looked upon the condition of the bones not as a disease but as a manifestation of a diseased condition as yet unknown, possibly related to rickets.

LIVING BAROMETERS.

That is a curious instinct which a large number of animals possess, of predicting the weather and signifying the approaching change by peculiar movements or sounds. Some of their actions in this respect appear to be more governed by reason than by mere instinct, others are clearly due to the moisture in the air or various atmospheric influences, while some, which occur under conditions which prevent their being referred to the latter cause, offer an interesting field for the investigations of the naturalist. The presence of the barometer in almost every farmhouse, together with the weather bulletin or the dictum of "Old Probabilities," good for the next twenty-four hours, render such homely knowledge as that which governed the labors of the farmers and sailors of the last century almost superfluous in this advanced age; but the subject, like all topics which relate to the sagacity of the lower animals, is of itself an interesting one. And besides, it is not entirely impossible that some farmer to whom the barometer, if he had one, would be incomprehensible, and whose location prevents his obtaining the weather reports, may, by some odd action of his own cattle, of some insect, or of some bird, as described in the following lines, be forewarned of a coming storm in time, and save perhaps a crop during the present harvest months.

We have said that certain movements on the part of the animals, before a change of weather, appeared to indicate a reasoning faculty. Such seems to be the case with the common garden spider, which, on the approach of rainy or windy weather, will be found to shorten and strengthen the supporting guys of his web, lengthening the same when the storm is over. There is a popular superstition in England that it is unlucky for an angler to meet a single magpie; but two of the birds together are a good omen. The reason is that the birds foretell the coming of cold or stormy weather; and then, instead of their searching for food for their young in pairs, one will always remain on the nest. Sea gulls predict storms by assembling on the land, as they know that the rain will bring earthworms and larvae to the surface. This, however, is merely a search for food, and is due to the same instinct which teaches the swallow to fly high in fine weather, and skim along the ground when foul is coming. They simply follow the flies and gnats which remain in the warm strata of the air. The different tribes of wading birds always migrate before rain, likewise to hunt for food.

There is a large variety of actions of which it is hardly possible to give a satisfactory explanation. Coming rain is foretold by the peacock uttering frequent cries, by the

woodpecker lamenting, by paroquets babbling, by pintados perching, and by geese running around uneasily. So also it is said that, when a storm is at hand, swine will carry hay and straw to hiding places, oxen will lick themselves the wrong way of the hair, sheep will bleat and skip about, hogs turned out in the woods will come home grunting and squealing, colts will rub their backs against the ground, crows will gather in crowds, crickets will sing more loudly, flies come into the house, frogs croak and change color to a dingier hue, dogs eat grass, and rooks soar like hawks.

It is probable that many of these actions are due to actual uneasiness, similar to that which all who are troubled with corns or rheumatism experience before a storm, and are caused both by the variation in barometric pressure and the changes in the electrical condition of the atmosphere.

PLUMBERS' CARELESSNESS.

The Prince Consort of England was killed by typhoid fever generated by foul sewer gases, due to carelessness and ignorance in the plumbing work of his residence. The Prince of Wales nearly lost his life through the same insidious means, due to the same inexcusable cause. One of the grandest and most venerable of English cathedrals that of Canterbury, was badly injured and nearly destroyed through sparks from a carelessly managed plumber's furnace igniting the roof. The magnificent Alexandra Palace, just completed and containing works of art of immense value, quite recently fell a victim to the flames, again originating among the plumber's working apparatus. Later still, the burning of the Liverpool landing stage, the greatest floating platform in the world, is now stated to have been due to the carelessness of the plumbers employed in joining the gas pipes below the flooring. The dangerous qualities of carelessness and ignorance, which are inherent to the workman of the trade, are therefore very justly coming in for their full share of reprobation from the English journals.

"Are we to spare a prince for every step of progress, or will our plumbers learn for the future without? They burn down cathedrals and music halls with unflinching impartiality by means of a system of soldering long ago abandoned by other nations. Thinking a good 'wiped joint' the perfection of human ambition, the plumber takes a long time over it and admires it lovingly from every side before he can make up his mind to part with it. This choice production of human skill is perhaps laid in the earth or built into a wall, and has no need of this fine art finish, but gets it, nevertheless." So says a correspondent of the English *Builder*. We echo his remarks with a grim sort of satisfaction, for it is not very long since we experienced one of the advantages of these lovely wiped joints, artistically molded by a bungler's paw. The completion of the work was the signal of a series of complaints (by the occupants of the building) that the water refused to run, except in a miserable little stream, from any of the faucets. Then we hired more plumbers to find out the mistakes of the first ones, and these overhauled pipes, and poked sticks and wires down them, and nosed around the cellar, and went on the roof, and ripped up the street. This was to the tune of something over a hundred dollars—still the water would not come; then the plumbers went at it again, and probably would have been struggling with wires and wrenches and spades and pincers up to the present time, had not some one suggested to look at the joints, and then the evil was found. One important wiped joint had had the solder squeezed into it so as to block up nearly the whole bore, and of course but very little water could pass through.

We hired another of the craft not long ago to look after a furnace, from every register of which horrible smells were emitted. We had a man and a helper; the duty of the latter was to hold a candle and converse with the man on appropriate and interesting topics, for which we paid him some dollars per day. This pair of worthies we turned loose in the house, with instructions to find out and eradicate the trouble. They got into the furnace, and poked brooms up into the flues, and took off the registers and poked brooms down. Then they pulled out several pieces of flue and soldered them over again, nobody ever could divine what for. Then they upset a furnace on a heap of kindling wood and nearly burnt the house down; and finally, after some days' tinkering, brought us an astonishing bill. We paid it, supposing that the work was thoroughly performed; but on lighting the furnace, again came the odor. On making a personal investigation, the first door that we opened (that in the brick casing of the furnace, which these individuals never thought to touch) revealed the cause in the shape of a bushel of dead rats. To make matters worse, the flues, which they had pulled out and fixed, had come to pieces, and we had to hire more plumbers to solder them with something besides rosin.

A few pages further on, in the same issue of the journal from which we clip the extract given in the beginning, is the report of the conflagration of some fine tenement houses in Edinburgh, due to a plumber's carelessness. The man left his furnace with a bright fire in it on the leads and went to dinner. A strong breeze blew it over, and the igniting of the building was the natural result.

We have no space to go over the series of outrageous botches which have been foisted upon us, coupled with enormous charges from plumbers, in this city. We have seen traps put in waterclosets, of not the slightest use in keeping down the noxious emanations. Water pipes run up the back walls instead of between the party walls, of course freezing at the first frost; new joints are made between floors, through which, the moment water was let on, the leakage poured out, to the ruin of our ceilings.

In fact so often have we been ruthlessly victimized that

when we do obtain a plumber that does his work in an honest, workmanlike, and substantial manner, at moderate cost, we shall be disposed to cherish him as a jewel of rare price.

QUICK AS WINK.

Our notions of the value of time are altogether relative. Ordinarily a minute more or less is a matter of little moment. A would-be passenger, who arrives at a railway station just in time to be too late, realizes that even a less interval than a minute may materially affect his calculations. To the timer of a closely contested race, a second is important; it may be a quarter of a second will make all the difference between fair speed and the "fastest on record." To the astronomical observer, a quarter of a second is a very long time, as an uncertainty of that amount might render worthless an observation which he can never hope to repeat, and for which he may have journeyed thousands of miles.

In some cases an interval so brief as that required for the movement which stands proverbially for instantaneous action may have a material effect on the accuracy of a calculation; indeed it is at times not only necessary to know and make allowance for the time of movements as quick as winking, but to know substantially how much quicker one man winks than another.

Though the movement of the eyelid is so rapid that there is no apparent interruption of vision, the act really involves half a dozen distinct physical and mental operations, the duration of each of which can be closely measured. If the movement is reflexive or involuntary, time is required for the transmission of the impelling sensation to the sensory center, time for its reflection to the winking muscle, time to overcome the inertia of the muscle—the period of latent excitation, as it is called—and lastly time for muscular contraction. That the sum of all these periods is something considerable can be roughly proved by counting the number of winks one can make in a second, or by timing the act by the ticking of a watch.

The purely reflexive part of the act of winking has been ingeniously timed by Dr. Sigismund Exner, who chose this act as the one best adapted to enable him to determine the time required for a complete reflex action. His apparatus consisted of a very light lever of straw, terminated at one end by a bristle which was applied to the eyelid, the other end being connected with the usual contrivance for exactly registering the beginning of muscular contraction. The stimulus was an electric spark, applied in two ways, by passing in front of the eye and thus acting on the optic nerve, or by exciting the nerve of sensation by striking directly on the cornea. He found the interval between the spark and the beginning of motion (that is, the time occupied in the transmission and reflection of the sensation, with the period of latent excitation in the muscle) to vary, with the intensity of the stimulus, from about $\frac{1}{15}$ to $\frac{1}{25}$ of a second; the stronger the spark the quicker the action. The period of latent excitation of muscle in man has never been precisely determined. Dr. Exner estimated it at about a hundredth part of a second, which would reduce the time required for the purely reflexive part of the act of winking to about $\frac{1}{25}$ of a second for a weak impression, and $\frac{1}{37}$ of a second for a stronger stimulus.

For a voluntary wink, a slightly longer time appears to be required, since a measurable interval is occupied in the act of volition.

WHAT MAKES THE APPLES ROT?

Our worst enemies are the smallest. All the ravenous beasts in the world, mad dogs included, probably destroy fewer human lives than are destroyed in this city alone by the ravages of those minute but virulent organisms of the genus *micrococcus*, to which we owe small pox, diphtheria, and some other malignant diseases. Similarly, the thousand sturdy weeds which annoy the farmer, the caterpillars and grasshoppers which occasionally devour his crops, are relatively innocent and harmless compared with the numerous microscopic pests which rust his grain, rot his potatoes and fruit, and otherwise levy their burdensome taxes without making themselves visible.

Just at this season, not the least interesting of these individually insignificant, collectively enormous, nuisances are the two forms of fungus growth which have most to do with the untimely destruction of fruit—*mucor mucedo* and *penicillium glaucum*.

Our apples decay, not because it is their nature to, as Watts might say, but because it is the nature of something else to seize on them for subsistence, as we do, at the same time making of them a *habitat*, as we do not. Kept to themselves, apples and other fruit never rot; they simply lose their juices by evaporation, shrivel, and become dry and hard, or, if kept from drying, remain substantially unchanged, as when securely canned. It is only when invaded by the organisms we have named that they lose color and quality, take on offensive tastes and odors, become covered with white or green mold—in short, develop rotteness and decay.

Formerly this process was thought to be no other than a continuation or exaggeration of the natural process of ripening, the chemical changes which produce the odor and flavor of the ripened fruit simply going on to their legitimate though less delightful end. But this theory overlooked the very common and important facts that fruit may rot without ripening, and that ripe fruit will not rot if properly protected.

It was not until the microscope was brought to bear on the problem, and the conditions of decay were so convincingly demonstrated, by Davaine, that the real nature of the process became clear. Now we know that, so far from being

the complement of growth, the antithesis of life, decay is in reality the taking on of a more rapid though specifically different growth. It is synonymous not with death, but with intensely active life.

In general structure, the numerous microscopic fungi are very much alike, consisting mainly of a network of colorless cells and filaments, called the *mycelium*. This is the vegetative part. There is, besides, a reproductive part, in which is produced the seed or "spore," the structure of which is different in the different genera. In the *mucor* each reproductive filament bears a globular swelling at its superior extremity, in the interior of which the spores are developed. In the *penicillium glaucum* the reproductive filament bears a tuft of from four to eight branches, which, in turn, produce upon their extremities a chaplet of small oval spores. It is called *penicillium* on account of this pencil-like tuft of its spore-bearing filaments, and *glaucum* from their bluish green tint. The mold so frequently seen in oranges is produced by this fungus. It is comparatively of slow growth, and the alteration it produces in the properties of the fruit it lives in and upon is not so marked as that caused by the *mucor*.

When a fruit is invaded by either of these fungi, the vegetative filaments send their branches among and around the fruit cells, and rapidly envelop them in a network of mycelium, absorbing the substance and juice of the fruit, and producing the chemical transformation characteristic of decay. All this goes on in the interior of the fruit, the fructification of the fungus taking place only on the surface, in contact with the atmosphere. For this reason fruit covered with a firm, fine skin, like the apple, may be a mass of what we call corruption within—in other words, thoroughly decomposed by fungus growth—while no visible mold—the fructifying part—appears on the surface. On the other hand, thin-skinned fruits like the strawberry, which are easily pierced by the reproductive filaments, are often covered with an abundant fructification in a very short time, for the fecundity of these microscopic fungi is sometimes as marvelous as the rapidity of their growth. For example: A single zoospore of the *peronospora infestans*, which causes the potato rot, will envelop the cellular tissue of a potato leaf with mycelium filaments in twelve hours, and fructification will be completed in eighteen hours longer. One square line of the under surface of a leaf, where the fructification naturally takes place, may bear as many as three thousand spores. Each spore supplies half a dozen zoospores, individually capable of originating a new mycelium. From one square line, therefore, there may come, in less than two days, nearly twenty thousand reproductive bodies, and a square inch may yield nearly three millions! No wonder the disease spreads rapidly.

In the case of fruit, decay may be originated in two ways, and two only: by direct contagion or by wind-wafted spores. With firm-skinned fruit like apples, still another condition is essential, namely, a break in the skin of the fruit to allow the parasite to enter and take possession. In every case of decay in apples, the center of disturbance will be found at a bruise, scratch, or puncture; and unless such a way be opened, the apple may hang until it is dry as leather, or it may lie for weeks in direct contact with rottenness, and remain perfectly sound.

To this it may be objected that the constant presence of the fungus in decay is no proof that it is the cause of that condition, on the contrary, the breaking down of the fruit tissue by violence, and subsequent chemical action owing to access of air, may rather make the growth of the fungus possible by preparing a suitable soil for its development. The objection has been met in the investigations of Davaine. The evidence that the fungus precedes and causes the changes which we call decay is of the same character as that which establishes the connection between a vaccine pustule and inoculation by vaccine virus. When sound fruit is inoculated with the spores of *penicillium*, decay begins at and spreads from the point of inoculation. Apples similarly wounded, but not inoculated, remain the same.

FAT IN FORAGE PLANTS.

To any one not a chemist or a quadruped, the last place to look for fat would be a hay mow or a stack of straw; yet it appears from recent investigations that fat is not only an essential constituent of hay, straw, and similar forms of vegetation, but one of considerable economic value.

In the lower leaves of oats in blossom, Arndt found as much as ten per cent of the dry weight to consist of fat and wax, the latter appearing as the bluish bloom so conspicuous on the leaves of luxuriant cereals. In fodder crops, generally the greatest proportion of fat is found in young and thrifty plants. Thus Way found early meadow grass to contain as much as six and a half per cent of fat; while in that of the same meadow, collected in the latter part of June, there was but a little more than two per cent. The proportion of fat is increased by nitrogenous manures: the grass of a sewage meadow at Rugby contained above four per cent of fat, while similar grass, not sewage, afforded less than three per cent of fat.

The nature of this sort of vegetable fat was investigated some little time ago by the German chemist König, who found that by treatment with strong alcohol the fat of grass and clover hay could be separated into two parts, one a solid waxy substance, the other a fluid fat, soluble in alcohol. At first he considered the latter to be a true glycerin, but changed his mind after the investigations of Schulz, who proved that, though it contains the same proportion of carbon and hydrogen as ordinary fat, the fluid fat of hay is something quite different, since no glycerin can be obtained from it.

König has since confirmed these results and carried for-

ward the investigation, showing that the fat of oats, rye, and vetch seed is similarly constituted. In all these forms of vegetation, hay, oat straw, the grain of oats, rye, vetches, and possibly others, he finds oleic and palmitic acids, not combined with glycerin but in a free state; and as these acids in their combinations are well known as large ingredients of nutritive fats and oils, it is likely that they have a considerable influence on the value of these plants for fodder.

König also finds in hay and in oat straw the important ingredient of animal bile, *cholesterin*; still further, cerotic acid, a waxy body which forms twenty-two per cent of ordinary beeswax; and two fatty substances new to Science, one fluid, the other solid. They are distinct compounds, having the character of fatty alcohols. Another interesting discovery in hay fat is the presence of a hydrocarbon, the relations of which are not fully made out. In several respects, it agrees with some of the paraffins.

SCIENTIFIC AND PRACTICAL INFORMATION.

EFFECTIVE POWER OF ANCIENT WEAPONS.

A curious and interesting series of experiments recently took place in France, under the auspices of the Directors of the Museum of St. Germain, which consisted in tests upon ancient war engines constructed after the bas-reliefs found on Trajan's column.

An onager—variety of catapult—threw stone balls to a distance of 640 feet. Bolts from another kind of catapult traveled 980 feet in six seconds of time, showing a velocity of projection of 160 feet per second. The range and adjustment of the engines were readily calculated, and accurate shots were made at a distance of 480 feet. It would seem therefore that ancient Roman artillery included weapons of by no means contemptible effect, particularly since the muskets of seventy years ago failed to carry with accuracy over a distance equal to but little more than half that last mentioned.

NEW PROCESS FOR MAKING SILVERED TELESCOPIC MIRRORS.

M. A. Nicole states that he has succeeded in producing telescopic reflecting mirrors cheaply and easily by the electroplating process. He takes the mold of a concave surface, made of a mixture which is either an electrical conductor itself or else a non-conductor metallized by the aid of nitrate of silver and phosphorus dissolved in sulphide of carbon. In either case the mold is plunged in a bath of galvanic silver, where the current, conducted very slowly to the mold determines a deposit of excellent quality.

When the silver has reached a thickness of 0.015 inch, the bath of that metal is replaced by one of copper, so as to obtain a solid backing. The mold is then dissolved or melted and the mirror removed, nothing further being necessary than a light polishing. M. Nicole adds that he has produced perfect mirrors of four inches in diameter in this manner.

COMBUSTION OF POWDER.

As the result of their extended series of experiments, details of which we have from time to time published, Messrs. Noble and Abel conclude that the explosion of gunpowder determines a temperature of 4664° Fah., comparable to that of the fusion of platinum. The products of the explosion consist in 57 per cent of solid matters and 43 per cent of permanent gases, the latter consisting of carbonic acid, nitrogen, carbonic oxide, and sulphuretted hydrogen. Small grained powders give less gas than those of large grains: but generally the variations are so great that it is impossible to express the reaction by any chemical formula. The solid matters are mainly carbonate, sulphate, and hyposulphite of potash.

MUSCARINE.

This is the poisonous principle extracted from a mushroom of the genus *agaricus*. According to Dr. Prevost, of Geneva, when it is administered in a very weak dose it acts with force upon the pancreatic and biliary, while lessening the urinary secretions. It is known that the sulphate of atropine produces exactly the contrary effects, so that these two poisonous substances are therefore antidotes to each other.

PARAFFINIC ACID.

Submitted to the action of fuming nitric acid at 47° B., or to that of a mixture of sulphuric acid and fuming nitric acid, paraffin oxidizes and becomes transformed into an oily liquid, of a light yellowish green color, which M. Champion has named paraffinic acid, and to which he ascribes the formula $C^{26}H^{38}N O^{10}$.

The composition of the paraffinic acid permits paraffin to be certainly designated by the formula $C^{26}H^{50}$. It may therefore be regarded as a clearly defined compound, and not as a mixture of different carburets of hydrogen.

ACTION OF ATMOSPHERIC VAPOR ON THE LUMINOUS AND OBSCURE HEAT OF SOLAR RAYS.

Father Provenzani, as the result of investigations on the above subject, finds that the luminous heat and the obscure heat do not maintain a constant relation, but that, while the former diminishes, the latter increases, and *vice versa*. The luminous heat diminishes in proportion as the quantity of vapor in the atmosphere augments. Such is not the case with obscure heat; for during days of the greatest absolute humidity, the obscure rays are almost always the strongest. This is ascribed to the radiating power of the aqueous vapor, which, after having absorbed the luminous rays, emits them under the form of obscure heat.

The conclusion reached is that photometric observations, continued over a long period, may be a useful means of determining the hygrometric state of the superior regions of the atmosphere.

NEW INVESTIGATIONS UPON SCORPIONS AND THEIR VENOM.

Some interesting and novel investigations have recently been made by Doctor De Bellesme into the nature and effects of scorpion venom upon the blood. We may here observe that, although the name of the scorpion is common enough, it has become so more through connection with groundless fables and superstitions than from any knowledge of the manners and habits of the insect. There are various species, of many of which the sting produces a painful wound; and among which there is one variety, however, the *scorpio occitanus*, which, it is stated, is capable of inflicting a deadly injury upon man. This insect is found in the south of Europe and probably in portions of Central America. It is nocturnal in its habits, avoiding the light and living in moist places, frequently under large stones, in little cavities dug in the earth.

While the sting of the less harmful variety of the insect results in no more pain than the similar wound of the wasp or hornet, that of the *occitanus* is followed by inflammation, swelling, and tumefaction around the lesion, together with strong nervous convulsions, often resulting in death. The insect strikes with its tail, or, more properly speaking, a prolongation of its abdomen, composed of a number of rings, the sixth and last of which constitutes the venom sac, terminating in a sharp curved point, from which the poison escapes through two connecting glands. The mere bite of the scorpion is harmless since there is no connection between the venom organs and the mandibles. When quiet, the insect lies upon its side, as shown in our engraving, where it is represented of its natural size. Once aroused, however, its whole aspect changes; the prehensile claws project forward, and the tail is carried in advance beyond its head, striking in every direction with lightning rapidity.

The natural prey of the scorpion is small insects and especially spiders, which it kills by its poison. The latter is its most useful weapon in its repeated struggles with other venomous insects, to the bite of which it would itself succumb.

Dr. De Bellesme finds that when the scorpion is aroused, as above described, the venom appears at the extremity of the sting in a very minute drop. By collecting an infinitesimal portion of the substance daily, he was enabled to obtain a sufficiency for his experiments. He noted that if the orifice in the scorpion's tail were closed with a drop of varnish, the sting became harmless, and, further, that the venom, once collected, preserved its poisonous qualities indefinitely.

A large number of experiments were conducted upon frogs, dogs, and pigeons; 0.009 of a grain of fresh venom, injected into the thigh of a frog, caused the skin to become violently inflamed and the animal to die in great agony in fifty-seven minutes. On examining microscopically a drop of frog's blood, in connection with a minute portion of venom, the investigator found that the globules became deformed and agglomerated into a viscous mass. Fig. 2 represents this effect. At 1 are the normal globules; 2, the same beginning to undergo alteration, and 3, their appearance after five minutes' action of the poison.

The globules appear to lose their normal properties and to run into each other, forming clots which stop the circulation of the blood. The sting of the scorpion is, therefore, of a very serious nature, since there is no known remedy which will cause the globules, when thus agglomerated, to return to the condition necessary for the sustenance of life. We are indebted to *La Nature* for the engravings referred to above.

The True Course for Employees.

The *Mercantile Journal*, of this city, has a sensible editorial on this subject, which we copy in part as follows:

The true question for an employee is not how much he can get forthwith, but how he can keep steadily employed. The men who get rich are not usually the strikers who refuse to work for particular wages. Strikers are apt to waste in idleness, in the course of a year or two, time wherein they could have earned more than the amount for which they strike. Those who increase their income are the men who accustom themselves to regular industry, who keep steadily at work for such compensation as they can get, live within their means, save money, and invest it. Thus they keep up a good income and increase it from year to year; quite as fast, in most cases, as they become able to manage it with judgment. The em-

ployee who takes the most pains to find out exactly what service his employer wants, to render that service carefully and generously, and who, having mastered the details of his work, does not leave it to go into some other employment where a larger but uncertain compensation is promised, is the man who is morally certain to rise. When hard times come, or when his employer is unfortunate and is compelled to retrench, he is the man who will not be dismissed, and who will not lose time in seeking work, when he would, of necessity, be eating up his savings till he finds it. When vacancies occur in the establishment, he is the one who will be intrusted with the most valuable work, which commands the highest pay. When his employer wants a partner, he is the man likely to be chosen. When others are discharged for

upon it, by means of which it is fastened into the spindle and bearings. Another form of cutting apparatus may be formed from a flat bar of steel, with saw teeth along both of its outer edges, and so twisted that the toothed edges are formed into spirals. By this arrangement the cutter readily clears itself from the slack which it cuts away. A revolving cutter of this kind may be worked in two ways. It may be caused to sweep in the arc of a circle into and out of the coal, so as to cut out a groove in it, the spindle of the cutter being for that purpose carried by a frame turning upon an axis, such axis being also traversed forward from time to time in a line parallel with the face of the coal operated upon. Alternatively the frame carrying the spindle of the cutter may simply be caused to move forward continuously in a line parallel with the face of the coal, in which latter case a groove will be produced of a depth equal to the length of the cutter. But if the cutter is caused to sweep round in the arc of a circle, a groove of any desired depth can be cut, irrespective of the length of the cutter itself.

The cutters can be driven either by hand power or by compressed air.—*Iron.*

Bugs.]

It is said that a chemical firm in Indianapolis has recently advertised for 100 lbs. of potato bugs. The insects are stated to possess qualities which render them a good substitute for the Spanish fly. This is interesting but, unfortunately, not authenticated. The man, however, who does discover a mode of utilizing the potato bug may rest assured that his fortune is made.

Another "shaky" item which is traveling the rounds of the press is about an insect which eats up iron pillars. This remarkable bug is about the size of a common house fly, and finds no difficulty in boring its way

into solid iron, ejecting the chips from the place of its entrance.

Speaking of bugs reminds us of a pleasant little anecdote told of Canon Kingsley, the celebrated English author, who has been lecturing through the country. While at Colorado Springs, in the midst of the delivery of a discourse, a bug, of some species of *coleoptera* new and strange to the speaker, alighted on his manuscript, and at once attracted his attention. Mr. Bug sat still for a moment or two, during which time Canon Kingsley—who is an enthusiastic and very clever naturalist, by the way—quietly proceeded to study its form and structure; but while these investigations were in progress, and his language rolling forth to the delight of his hearers, the insect began to expand its wings as if to fly away. The reverend speaker saw the motion, and deftly caught the bug in his hand. Going right on with his line of argument, he continued his examination for several moments, until, having settled everything to his own satisfaction, he let the insect buzz away about its own business. To any ordinary man the presence of such an intruder would have resulted in its being quickly brushed away; but the great English divine, trained to such close habits of observation and thought, could not forego the opportunity, even in the midst of his lecture, to study the points in a new species of bug, his mental discipline enabling him to carry on in his mind two trains of ideas at the same time.

Salt as Manure.

Various experiments, says the *Journal of Horticulture*, have been made by M. Pelliot and others, to test the value of salt as a manure. The following summing-up seems to have been arrived at: Salt should never be applied other than in a pulverous state, and never employed on impervious, cold, and humid soils. The best manner to use it is to combine it with other manures, a dose of two hundred weight to the acre being sufficient. When selected to destroy insects, it should be applied before sunrise. In the case of cereals, salt strengthens the stems and causes the ears to fill better, and favors the dissolution and assimilation of the phosphates and silicates. It acts vigorously on potatoes, and can be detected in their ashes to the extent of one half or one per cent. Asparagus is a veritable glutton in the presence of salt. A dose of three cwt. per acre acts without fail on beet, injuring its value for sugar purposes, but enhancing it for the feeding of cattle. Colza has as marked a predilection for salt as asparagus; and in Holland, where the culture of peas is so extensive, salt is something like a necessity. Mixed with hay in the proportion of 4 ounces to a 100 weight, the fodder is more appetizing; but the best way to feed it to animals is to allow them to enjoy it in the form of rock salt.



THE VENOMOUS SCORPION—(SCORPIO OCCITANUS).

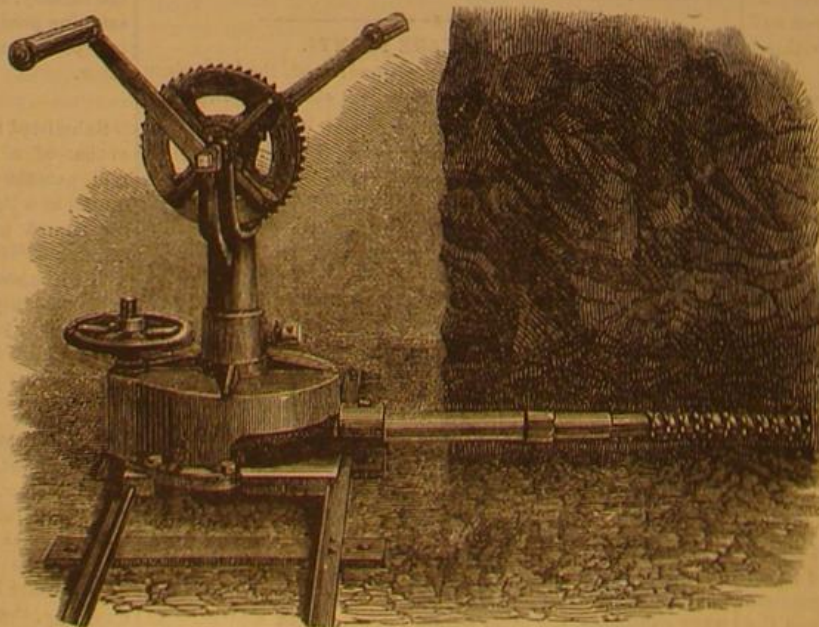


Fig. 2.—FROG'S BLOOD ENVENOMED.

incompetency, he will be retained; for his knowledge of the work and his known reliability make for him a good position in which he is sure to be able to do well. True, this way of life is not always easy; it requires self-control, conscience, and steadfastness; but it is the way to self-respect, honorable standing, legitimate wealth, and happiness.

A HAND COAL CUTTER.

This machine is practically a combination of inclined circular saws mounted upon a revolving rod, so that the groove cut by each saw runs into the groove cut by the next, thus



JONES' HAND COAL CUTTER.

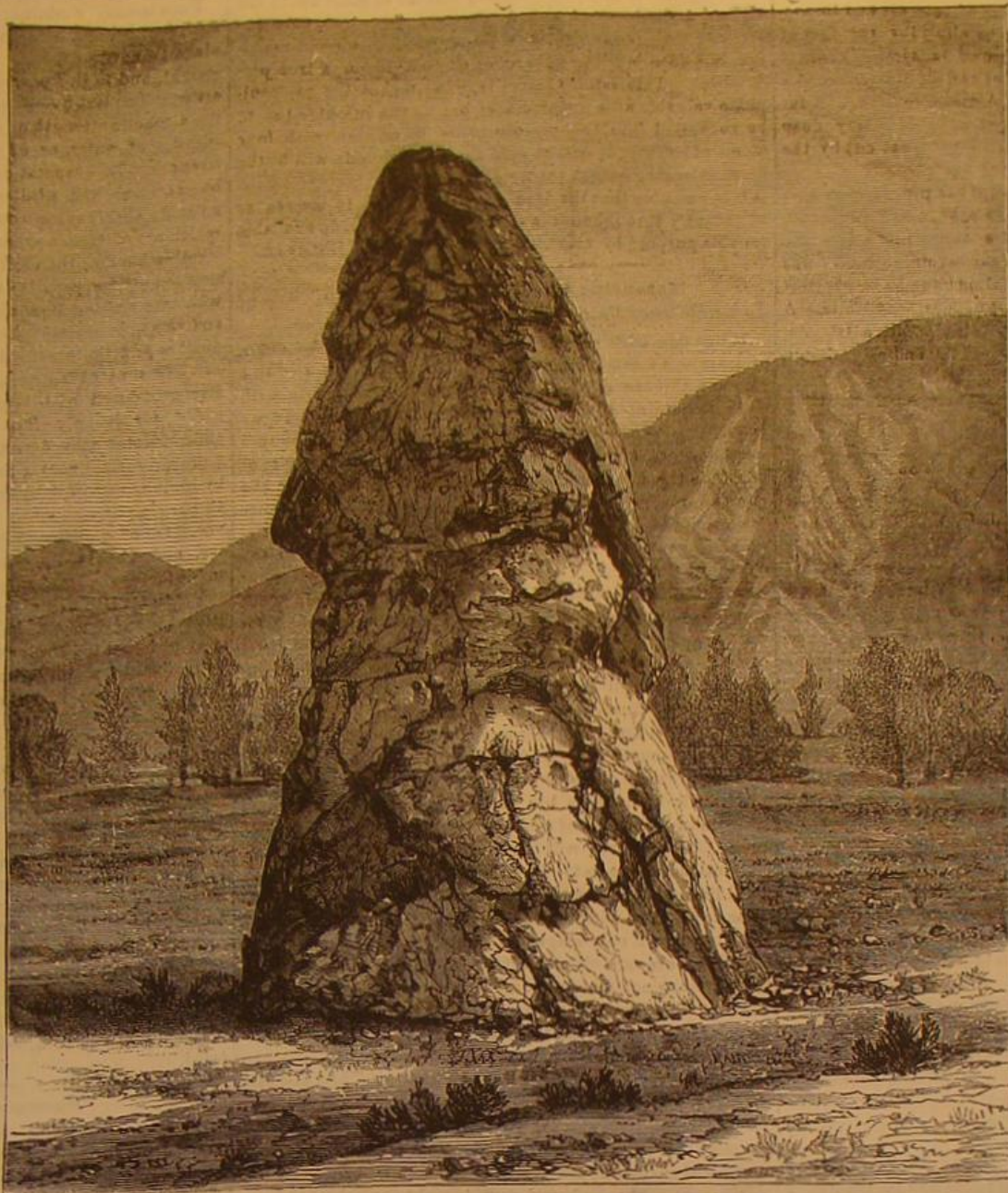
thoroughly under-cutting a seam. The saws are set on the rod obliquely, and provision is made for retaining them at a proper distance from each other, and in the most suitable position on the rod, the end of which has a screw thread cut

THE YELLOWSTONE HOT SPRINGS.

We publish herewith engravings of two of the most remarkable natural features of the Yellowstone region in Wyoming Territory, for which we are indebted to the *Illustrated London News*. This district abounds in geysers or boiling fountains, and in marvelous incrustations of calcareous or siliceous matter.

Congress, two years ago, passed an act reserving this portion of its dominion, fifty-five miles broad and sixty-five miles in length, from private agricultural or other occupation, in order that the wonders and grand beauties of its scenery may always be enjoyed by visitors from every part of the world. In the neighborhood of Gardiner's River, which joins the Yellowstone, are the Mammoth Hot Springs, the subject of one of our illustrations. Here the hot water flows down steep walls of rock from a terrace above, and fills the beautiful white basins it has hollowed out in each ledge of the cliff. These basins are from 4 feet to 8 feet wide, and 2 feet or 4 feet deep, making perfect natural baths, of different degrees of warmth. The white deposit covers the entire side of a mountain 1,000 feet high, and extending one mile in length.

Not far from this is an extinct geyser, which has built up a cone of lime, 42 feet high, and 22 feet in diameter at the base, formed of the successive deposits of matter from its old eruptions of boiling water. This cone, of which we also give a view, is called "The Cap of Liberty," from the fancied resemblance of its shape to



THE CAP OF LIBERTY. YELLOWSTONE REGION.

that of the emblematic head dress worn by the revolted slaves of ancient Rome.

Sounding the Pacific.

Commander Belknap, of the U. S. S. *Tuscarora*, now engaged in deep sea soundings in the Pacific Ocean, has recently transmitted a report to the Navy Department, from which it appears that the first efforts made only served to prove the impossibility of laying a cable over the bed of the Pacific ocean. The course last taken was on a great circle passing through the island of Tanaga, of the Aleutian group, from Yokohama to Puget's Sound. Hardly 100 miles of this route had been traversed when an extraordinary shelving of the bottom occurred, the lead making a descent of 1,594 fathoms in a 30 miles' run. On the next cast no bottom was reached at 4,343 fathoms, or nearly five miles depth, at which point a heavy current tore the fine sounding wire apart. This settled the question as to laying a cable in that direction; for it was evident that if the force of the current were strong enough to break the fine wire, it would quickly destroy the large line.

The *Tuscarora* then returned to shore and started off on a new great circle from Point Komoto. Great depths were again encountered, at which such pressures existed as to crack and crush the thermometers sent down. Currents also caused the loss of large quantities of wire, so that Commander Belknap abandoned the second attempt.

The investigations thus



THE MAMMOTH HOT SPRINGS. GARDINER'S RIVER, WYOMING TERRITORY.

far described, while of but negative value so far as the main object of the search is concerned, are of interest and importance to hydrographic science, as establishing the fact of depths in the sea hardly to be expected in view of the numerous soundings of the Challenger and of the Tuscarora herself, over wide expanses of the Atlantic, Pacific, and Indian Oceans, and confirming the existence of a very deep trough under the Japan stream, similar to that cut by the Gulf Stream on our own coast.

Commander Belknap's third attempt has proved more successful; and in a telegram from Ounalaska, dated August 29, he announces the practicability of a shore line along the coast of the Kurile Islands. The greatest depth found was 4,037 fathoms, 80 miles from Agalton; the next greatest depth, 3,734 fathoms, 120 miles east of Kurile's Straits. A ridge is reported between Kurile and the Aleutian Islands, the least depth of which is 1,777 fathoms, and at Tenaga a fine harbor and beach exists.

Correspondence.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

The query of your correspondent J. T. N., "Is this true," (referring to the colors produced on the surface of steel in the process of tempering) is very certainly answered in the affirmative, Nobili to the contrary notwithstanding, when it is remembered that these colors appear as readily upon pure (wrought) iron, in which, of course, there is no carbon, as upon steel. In fact, similar effects are produced upon many other metals, and always during an elevation of their temperature.

It is true, as he states, that the hardness of a piece of steel varies with the carbon contained, but not so with the temper, the latter being simply a degree of softening produced by elevation of its temperature, of which softening the colors are taken as a measure; and this measure holds good for any grade of steel.

It is well known, also, that a coating of oxide upon the surface of any metal greatly retards the further rusting, instead of accelerating it, as J. T. N. asserts. But for this fact, the value in the arts of most of the oxidizable metals would be greatly diminished, and iron would be one of the most perishable of substances; even at ordinary temperatures. This fact, then, accounts for the protection afforded to metallic surfaces by the presence of such a film, and does not require that the infinitesimal quantity of carbon resident in steel should have any credit for it. JOHN T. HAWKINS.

63 Cannon street, New York city.

To the Editor of the Scientific American:

Mr. Rose's papers on "Practical Mechanism" come right down to an intricate knowledge of practice and its theory. I find in them solutions of things that had often puzzled me, and explanations of things which I thought I understood, but now find I did not. In speaking of tempering taps, etc., Mr. Rose gives three methods, which include all our present shop practice, to which a Mr. Hawkins objects. What plan does he want to substitute?

We do not care why the color comes; but if there is a new way to temper, any better than the old one, I for one would like to know it. G. S.

New York city.

Swimming with the Clothes On.

To the Editor of the Scientific American:

After perusing your valuable article on learning to swim, I gave swimming with the clothes on a trial, and I must say I fully agree with you as to its value. I felt nervous at first, thinking that I would not be able to swim at all; but after making an attempt, I was astonished to find but little trouble in keeping upon the upper surface of the water. My clothes seemed to act as if they were filled with air, assisting to keep me up rather than to pull me under. I find that confidence and coolness are of great value. Many good swimmers are lost for want of these. W. A. HUTCHINSON.

Albany, N. Y.

A New Disinfectant.

To the Editor of the Scientific American:

The deodorizing and disinfecting properties of the protosulphate of iron have been long enough known, and immense quantities of it have been used for such purposes during the past three or four years. Still the odor of the city of Cologne can be distinctly discerned in every town and city; and there are few abodes of men where there is not still needed some chemical agent for making the air tolerable. The stable, the pig pen, the privy, are all offensive, and probably will be until that scientific millennium comes, when cleanliness and healthfulness will be cared for first. I have had my attention drawn, to a new source for disinfecting purposes, by an accident. Last winter I had brought to me, in a load of bituminous coal, a bushel or two of that slaty sort which is filled with iron pyrites. I had it thrown into a heap at the time, upon some sod. It remained there some months, slowly decomposing into flakes and white efflorescence. At last a heavy rain came and washed a quantity away into the grass; and wherever it went it killed the grass, turning it black to the point. This led me to think of the chemical changes which had taken place, from which I concluded that it might be useful as a deodorizer, and I had the rest thrown into a privy vault, with the result that the odor was so completely removed that no one would suspect the place from it. As this sulphide of iron is so abundant throughout the United States, and especially as it is got out in large quantities in the great coal fields (where it is not only worth nothing, but

is an expense to cart away), it may become of some use in the way of a disinfectant and deodorizer. The iron sulphide becomes iron protosulphate when exposed to air and moisture, and then, uniting with more oxygen, becomes iron persulphate. This latter change is what makes the protosulphate valuable as a disinfectant; but as the sulphide has to be converted into the protosulphate by uniting with four atoms of oxygen, it will be seen that the sulphide will be the more valuable, weight for weight.

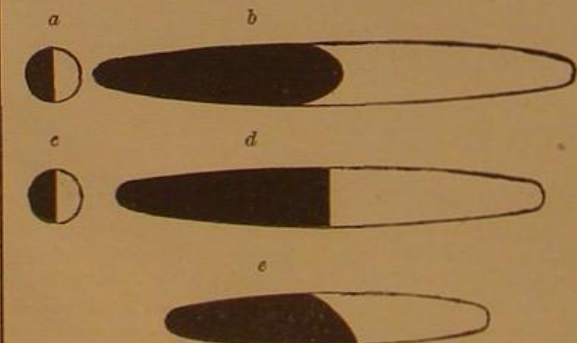
It is probable that the iron sulphide, found in masses so abundantly throughout the country, could be made available for this purpose by crushing it. A. E. DOLBEAR.

Measuring the Distance of the Sun.

To the Editor of the Scientific American:

When one edge of the illuminated surface of the moon appears as a straight line, the line joining the center of this line and the eye of the observer forms a right angle with the line joining the centers of the sun and moon. If we can determine the exact time when the edge of the illuminated surface appears as a straight line, we can measure or calculate the angular distance between the centers of the sun and moon; and taking the moon's accepted distance from the earth as a base line, we have only to find the hypotenuse of a right-angled triangle for the distance to the sun.

To find the exact time when the right angle is formed: The common telescope, with spider lines, is not suitable for the purpose, for the edge will appear rough and straighter than it does to the naked eye. I propose to use an instrument that will make the edge of the light appear, say, one thousand times as crooked as it does to the naked eye; so that when the edge becomes exactly straight, in being made one thousand times as crooked it will still be straight. This instrument contains the same number of lenses as an astronomical telescope, but the surface of the lenses must be cylindrical instead of globular, and rectangular instead of round. Such lenses will throw parallel rays of light to a line instead of a point. In adjusting the instrument, these focal lines must coincide. One spider line should be placed so as to coincide with the focal line of the eyepiece. This instrument will only magnify in one direction. It will make round objects very elliptical. To determine whether a line is straight or not, the instrument must be placed in such a position that the direction of the magnifying power will form a right angle with the line. The edge of the illuminated surface appears smooth when magnified in only one direction. By making observations at both the first and last quarters, and comparing the results, corrections can be made for the small irregularity of the general curvature of the moon's surface, at the very moment that the edge of the illuminated surface appears straight, as viewed through this instrument. The sun's and moon's right ascension and declination must be known, from which we can obtain the required angle. I hold that by this method the distance to the sun can be measured with greater accuracy than by the common method, because the base line is so much longer.



a To the naked eye when edge of light is not quite straight.
b As moon appears through the instrument at same time.
c To the naked eye when edge of light is exactly straight.
d With the instrument when the edge of light is exactly straight.
e With the instrument, when the focal line is not quite parallel with the straight edge of light.

L. LILLARD.

Undetectable Adulterations.

The public has been so frequently cautioned against the poisonous compounds sold under the name of liquors, at even the more pretentious drinking saloons, that warnings are taken as a matter of course and set down as part and parcel of the well known though incontrovertible arguments of the teetotalers. While we should scarcely expect to awaken new interest by reverting again to the quantities of fusel oil, benzine, and kindred abominations entering into the composition of the liquids retailed, there is certainly sufficient of novelty and importance to arouse thought and attention in Professor J. F. Babcock's excellent article on testing wines and liquors, recently published in the *Laboratory*, particularly since the writer positively asserts that artificial liquors may be made, the difference between which and the genuine, chemical analysis cannot detect, and which are excelled only by the very finest brands.

Distilled liquors are at first colorless, because the coloring matter of the substances from which they are distilled, being non-volatile, remains behind in the still, while only water, alcohol, and the peculiar compound ethers to which the different liquors owe their flavors pass over. By keeping in an oak cask, an amber tint is obtained from the wood, and also a small portion of tannin, augmenting the astringent properties.

Pure brandy contains: Alcohol, water, traces of acetic acid, acetic ether, conanthic ether, coloring matter, and tannin. It never contains over fifty per cent of alcohol by weight, and to this percentage it owes its intoxicating properties. The last five ingredients impart flavor. By testing the alcoholic strength of the liquor, we may find either the addition of water, or of spirit, or that it is of the proper strength. By evaporating to dryness, the solid residue may be examined, and adulterations of glycerin, capsaicum, etc., noticed; all brandies contain coloring matter and tannin, which are of course present in the residuum. But the determination that the alcoholic strength is exactly right, and that the residue contains no foreign ingredients, is no proof whatever that the liquor is not a gross imitation. Chemical analysis is powerless before the two common frauds of reduction and imitation. It cannot tell that perhaps twenty-five per cent of spirit and water, of the proper alcoholic strength, dosed with tannin and coloring matter, has been added, for the only effect is to impair the flavor. Experienced palates may detect the fraud by taste; but this is but a precarious reliance. So-called British brandy is prepared by giving to proof spirits, made from molasses and possessing 49 per cent of alcohol by weight, an imitation of brandy flavor. Oil of cognac, distilled from the lees of wine with water, and dissolved in alcohol, is often used in the spurious manufacture.

Professor Babcock gives the following formula for an artificial brandy, which, he states, contains nothing but what may be found in genuine Cognac. No chemical analysis can prove it to be an imitation; and for all practical purposes, he sees no reason why it should not have all the medical virtues of the original:

Cologne spirit is diluted with water till it stands at proof. Of this 12 gallons are taken and mixed with 5 gallons of water; $\frac{1}{2}$ lb. of crude cream tartar, previously dissolved in 1 gallon of boiling water, is added, together with 6 fluid ozs. of acetic ether, 2 quarts of wine vinegar, 5 lbs. of prunes (bruised), and a small quantity of oil of Cognac, sufficient to flavor the mixture. After standing for a fortnight with occasional agitation, the mixture is placed in a still and 15 gallons distilled. The distillate is put into a clean brandy cask, and a small quantity, say 1 lb., of oak shavings is added to produce the desired astringency. After standing for a week, it may be drawn off and colored with a solution of caramel.

What has been said of brandy applies equally well to whisky, gin, and rum, which may all be successfully imitated.

Pneumatic Telegraphy.

An interesting exhibition of telegraph machines, worked exclusively by air, was lately given in London by Mr. Guattaris, the inventor. A number of different instruments were on view. The impulse is produced at one end of a tube by the operator, and performs the mechanical work at the other end, either by ringing a bell or turning a needle round a dial. The rapidity and precision can be made equal to the electric telegraph, the conducting tube being able to be laid under or over cover in the same manner as the ordinary telegraph. Attached to each machine is a bell and dial, and the message is transmitted by the moving of a small lever which drives the air through a pipe to the other operator. As the lever is moved up and down, the dial, which stands where the message is destined for, registers whatever the words may be. Each dial is supplied with a needle; and as each spurt of air presses against the works of the machine, the needle is moved exactly the number of times that the lever is pressed. Each instrument can receive or send a message about 400 yards. The instruments exhibited were designed for intercommunication between large coffee houses, offices, hotels, and vessels.

Nickel Mines in Australia.

The Sydney *Morning Herald* notes recent analytical tests of a rich vein of nickel, found at Noumea, New Caledonia. The substances present are oxide of nickel, magnesium, silica, iron, aluminum, and calcium. The nickel ore is a silicate of nickel and magnesium, with certain impurities, and the brown serpentine accompanying it is an impure silicate of magnesium, containing a small proportion of oxide of nickel.

The development of Australian mines of nickel will have no small effect upon the quantity and consequent value of that metal now in existence. It will be remembered that, not long since, the German manufacturers of German silver petitioned their government not to use nickel for coinage, on account of its scarcity and the greater need which existed for its application to other purposes.

RAILWAY STATISTICS.—A Parliamentary return just published states that in 1873 there were in all 15,814 miles of railway in the United Kingdom. The total authorized capital amounted to \$3,383,432,930, of which \$2,941,601,540 was paid up. The number of passengers, exclusive of season ticket holders, was 455,320,188. The total receipts from all sources amounted to \$288,710,000, of which fifty-five per cent was from goods traffic, and forty-one per cent from passenger traffic. Fifty-three per cent of the gross receipts was consumed in working expenditure, leaving \$134,945,760 for net receipts. This was 4.59 per cent on the total paid up capital.

G. R. B. says: "To restore the burnt steel point of a pick, drill, or any similar tool, do not touch it with a hammer; but while it is still emitting sparks, plunge it into cold water and let it remain until cold. Then reheat to the proper degree, and work it: you will find it as good as before it was burnt."

DENTISTRY IN THE UNITED STATES.

MANUFACTURE OF ARTIFICIAL TEETH.
No. 1.

An artificial tooth, says "an expert," in *Old and New*, is made of porcelain ("ceramic dentistry" is the elegant title to which some of the more elegant in the business aspire); which porcelain differs from the material of a stone pot, a china teacup, a Wedgwood ware match safe, or a Parian statuette, in the same way as they differ from each other. In its manufacture are chiefly used felspar, quartz, and kaolin; oxides of titanium, gold, manganese, cobalt, uranium, and silver; platinum; glass of borax; and sal tartar. The tooth is made somewhat as follows: Mix into a putty-like mass, with water, calcined and pulverized siliceous felspar, and kaolin properly washed and dried, for the "body" of the tooth; with oxide of titanium or other selection or combination of oxides for coloring matter (there may be sixteen hundred different sorts and shades of colors). For the enamel, mix in like manner felspar, platinum sponge, and a flux of quartz, borax, and tartar. The teeth, either separate or in "sections," are shaped in a brass mold, which is about one fifth larger than the tooth, to allow for shrinkage. When the materials are all ready, the molds are greased; the platinum pins for fastening the teeth to their bases are placed in the holes made for them in the mold; the enamel is laid first in a thin coat on the inside of the mold; and the "body" of the tooth, in a properly shaped lump, put inside of this coat of enamel; then the top of the mold is put on; the whole is laid under a press, which compacts the mass; and then mold and all are exposed to a slow heat until perfectly dried. The teeth will now drop out of the mold when it is opened, but are extremely tender. Next they are "carved," or trimmed and finished, and laid on coarse quartz sand on small slides or trays, of fire clay. These are slid into a "muffle" or firing pot; this is run into the furnace; and after it is in place, the muffle is closed and carefully luted hermetically tight; and the heat is put on. The only way to know when the teeth are done is by the judgment. If over fired, they are injured; if not fired enough, they must be quickly put back, and heated longer. There are many variations in combining the "body," the enamel, the flux, etc., and in the subsequent manipulations; but the above brief summary will sufficiently show what sort of process is used.

The average annual sale of artificial teeth, in the six New England States, in the three years 1870, 1871, 1872, was three hundred and forty thousand sets; though it does not follow that all these were made up and actually used. Two and sometimes three sets must be made and tried, before the patient is satisfied. As the set made for one mouth will not fit another once in twenty five thousand times (I know personally of but one case, and have heard of two more, about one of which I doubt), all these rejected sets are wasted. A set is also frequently cracked or broken in mounting it on the base to which it is to be attached, which accounts for a further proportion of loss. Again, partial sets are sometimes required; and if the operator does not find a good match among his promiscuous teeth, he takes one out of some full set in order to make a perfect case. The chances are five hundred to one that he will not be able to use the rest of the set thus broken, along with any other set, as size, color, or shape will fall in some minute particular; and thus another set is lost. These various losses reduce the number of sets of teeth actually put into use each year in New England, from three hundred and forty thousand to about two hundred thousand.

The Western division of the country yields a better crop to the dental farmer (if so he may be called, and indeed his operations of pulling, digging, transplanting, and so on may reasonably well admit it) than either New England or the South. In the West, more sets are made up in proportion to the population, and fewer are lost out of the number sold. This greater demand seems to depend upon two circumstances. The Western people, as if they considered false teeth not merely useful and ornamental, but also as evidence that the wearer has money to invest in luxuries, are in the habit of informing their neighbors that they are using a set; and they also mention the name of the dentist who made them, and what they cost; so that they advertise their "benefactor," and increase his business. Secondly, the Westerners are not so fastidious as their fellow countrymen about a fit, or about their teeth looking "too natural;" and thus the operator can induce them, by honeyed words or positive assertions, to accept the set he has made for them, and to pay for it. As the patient is thus generally satisfied, a large percentage of loss is prevented. It is not intended to deny that the profession consists of honorable men in this more than in the other two sections; but taking them at an average, they certainly manage to use their stock cleaner than in the Eastern or Southern sections. There are certainly also in this division more "butchers" than in the others; men who, instead of being benefactors to their patients, might be justly termed their despoilers. It is notorious that there are such persons, who will extract sound teeth, as well as loose and decayed ones, for the sake of making room for a full set, as they are quacks, and cannot make a good partial set. Estimates made from personal observation of the traffic in this section show the sales for an average year to be, in round numbers, seven hundred and twenty-eight thousand sets, with a shrinkage in losses of two hundred and nine thousand, leaving five hundred and nineteen thousand sets used. The Southern division, including, for the present convenience, the rest of the United States, is at this time, for the most part, an entirely new field for dental operators, though part of it has

been well worked over, inasmuch that the amount of sales in it rolls up to one hundred and eighty two thousand sets, from which must be deducted a greater discount than elsewhere for losses, for the reason that the work has been done by young and inexperienced dentists, or, indeed more properly, dental students. The "practising" of these enterprising young gentlemen has resulted in the loss of one hundred and seventeen thousand sets, leaving only sixty-five thousand actually used.

There are five extensive manufacturers of artificial teeth in the United States, besides numerous smaller ones. They turn out, in all, about a million and a quarter sets of teeth every year.

Carrier Pigeons.

"One of the most curious incidents connected with modern journalism," says *Land and Water*, "is the regular employment of carrier pigeons in collecting intelligence for the daily and weekly newspapers. In the competitive exertions to procure the latest intelligence, it has been found that for short distances newspaper reports can be sent readier, cheaper, and quicker by press carrier pigeons, flying a mile per minute, than by the postal telegraph. These aerial postmen are entrusted to resident correspondents in various places, ready to be despatched at any moment, while others are sent out by reporters to places where important events are transpiring. It is now no uncommon thing to see reporters at police courts, inquests, public meetings, etc., despatch folio after folio of "copy" by press carrier pigeons tossed through the nearest window, or thrown out of a train or steamer going at full speed. The attachment of these birds to the place of their birth, and the ability to find their homes from marvelous distances, are, of course, their distinguishing characteristics. A "columbler," or home, is established at the various newspaper offices, and whenever a bird arrives with a message, the act of the pigeon entering its cot sets a call bell ringing in the editor's room, the bell machinery continuing in motion until attended to.

Carrier pigeons, though as a rule only used for short distances, in competition with the electric telegraph, can be specially trained to distances of 500 miles, and frequently fly to England from Dublin, Brussels, Paris, Lisbon, and even Rome. The utilization of the instincts of birds for press purposes is being carried even further than this. An ocean homing bird of great docility, intelligence, and spirit has been found in Iceland, and it flies at a meteor-like speed of 150 miles an hour, and is able to find its home, over sea and land, from any part of the habitable world. A pair of these birds, a few days ago, brought despatches from Paris to a lonely spot, congenial to their nature, in a wild and rocky part of Kent, within ten miles of London, in 1½ hours. Press carrier pigeons took the despatches on to the city, the whole distance from Paris to London, by actual parcel mode of conveyance, being done within 1½ hours."

The New York *Sun* was the first newspaper, we believe, to employ the aid of carrier pigeons for the rapid transmission of news. Thirty years ago, before the electric telegraph had come into vogue, the *Sun* concern had a large pigeonry upon the roof of its building, just over its editorial rooms, corner of Nassau and Fulton streets, in this city, where many carrier pigeons, of the best procurable breeds, were maintained. In those days the public were often surprised by the appearance of important news, brought by the birds, in advance of the ordinary mails. The advent of the telegraph superseded the *Sun* pigeons, and the department was sold out.

At the present time, the telegraph business here is in the hands of competing private companies, who take especial pains to transmit the news despatches of the press with the greatest promptitude, and at very low rates. But when the telegraphs pass into the hands of the government, as in Great Britain, the press will no longer have the advantages of this promptness and economy. Lazy officials will then govern the sending of telegrams on the red tape system, and our newspapers will doubtless find an advantage in using pigeons, as they are now doing in England.

Chrome Steel.

With the exception of eighteen pieces, all the metal used in the superstructure of the St. Louis bridge is chrome steel, this alloy being selected by the engineer, Captain Eads, on account of extended experiments thereon showing the high tenacity under tension and the utmost refractoriness under compression. The steel was made by the Haughlin process, belonging to the Brooklyn Chrome Steel Company, of Brooklyn, N. Y. The following details regarding the metal, we find in the *St. Louis Railway Register*:

The quantity of chromium required in the steel is so small, relative to the quantity of iron, that the cost of the alloy is not greater than that of the usual grades of carbon steel. In a pure and crystallized state, it is a grayish, very hard metal, not oxidizable by any acid nor reducible in any furnace.

It is quite probable that the mixture of chromium and iron is truly chemical. As far as can be learned, there is no gathering together into separate crystals, nor congregating in spots, as in the case of carbon; and it would, indeed, appear that, after combination, separation in whole or in part is almost impossible. From this stability of the alloy, it is possible to grade the mixture in exact accord with proportions of ingredients, and to judge of character with much precision.

The most useful property of chrome steel, next to its stability, is the ease with which it may be welded. No wrought iron excels it in this; and moreover, sand and borax may be entirely dispensed with, since the effects of the heat—

for a white heat may be used without fear—are to glaze the surface with a film of chromium, which, being unoxidizable, presents no obstacle to the full and entire union of the parts. Such springs as those used in vises need, when made of chrome steel, no tempering, but may be put in place direct from the anvil. Watch springs could, it is believed, be made from it, of extra quality. A ½ inch bar can be bent double when perfectly cold with the same certainty as with the best wrought iron. For anvil and hammer faces, and hammers and mauls, it is peculiarly fitted, because of its homogeneity and the exact equality of hardness over the surface. Blocks of four inches may be drawn out into a crowbar; any welding or upsetting necessary can be done, and the bar finished, with the same facility as though formed of the clearest iron.

As a test of toughness, a bar of chrome steel five eighths of an inch square has been twisted cold until the angles of the bar lay around a cylinder, resembling a wire cable strand. Seventy turns to the inch made on a cold bar of steel is sufficient evidence of toughness. The results of tests made at the West Point Foundry give for the material an average strength of 180,000 pounds to the square inch. This is considerably in excess of the figures given by authorities as the highest strength of carbon steel, namely, 131,000 pounds per square inch.

New Explorations in Central America.

Few persons are aware of the important exploration which has been going on for a year or two past in Costa Rica, under the direction of Professor William M. Gabb, a geologist and explorer of Philadelphia, well known for his excellent scientific work, especially in connection with the geological survey of California, under Professor Whitney. The special object is an investigation of an entirely unknown region of Southeastern Costa Rica, inhabited only by savages, but known to contain rich treasures of minerals, worked by the Spaniards in the early day of the conquest; this knowledge being only by traditions. Although the party has consisted only of Professor Gabb and four assistants, it has already gathered a great deal of important information and material in reference to the economical, scientific, and political history of the region investigated. In the course of his labors, Professor Gabb found the people less savage than had been supposed, and he has already succeeded in winning their confidence to such an extent as to induce their chief to accompany him on a visit to San José. As might have been expected, the geological structure of the country has occupied a large share of Professor Gabb's attention, and enough has been discovered to warrant the belief that the mineral resources are of great importance. The greatest interest attaches, however, to the discovery of two previously unknown volcanoes, not less than 7,000 feet high, in the main cordillera just northwest of Pico Blanco. Of these he is about to make a thorough examination. The natural history collections made by the Professor are of unusual magnitude and value, embracing all departments of zoology, and especially rich in mammals, birds, reptiles, and insects. Of fish there were but few species, but all that could be found were secured. The ethnology and philology of the country have been attended to very thoroughly. Material illustrating the manners and customs of the people was also gathered in great quantities, and important discoveries made of *Aztec*, or prehistoric graves. In addition to these, Professor Gabb is on the track of an ancient buried city, of which no mention is made in any history of the country. The natural history and ethnological collections made have been sent to the National Museum, where they form a conspicuous feature in the Central American series. The material thus collected by Professor Gabb will, on his return, be made the subject of an elaborate work, in which he hopes to present the whole subject of the physical and natural history of the country in its fullest detail. An important geological discovery made by him is that the appearance of dry land on the Isthmus is of tertiary date, and that it is coeval with the period of volcanic excitement in the Californian sierra.—*Nature*.

Trees for Avenues.

For avenue planting, those two near relatives, the cucumber tree (*magnolia acuminata*) and the tulip tree (*liriodendron tulipifera*), combine many excellent qualities. They are rapid growers, beautiful in foliage and flower, of perfect form; hardy, excepting in the extreme north, not particular about soil or situation, and comparatively free from insects and diseases. They are readily grown from seeds, gathered and sown at once in the autumn, or, as some prefer, preserved moist until spring. When two years old, they are generally sufficiently large to plant out with a protection; or if intended for the street, they may be cultivated in nursery rows for three or four years, until they are tall enough to be beyond the reach of animals. A long line of either of these trees forms a magnificent sight when in bloom, and for shade, combined with beauty, will satisfy the most fastidious. One of the greatest mistakes in street planting is the selection of an improper kind—for instance, a first class tree, such as we have named, for a narrow street, and a small slow-growing species for a wide avenue. Each is equally out of place, and never looks appropriate, no matter how handsome the individual specimens may be.—*New York Tribune*.

ERASIVE SOAP, TO REMOVE GREASE AND STAINS FROM CLOTHING.—Two pounds of good Castile soap, half a pound of carbonate of potash, dissolved in half a pint of hot water. Cut the soap in thin slices, boil the soap with the potash until it is thick enough to mold in cakes; also add alcohol half an ounce, camphor half an ounce, hartshorn half an ounce; color with half an ounce of pulverized charcoal.

IMPROVED WATER WHEEL GOVERNOR.*

The apparatus herewith illustrated is used in connection with the governor, where there is a variable head of water and when it is desirable to keep up the head though at the sacrifice of speed. Its greatest utility is realized where steam power is employed in connection with water power. The water governor being speeded to run the line a trifle faster than the steam governor, the engine is relieved of its weight so long as there is an available head for the supply of the wheel; but when the water is drawn down to a given point, say from three to twelve inches, the governor automatically closes the gate sufficiently to allow the water to regain the lost head, and, when at the available point, automatically resumes its natural action. All this is accomplished by very simple means, as shown by the engravings. The reservoir is placed so that the high water line in the flume is within three inches of the top of the reservoir.

Our engravings represent opposite sides of the apparatus; and in Fig. 2 is shown the reservoir and float in connection.

The operation is as follows: Water is admitted from the flume through the pipe, I. The float, B, in the reservoir, A, rises with the water, and the cord is slackened, which leaves the governor to its natural action. As soon as the water lowers to any given point (regulated according to length of cord), the pawl shifter, C, is drawn down, throwing the closing pawl, F, into action, and the water is closed off. The machinery being all in motion, the gate would become closed, with a tendency to go beyond, but for a stop motion which limits the hoisting and closing of the gate, and which is simply a sliding bar inside of the bracket D, and operated by the worm, E.

Another feature of the governor is an adjustable weight connected to an arm of the pawl shifter, C, but not shown in the engraving (other parts of the machine being in front of it). By means of this sliding weight the speed of the governor may be changed from 140 revolutions to 165—a great convenience in many establishments, particularly in the case of wheels driving paper machines, where an adjustable speed is indispensable.

These governors have been in use, it is stated, now about six years, in some of the largest as well as in the smallest establishments, and attached to all kinds of wheels (even over-shot and breast wheels), with heads varying from seven feet to seventy-eight feet, including the largest cotton mills in the world, in iron rolling mills, and down to one set woolen factories. The manufacturers add that they have yet to learn of the first complaint of them.

The latest improvements of this machine were patented May 26, 1874, and the improved machines are manufactured solely by Wm. T. Horrobin, Cohoes, N. Y., under the personal supervision of Mr. H. D. Snow, the patentee.

How to take care of China and Glass Ware.

In the average household few things suffer more from ill usage than porcelain and glass, especially the finer kinds of such ware. We copy from the *Boston Journal of Chemistry* a few practical suggestions on the best methods of cleansing and preserving these fragile materials:

One of the most important things is to season glass and china to sudden change of temperature, so that they will remain sound after exposure to sudden heat and cold. This is best done by placing the articles in cold water, which must gradually be brought to the boiling point, and then allowed to cool very slowly, taking several hours to do it. The commoner the materials, the more care in this respect is required. The very best glass and china is always well seasoned, or annealed, as the manufacturers say, before it is sold. If the wares are properly seasoned in this way, they may be washed in boiling water without fear of fracture, except in frosty weather, when, even with the best annealed wares, care must be taken not to place them suddenly in too hot water. All china that has any gilding upon it may on no account be rubbed with a cloth of any kind, but merely rinsed first in hot and afterwards in cold water, and then left to drain till dry. If the gilding is very dull and requires polishing, it may now and then be rubbed with a soft wash leather and a little dry whiting; but this operation must not be repeated more than once a year, otherwise the gold will most certainly be rubbed off and the china spoiled. When the plates, etc., are put away in the china closet, pieces of paper should be placed between them to prevent

scratches on the glaze or painting, as the bottom of all ware has little particles of sand adhering to it, picked up from the oven wherein it was glazed. The china closet should be in a dry situation, as a damp closet will soon tarnish the gilding of the best crockery.

In a common dinner service, it is a great evil to make the plates too hot, as it invariably cracks the glaze on the surface, if not the plate itself. We all know the result—it comes apart; "nobody broke it," "it was cracked before," or "cracked a long time ago." The fact is, when the glaze is injured, every time the "things" are washed the water gets to the interior, swells the porous clay, and makes the whole fabric rotten. In this condition they will also absorb grease; and when exposed to further heat the grease makes the dishes brown and discolored. If an old, ill used dish be made very hot indeed, a teaspoonful of fat will be seen to exude from the minute fissures upon its surface. These latter remarks apply more particularly to common wares.

As a rule, warm water and a soft cloth are all that is required to keep glass in good condition; but water bottles and wine decanters, in order to keep them bright, must be rinsed out with a little muriatic acid, which is the best substance for removing the "fur" which collects in them. This acid is far better than ashes, sand, or shot; for the ashes and sand scratch the glass, and if any shot is left in by accident the lead is poisonous.

Richly cut glass must be cleaned and polished with a soft brush, upon which a very little fine chalk or whiting is put; by this means the luster and brilliancy are preserved.

Household Hints.

The following recipes have, most of them appeared in this paper, but to the *English Farmer* is due the credit of printing them in the following order:

If you have been pickling or handling acid fruit and have stained your hands, wash them in clear water, wipe them lightly, and, while they are yet moist, strike a match and shut your hands around it so as to catch the smoke, and the stain will disappear.

Wet the spots of iron rust on muslin or white dress goods thoroughly with lemon juice, then lay in the hot sun to dry. Repeat the same if the color is not removed by one application. When dry, rinse in clear, cold water. Lemon juice cannot be used on colored goods, as it will take out printed colors as well as stains. It will remove all kinds of stains from white goods.

Dusting articles of steel, after they have been thoroughly cleaned, with unslacked lime, will preserve them from rust. The coils of piano wires thus sprinkled will keep from rust many years. Table knives which are not in constant use ought to be put in a case in which sifted quicklime is placed, about eight inches deep. They should be plunged to the top of the blades, but the lime should not touch the handles.

To remove mildew, make a very weak solution of chloride of lime in water (about a heaping teaspoonful to a quart of water), strain it carefully, and dip the spot on the garment into it; and if the mildew does not disappear immediately, lay it in the sun for a few minutes, or dip it again into the lime water. The work is effectually and speedily done, and the chloride of lime neither rots the cloth nor removes delicate colors, when sufficiently diluted, and the articles rinsed afterwards in clear water.

The white of an egg has proved, of late, the most efficacious remedy for burns. Seven or eight successive applications of this substance soothe pain, and effectually exclude the burn from the air. This simple remedy seems preferable to collodion or even cotton. Extraordinary stories are told of the healing properties of new oil, which is easily made from the yolks of hens' eggs. The eggs are first boiled hard, and the yolks are then removed, crushed, and placed over a fire, where they are carefully stirred until the whole substance is just on the point of catching fire, when the yolk will yield nearly two teaspoonfuls of oil. It is in general use among the colonists of South Russia as a means of curing cuts, bruises, and scratches.

At this season of the year, it is important for all housekeepers to be on their guard against the insidious attempts of the various species of ants and the detestable cockroaches to invade the kitchen and pantries or store rooms. Sprigs of wintergreen will make the small red ants leave their cherished haunts. Borax powdered and put into the crevices where cockroaches abide will finally cause them to disappear; but we have found concentrated lye, melted into a sort of paste and applied with a knife, a more expeditious mode of destroying these noxious insects. Scalding alum water is also certain death to cockroaches.

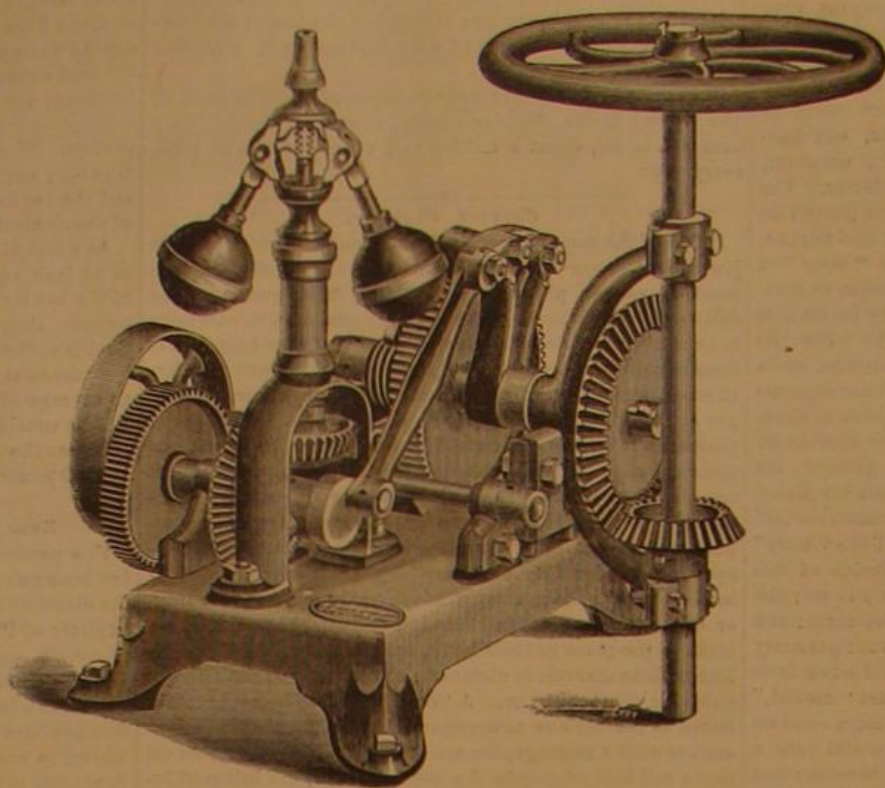
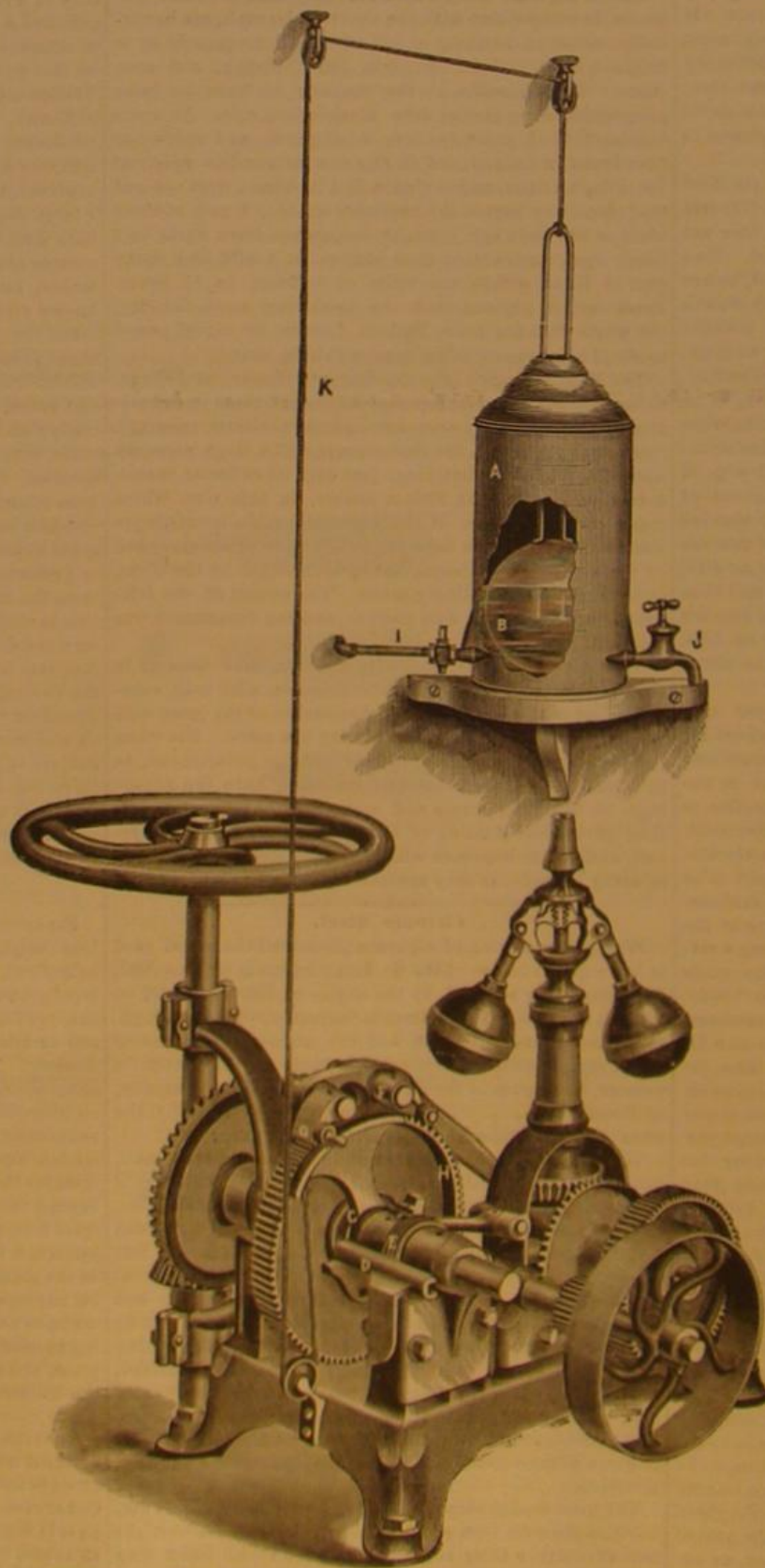


Fig. 1.



SNOW'S STANDARD WATER WHEEL GOVERNOR.—Fig. 2.

DISASTER IN LAUNCHING A TURRET SHIP ON THE THAMES.

The ironclad man-of-war and steam ram *Independencia*, just built for the Brazilian government at Dudgeon's yard Blackwall, London, is now lying, to all appearance, a wreck on the foreshore close to Cubitt Town Pier, with the tide at high water washing over her decks, having met with a disaster in launching. The ship is 310 feet long and very broad, having a beam of 63 feet, and she is of 5,000 tons burden, builder's measurement, which is equivalent to a displacement of 10,000 tons when armed and afloat. She has two turrets on deck; the decks are of iron covered with wood, and the sides are covered with a belt of 12 inch armor plates to a depth of about 14 feet. The armor being nearly all fixed while the ship was on the stocks, the weight of the hull was little short of 6,000 tons, and the operation of launching was therefore felt to be one of considerable difficulty. Hydraulic rams were employed to start the ship, which went safely down the slips for about her own length, and then stuck fast. The rams and all manner of appliances were brought to bear, but failed to move the ship further; and when the tide fell she settled down with her stern in the bed of the river, about a third of her length only having left the ways. Her position is a critical one, and the outer shell of her double bottom has given way in the bilges. We give a representation of her as she remains fast on the ways, extracted from the *Illustrated London News*.



THE FRIGATE INDEPENDENCIA AFTER THE ATTEMPTED LAUNCH.

BURNISHING SURFACE COLORED PAPERS.

Marbled and other papers which have color laid on one side have been hitherto burnished or glazed by rubbing with a polished flint or other stone, worked over the surface by hand. Many attempts have been made to substitute glazing rolls and other appliances for the tedious process, but no good result has ever been achieved. M. Alauzet, of Paris, exhibited at Vienna a machine for manipulating the burnishing stone, and thus economizing the cost without impairing the beauty of the imparted surface. This machine, which may be used for dyed and undyed paper, is double acting; the sheets of paper are represented by *c*, while *a* shows the burnishing steel or stone guided and moved by the bar, *b d t*, and the rod, *g*, which is connected with the crank, *f*. The weights, *t* and *l*, may be increased or diminished according to requirements.

We are indebted to *Engineering* for the engraving.

Lawn and Pleasure Grounds.

A writer in the *American Farmer* for September reiterates, what we have often stated, that the love and taste for horticultural pursuits is rapidly growing in this country. He also states the generally known fact that, up to the present time; the great majority of thorough practical gardeners in the United States are foreigners, and even those, however well educated in that profession at home in their native land, have, under a different climate and other influences by which they are surrounded in this land of their adoption, to pass through another term of apprenticeship before they can make their services acceptably available; we speak here of thoroughly educated men in the profession, and not of that crowd of one-year pretenders by which the country is overrun. It has been often remarked that very few native born Americans take to horticulture as a profession; and that when they do, it is usually to enter upon the higher or lighter branches, or follow it as a mercantile or money-making pursuit. Yet it is true, beyond all dispute, that the love of horticulture is growing rapidly, as may be seen by the millions of fruit trees put out as orchards, and tens of millions of flowers used annually in the flower garden, together with the ornamental trees and shrubs which are sought after with avidity.

The residences that formerly stood isolated on the plain are now seen nestling in groves of umbrageous trees, embracing the noblest and most desirable kinds to be found in all temperate climes; now this state of things is pleasing for all lovers of Nature to contemplate, and should not every laudable incentive be used to further its growth? As having a tendency in that direction, we would remind those

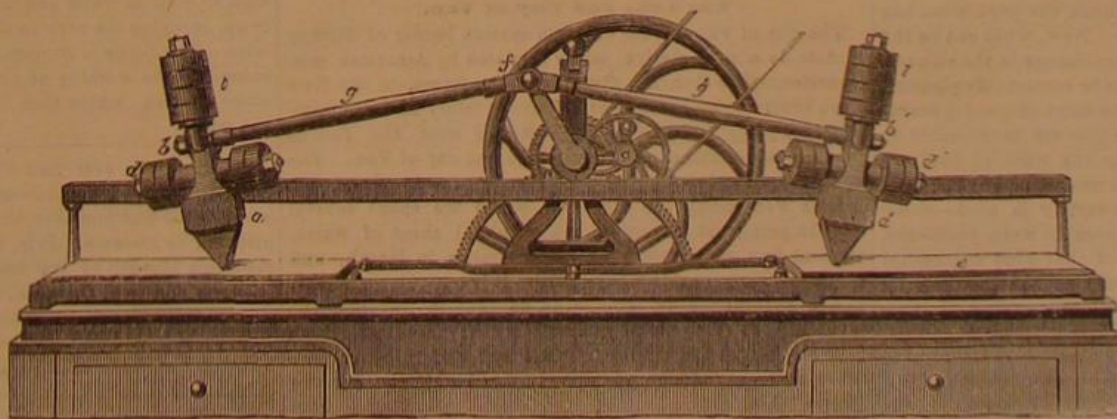
situated in the Middle States that during the present month is a good season to transplant evergreens, and this work is best performed soon after a good rain, or when the ground is mellow enough to admit of getting as many perfect roots up as possible, but by no means permitting the trees after being lifted to be long exposed to the action of the sun or drying winds; cloudy weather is desirable for this work; and should the ground to be planted be light and dry, give a good settling of the earth about the roots with water, finish-

ing the filling in around the stem with loose earth, which prevents the surface from cracking, should a drouth follow.

Cuttings made of the present year's growth root freely at this season, of such hardy shrubs as wigewillas, forsythias, spiraeas, and deutzias; make the slips about 3 to 6 inches long, removing the leaves entirely from the lawn half, and those on the upper half cut back so as to leave about one inch of the leaves and petioles; then plant them in a sandy soil in some shady place, observing to press the earth close to the cutting; these, when rooted, can remain until next spring, against planting out permanently.

Samples of seeds of choice border plants should be from time to time collected, and placed in a cool airy place to dry; if the kinds collected are pure, and have not been contaminated by impregnation of worthless sorts growing close by, then you are stocked for next year and will have the pleasure also of helping your friends to a few, as the votaries of Flora ought by all means to eschew anything that would border on selfishness. When the flowers in your beds or borders become unsightly from decay, have them removed and the ground raked clean and smooth. Such articles as dahlias should be tied up neatly to stakes. For ourselves, we prefer training them so that they will lie upon the ground, where a greater number of finer flowers will be produced; we attribute the difference to the ground being kept cooler and more regularly moist during the heat of summer.

Toward the end of the month, prepare beds in which to



PAPER BURNISHING MACHINE.

plant tulips, hyacinths, narcissus, crocus, and lily roots; a sandy soil, made rich by well rotted cow manure, suits them best.

Wood the Most Costly Building Material.

Four fires on the 11th and 14th of July, in Illinois, Wisconsin, and Iowa, destroyed wooden buildings, which cost originally \$350,000, and an aggregate of \$5,080,000 property. These buildings cost about \$70,000 less than brick ones would have done. The wooden buildings burnt at Chicago, July 14, first cost \$150,000, but carried with them property to the amount of \$4,000,000. The wooden buildings burnt in the great fire of 1871, when the entire loss was \$200,000,000, were worth \$2,000,000, or one per cent of the whole. Wood is thus shown to be one of the costliest of building materials

Herb Cultivation.

The London Garden contains the following account of herb raising for commercial purposes, at Mitcham, England, a place long celebrated for its herb fields, from which the London herbalists derive their mint, sage, licorice, and similar herbs. Of these, as a rule, distillations are made by the growers, and they are disposed of in a semi refined condition, or the herbs themselves are brought into market as soon as they are harvested.

Chamomile.—To this several acres are devoted, the double flowered kind being preferred on account of the weight of the produce; but both single and double sorts are grown. In March, old and somewhat spent plantations are broken up and the plants divided into good rooted slips, which are planted in well prepared ground in rows 2½ feet apart, and 2 feet asunder in the rows. A common practice, however, is to plant as thick again as this, and to thin out the plants afterwards to the distances just named. The plantations are intercropped with lettuces in spring. As soon as the blooms begin to expand, they are fit for gathering, and from that time, as long as they yield sufficiently to pay, the flowers are gathered several times in a season by women, who are either paid a regular day's wages, or a penny, or thereabouts, per pound for picking.

Lavender.—This is extensively cultivated at Mitcham, both farmers and cottagers bestowing special attention on it; and this district presents a lovely sight in the last fortnight of July, when the different fields of it are in full bloom, the air for miles around being loaded with its fragrance. Lavender is increased by means of rooted slips, planted out, in rows about 18 inches apart and half that distance asunder, in March or April. Sometimes the sets are planted as wide in the row as the drills are apart. For the first year the produce amounts to but little; and, therefore, parsley or lettuce is planted between the rows. As soon as the plants have grown sufficiently to become crowded, every alternate row, and also every alternate plant in the rows left, is lifted—say in spring—and transplanted into another field, so as to form a new plantation. Thus the plants stand 3 feet apart each way, or 3 feet one way and 18 inches the other. Coleworts, lettuces, or other early and quickly matured crops, are raised among the lavender in the early part of the year; but, after June, all such catch crops are removed. The flowers are usually harvested in the first fortnight of August, and, as has been stated, are distilled at the farm on which they are grown.

Licorice.—This was once largely grown at Mitcham, but, although it is grown in considerable quantities, it is not now so extensively cultivated there as formerly, on account of the cost attending its culture. It entirely occupies the ground for three years, and during that time requires great attention in the way of cleaning, besides the ultimate cost of trenching out the roots, or, rather, underground stems. The ground, being deep, is heavily manured in autumn or winter, when it is trenched and laid up in ridges, in a rough state, till spring. It is then leveled, marked off in drills about 2 or 3 feet apart, and some 3 or 4 inches deep, and in these the sets are planted in March. The sets consist of finger length pieces of the old root stems, each containing an eye or two. During the first year the ground is usually intercropped, as is also the case in the earlier portion of the second year; but after the

middle of the second summer, and throughout the whole of the third year, the licorice requires all the room. When the stems are matured in the autumn of each year, they are cut over close to the ground; and if time can then be spared, the soil between the rows is forked over, some well decayed manure being occasionally worked into it at the same time. The lifting of the crop, which usually takes place in the end of the third season, is a difficult operation, involving much labor. A deep trench is cast out, lengthways, alongside the first row, and by means of forks, pulling ropes being even sometimes employed, the root stems are extracted. In this manner the whole of the rows are treated, until all are successfully lifted. The roots may then be stored in sand or pits, like beets, carrots, or potatoes. Growers of licorice do not always harvest the crop; on the contrary, they some-

times sell it as it stands in the field, and the purchaser lifts it himself.

Mint.—Both spearmint and peppermint are largely grown at Mitcham, particularly the latter; indeed, this crop ranks second in importance only to lavender. It is first planted in rows 13 inches apart each way, and in the end of the next two seasons it is plowed in. The plantations are kept free from weeds during the summer by means of hoes; and about the end of the first week, or during the second week of August, is the usual time for cutting mint for distillation. In the Fulham fields, and in other districts in which market gardening is carried on, mint is largely grown for sale in a green state. For this purpose the dampest piece of ground is selected for its culture, if it is to be a permanent plantation; but it will grow in almost any soil. It is planted in rows a foot apart, and the ground is intercropped the first year; but afterwards it runs through the soil in such a way that it becomes a complete mass of undergrown stems and roots. It is cut and bunched for market as required, the greatest demand for it being during the pea season. It is also forced in large quantities. "I have seen a range of 43 light frames filled with mint alone. These beds are made up in December or January, when the ground they occupy is excavated to a depth of 20 inches, and filled in with fermenting manure packed firmly. A few inches deep of soil are then added, and in this the mint roots are thickly planted. Linings of manure are also placed round the frames, the sashes during the night and in cold days being also covered with it."

Poppies.—Of the white kind, several acres are grown. They are sown in rows in spring, some 20 or 24 inches apart, and require no further care, beyond a little thinning and cleaning, till August, when their seeds ripen.

Sage.—This forms an important crop, which, under favorable circumstances, is pretty remunerative; the stalks being cut over, bunched, and sent to market at once. New plantations are formed with rooted slips, obtained by dividing the old plants; they are inserted, late in spring, in rows 1 or 2 feet apart, and about a foot asunder in the row. During the first season parsley or lettuce forms an inter-crop, which also occupies the ground during the earlier part of the succeeding ones. Except hoeing and cleaning, the plantations need no care so long as they continue in a thriving condition; and when the lines get broken, and blanks and sickly plants occur, the plantation is broken up. Both the reddish and green-leaved kinds are cultivated.

Squirting Cucumbers.—These are raised in frames, like vegetable marrows, and are planted out, about the end of May, in rows some 4 or 6 feet apart, and 4 feet asunder in the row. They flower and fruit at the same time, and the fruits are gathered before they are ripe, otherwise a mere touch would burst them. The fruits are usually distilled by the growers.

The Physical Failure of the Hawaiians.

Dr. Nathan Allen, in an interesting paper upon the decadence of the Hawaiian race, makes the following observations: The census of 1872 returned the whole number of the inhabitants, 56,897—males 31,650, and females 25,247.

In 1820, when the missionaries first landed upon these islands, the population was estimated at from 150,000 to 200,000, but may not have exceeded much the first mentioned number. We have, then, in a little over fifty years, a loss of full two thirds of the whole inhabitants.

The efforts of the missionaries were attended with remarkable success. A government of the people has become firmly established, education is generally diffused among all classes, and family instruction has for a long time been established upon a sound basis. In fact, all the advantages of a Christian civilization seem to be enjoyed in an unusual degree by this people.

But, notwithstanding these conditions, the population has kept steadily decreasing every year. Now, what can be the cause? It cannot be from any fault or change in the climate, which has always been represented to be remarkably pleasant and wholesome. It cannot be for the want of good government or for any outward conditions that are unfavorable to growth. It surely has not been for the want of food, as there has never been any complaint from this source; food has been provided in abundance, a variety in kind—cheap and healthy. There certainly have been no wars, pestilence, earthquakes, famines, or calamities of that kind to account for this change. It is true the small pox, the measles, and the leprosy have prevailed there at times, carrying off large numbers, but by no means enough to account for the change.

There is no evidence that there has been any extraordinary mortality on these islands, especially among children, but there is evidence that there has been a steady decrease in the number of births. The decay goes steadily on, and from all present indications it seems likely to continue, till, as a race, they become extinct.

Dr. Allen believes that the great primary cause of this degeneracy is not external to the body, but internal—affording strong evidence that the true law of propagation is based upon physical organization, and that external agents are only incidental conditions or secondary causes. The change of population going on at these islands affords a most fruitful theme for study.

N. O. says: "Your plan for clearing telegraph wires of kites, etc., by burning has at least one serious objection, and that is that wooden tenements prevail where kites are most abundant; and in burning them off, there is danger of destroying houses: at least the writer found it so in New Orleans, where he tried it several years ago. It is also a slow process, for rags, when wrapped tightly, do not burn quickly."

The Transmutation of Metals.

In the seventeenth century faith in transmutation was unbroken. Helvetius declares that he saw a stranger convert an inferior metal into gold, at the Hague, in 1666. Even Glauber, the discoverer of the salt that bears his name, was a believer in the attractive delusion, and it is said that the discovery was made while endeavoring to find the philosopher's stone among the *terra damnata* of chemical operations. At last suspicion was generally aroused regarding the claims of the alchemists; and in a report read by Geoffroy before the Royal Academy of Sciences at Paris, on the 15th of April, 1723, the tricks were exposed by which impostors had practised on the credulity of the public.

From this document we learn that the ordinary way of producing the appearance of transmutation was to employ a crucible or melting pot with a double bottom, the exterior being of some infusible material and the interior of suitably colored wax. In the space between these gold or silver was placed. Lead or quicksilver, the latter being preferred on account of its volatility, was then introduced into the vessel, together with the powder of projection. Heat being applied, the wax and the base metals disappeared, and a button of gold remained at the bottom. Sometimes a true crucible was used, and the gold or silver introduced into the fused materials by means of a hollow wand or stirrer, the interior of which had been filled with the powder of the metal the production of which was desired. Lead, in which holes had been drilled and filled with gold and then closed up, was also employed; or a piece of gold was washed with mercury and then transmuted into pure gold by an acid.

Where only a part of the base metal was to be converted, nails, or bars, consisting half of gold or silver and half of iron or some other metal, were prepared, the gold or silver being painted to resemble the other metal. The removal of this coating or transmutation was accomplished by means of alcohol or some liquid that could dissolve the paint. A nail of this description was at one time preserved in the museum at Florence; and the knife that belonged to Queen Elizabeth, which was half gold and half steel, was of the same nature. Such objects as coins, half gold and half silver, were at one time very common, and were distributed by alchemists as evidences of their power, in order to entrap the credulous.

The Austro-Arctic Exploration.

M. Sidoroff, says the *Eastern Budget*, member of the Geographical Society of St. Petersburg, has addressed a report to the Russian Admiralty with regard to the Austrian Polar Expedition, of which nothing has been heard since August, 1872. M. Sidoroff says in his report that the *Tegethoff* was last seen by Count Witczek in a gulf near Cape Nassau, whose outlet was then being choked up with ice. Since that time various seamen coming from Novaya Zemlya have reported that the quantity of drift ice in the icy sea had considerably increased, and that in the summer of 1873 it was extraordinarily abundant. Formerly the ice on the coast of the above island only extended to a distance of five versts in the month of June, while in midsummer, 1873, the width of the icy zone amounted to about 100 versts. M. Sidoroff believes that if Cape Nassau had been free of ice, the *Tegethoff* would certainly have gone round the northeastern point of Novaya Zemlya, which is only a day's journey from Cape Nassau, and thus reached the Gulf of Yeniseisk with difficulty. It is therefore probable that the expedition is frozen up and in want of provisions and M. Sidoroff accordingly recommends the Russian government to send food, etc., by land to Cape Nassau, adding that he will contribute \$500 to the expenses of the undertaking. The Admiralty has approved of this proposal, and is now taking the necessary steps for carrying it out.

The Lake and City of Van.

The city of Van, on the extreme eastern border of Turkey in Asia, is a new station lately occupied by American missionaries. The Rev. Dr. Barnum writes home, to the *New York Observer*, an account of a journey lately made by himself and party from Harpoot, eastward over the Taurus mountains, a distance of 300 miles, to the city of Van. The author says:

Lake Van, along the shores of which we spent several days in going and returning, is a beautiful sheet of water, without any outlet, sixty or seventy miles in length, and perhaps twenty or thirty in breadth. It is irregular in shape, and is surrounded by mountains, so that in traveling the whole length of the lake you obtain sectional views, which give one almost the impression of a series of three or four lakes, and remind one somewhat of Lake George and the Italian lakes.

The city of Van lies at the eastern end of the lake, and is surrounded by a wall and moat. Just back of the city is a high bluff which is surmounted by the most picturesque castle which I have yet seen. On the rocks are several inscriptions in the cuneiform character, but in the Armenian language. The city is said to have been founded by Semiramis, nearly 4,000 years ago; but I believe this distinguished queen is coming to be regarded by historians as a myth. At any rate the city is very ancient, whoever may have been the founder. Stretching away from the city and the lake for several miles toward the mountains on the east are beautiful orchards and gardens, and here the majority of the people live. The Armenian population of Van and its surrounding villages is very large.

TO RESTORE OLD ZINC WHITE.—If kept for a long time zinc white becomes granular and gritty, and useless for painting. It may be restored by ignition in an earthen crucible.—*M. A. Speidel.*

Leg Locomotion.

At a recent meeting of the French Academy, M. Marey communicated an account of some new researches on human locomotion. With his usual experimental skill he succeeded in recording the movements of the legs, on a rotating blackened cylinder (in reduced form, by means of wheel work). Weber supposed that, in walking, the leg was displaced merely by the action of gravity, and performed a pendulum movement. This has been variously disproved (by Duchenne and others); and now M. Marey demonstrates that the movement of transport is uniform throughout nearly its whole duration; in rapid paces it commences and terminates with short periods of variable velocity. This uniformity is due, in great part, to action of muscles of the leg, but two other elements have to be considered: 1, the angular movement of the leg about the pelvis, and 2, the horizontal translation of the pelvis itself, that is to say, of the point of suspension of the leg while it oscillates.

A Monument to Liebig.

The pupils of Justus Liebig propose to erect a fitting monument to the memory of their master, and now appeal to the chemists of all nations to aid them in the effort to raise a sum sufficient for the purpose. It has been decided to erect one monument at Munich, where Liebig spent the later years of his life, and, if the fund subscribed shall suffice, to place another—perhaps a copy of the first—at Giessen, the scene of his earlier labors.

Subscriptions in this country may be sent to either of the undersigned, who will forward the sums contributed to the Central Committee at Berlin:

Professor J. Lawrence Smith, Louisville, Ky., Professor E. N. Horsford, Cambridge, Mass., Professor Wolcott Gibbs, Cambridge, Mass., Professor C. A. Joy, Columbia College, East 49th street, N. Y., or Professor C. F. Chandler, Columbia College, East 49th street, N. Y.

One Hundred and Twenty Years Old.

There are certain portions of Virginia which have long been celebrated for the healthfulness of climate and the longevity of the inhabitants. Here is the latest example:

Mrs. Katie Shepp, living in the Massanutten Mountain, near Kezletown, five miles east of Harrisonburg, Va., has, it is stated, now reached her one hundred and twentieth birthday. Mrs. Shepp was married in the year 1774, at the age of twenty. Her husband, who has been dead about sixty years, was in his twenty third year at the time of his marriage, and he was a wagoner in the war of the Revolution. Mrs. Shepp remembers many of the incidents then occurring in the vicinity. Her mind is clear, and she does the work of the family she lives with, as well as her own sewing, and has never used spectacles.

A Russian International Exposition.

A permanent International Exposition of machinery is to open at the Museum of the Imperial Polytechnic Society in St. Petersburg, Russia, on the 15th of October next. The object of the exhibition is to promote the introduction and employment throughout the empire of new and improved tools and machinery, whether of domestic or foreign manufacture, by demonstrating their advantages through public experiments. The enterprise is also intended to establish closer relations between the Russian manufacturers and those of other countries. Full particulars may be obtained by addressing Colonel Sytenko, President of the Russian Imperial Polytechnic Society, 2 Rue Panteley Mouskala, St. Petersburg.

Fishing by Means of Explosives.

A method of catching fish, employed for years by poachers in England, is to fill a large stone bottle with quicklime, then to pour in water enough to nearly fill the jar, and cork it up, securing the cork to the neck of the bottle by copper wire. The bottle is thrown into the water, and the pressure, caused by the working of the lime, explodes the bottle and stuns the fish, which then float helplessly on the surface of the water.

PHENIC ACID FOR THE PRESERVATION OF WOOD.—It is admitted that, if tar increases the durability of woods exposed to air and moisture, this property is owing to its phenic acid and its creosote. It is, then, rational to believe that, in replacing the sap of the trees with slightly phenic water, they are protected from rot. But phenic acid is insensibly driven from the wood under the influence of water. M. Boucherle considers that phenic acid can only be rendered useful by mixture with sulphate of copper, to defend stakes driven into the sea against the attacks of the *teredo*.

THE British government is spending \$50,000 at Woolwich on a new 80 ton gun, which, when finished, is expected to beat the world. With a sixteen inch projectile, weighing 1,650 pounds, and a maximum charge of 300 pounds of powder, it will pierce the best iron plates, twenty inches thick, at 500 yards, sixteen inch plates at 5,300 yards, and will pitch a sixteen inch shell into a ship or fortress at a distance of 10,300 yards. The steel block forming the inner tube was the largest ever cast, weighing over twelve tons; while the trunnion piece, about eighteen tons, was the largest forging ever produced at the arsenal.

UTILIZATION OF WASTE SOAP LYES AND OILY LIQUORS.—Instead of separating the fatty matters from the water by means of mineral acids, the author proposes to treat them with salts of magnesia. Magnesian soaps are thus formed, containing 60 per cent of fatty matter, and which may be used in the manufacture of gas for lighting purposes.—*M. H. Vohl.*

Predatory Chickens.

One Max Adeler describes a novel method he adopted for ridding his garden of a neighbor's chickens. We copy the article from the *London Garden*, but we suspect it emanated from this side of the water, and we would not wonder if the *Danbury News* man was its author. It certainly reads like him; but no matter where it originated, the invention is made, and in Adeler's case it proved useful.

He says: "We had a good deal of trouble last summer with Pitman's chickens; as fast as we planted anything in our little garden, those chickens of Pitman's would creep through the fence, scratch out the seed, fill up, and go home. When the radish bed had been ravished in this manner for the fifth time, we complained to Pitman. He was not disposed to interfere. 'Adeler,' he said, 'I tell you it does 'em good; and it does them beds good to be raked over by chickens. If I had radishes, give me chickens to scratch around them and eat up the worms. Radishes that haven't been scratched ain't worth a cent.' Then we climbed over the fence with the determination to take the law in our own hands. We procured half a peck of corn and two dozen small fish hooks. Fastening the hooks each to a grain of corn, we tied wire to each hook. Then we scattered the whole of the corn on the radish bed, and fixed the ends of the wires to the biggest sky rocket we could get. The rocket stood in a frame about 10 yards away from the hooks. That very morning Pitman's chickens came over, and instantly began to devour the corn. We were ready; and as soon as it was evident that the hooks were all swallowed, we applied a match to the rocket. It is regarded as probable that no barnyard fowls that have existed since the days of Noah ever proceeded toward the azure vault of heaven with such rapidity as those did. A fizz, a few ejaculatory cackles, a puff of smoke, and Pitman's roosters and chickens were swishing around the celestial constellations without their feathers, and in some doubt respecting the stability of earthly things. Pitman never knew what became of his fowls; but when we read in the paper next day that twenty-four underdone chickens, with fish hooks in their craws, had been rained down by a hurricane in New Jersey, we felt certain that that sky rocket had done its duty."

Gas Light.—Average Prices.

The following information, showing the average net price of gas throughout the United States, has been procured by the Washington, D. C., Gas Light Company:

1. Maine.....\$3.87	20. Mississippi.....\$5.25
2. New Hampshire... 3.96	21. Michigan..... 3.43
3. Vermont..... 4.80	22. Wisconsin..... 3.87
4. Massachusetts... 3.86	23. Ohio..... 3.32
5. Rhode Island..... 3.35	24. Indiana..... 3.54
6. Connecticut..... 4.03	25. Illinois..... 3.87
7. New York..... 3.88	26. Kentucky..... 3.92
8. New Jersey..... 3.80	27. Tennessee..... 4.06
9. Pennsylvania..... 3.46	28. Minnesota..... 4.31
10. Delaware..... 3.95	29. Iowa..... 4.52
11. Maryland..... 3.59	30. Missouri..... 3.95
12. Dist. of Columbia. 3.16	31. Arkansas..... 5.00
13. Virginia..... 3.89	32. Louisiana..... 4.50
14. West Virginia..... 3.11	33. Texas..... 5.75
15. North Carolina... 6.67	34. Kansas..... 4.55
16. South Carolina... 3.80	35. Colorado..... 5.00
17. Georgia..... 5.07	36. Utah..... 4.00
18. Florida..... 8.00	37. California..... 6.11
19. Alabama..... 4.83	
Total average net price of gas in the United States. \$4.324.	

Proposed Statue to Daniel Webster.

Gordon W. Burnham, a wealthy resident of this city, proposes to erect in the Central Park, at his own expense, a bronze statue of Massachusetts' late statesman, Daniel Webster. Mr. Burnham has a special taste for bronzes, and his residence on Fifth Avenue contains probably the choicest collection in the country. The Central Park has already a handsome group (Eagles and Chamols) presented to it a number of years ago by Mr. Burnham.

The Park Commissioners have, we understand, requested that a model of the statue be submitted to them before they will consent to set apart for it the conspicuous and appropriate site on the Mall, suggested by the donor. The form of a renowned and representative American statesman, whose fame belongs to this country, deserves, we think, at least as prominent a position as that of Sir Walter Scott. It is to be hoped that Mr. Burnham's generous offer will not be withdrawn through any difference of opinion as to where in our everywhere beautiful Park his gift is to be displayed. The people will appreciate it, and heartily thank him for it, no matter whether it be located (as it should be) on the Mall, or half hidden in the shrubbery in some by-path of the Ramble.

ROPE CORDAGE.—Recently a very interesting experiment was made at Kirkaldy's Testing Works, Southwark street, London, as to the relative strength of handspan yarn rope, machine yarn rope, and Russian yarn rope. Mr. Pilm-soll, M. P., Captain Bedford Pim, M. P., and others attended the test, which lasted over three hours. There were nine pieces of rope, each 10 feet long, being three of each of the above classes. The ultimate stress or breaking strain of the Russian rope was 11,099 lbs. or 1,934 lbs. strength per fathom; machine rope, 11,527 lbs. or 2,155 lbs. per fathom; handspan rope, 18,279 lbs. or 3,026 lbs. per fathom. The ropes were all of 5 inches circumference, and every piece broke clear of the fastenings. The prices paid per cwt. were: Russian rope, \$11.75; machine yarn rope, \$11.75; handspan yarn rope, \$11.00 all described as best cordage and London manufacture. It will thus be seen that the handmade was cheaper by 75 cents per cwt. and broke at the testing strength of 7,180 lbs. over Russian, and 6,752 lbs. over machine made rope.

DECISIONS OF THE COURTS.

United States Circuit Court—District of New Jersey.
PATENT SHAWL STRAP.—GEORGE CROUCH vs. HENRY SPEER, REINHOLD SPEER, and ROBERT MATTHEW.

[In equity.—Before Nixon, Judge.—Decided April 27, 1874.]

NIXON, Judge:

This suit is brought for an alleged infringement of a patent for "Improvement in shawl straps," originally granted to the complainant, and surrendered and released March 7, 1871.

The patentee states in his schedule that before his invention straps had been used to confine a shawl or other similar article in a bundle, and a leather cross piece, with loops at the ends, had extended from one strap to the other; and above, and attached to this cross piece, was a handle; that the cross piece or connecting strap was flexible in its ends, and allowed the straps to be drawn toward each other by the handle in sustaining the weight; that hence the bundle was not kept in the proper shape, and the handle was inconvenient to grasp; and that his invention consisted in a rigid cross bar beneath the handle, combined with suspending straps that are to be passed around the shawl or bundle, such straps passing through loops at the ends of the handle.

The defendant's first allegation is that there is nothing new or useful in the complainant's patent. If they mean by this that it is not the subject matter of a patent, the objection must be examined and answered in the light of the provisions of the 24th section of the patent act of 1870 (16 Stat., 201). That section states that a patent is to be granted for "any new and useful art, machine, manufacture, or composition of matter, or any new or useful improvement thereof." It will be seen that utility and novelty are the requisite conditions. The invention or the improvement claimed must have both, or the letters patent secure nothing for the patentee. Whether it is useful in the sense of the law is not whether it is not mischievous or hurtful or frivolous or insignificant, but whether it is capable of use for a purpose from which some advantage can be derived. If it be useful in this sense, the degree or extent of its usefulness is altogether unimportant. It is not necessary, in other words, that it should be the best means of producing a desirable result, but a means, although inferior to others, of producing it. (Curt. Pat. Cas., 49.)

Testing the complainant's patent by this principle, it is undoubtedly useful. The rigid cross bar and the loops holding the straps, securing them in their place, and inside of the leather of the handle, if new and useful, and of value to the manufacturer; and this is shown by the fact that these defendants have failed to do so. The evidence introduced by them is frequently contradicted, and is inconsistent with itself and many well established facts.

There is ground for reasonable doubt in regard to its correctness. Where such doubt exists the complainant's *prima facie* case, even if uncorroborated, must prevail.

But it does not stand without corroboration. The complainant called William H. Cleveland, William Roemer, Peter Martens, Jacob Lagowitz, Joseph R. Davis, and Philip P. Lynch to testify as to the state of the art. They seem to be intelligent and disinterested witnesses; have been for years, more or less, connected with the manufacture and sale of shawl straps, and are the right class of witnesses to the state of the art of the complainant, or deny its existence or use prior to 1868.

Upon the whole case, I am of the opinion that there should be a decree sustaining the validity of the complainant's patent, and giving him profits and damages for its infringement since March 7, 1871, the date of the release, and also an injunction, restraining the defendants from further infringement.

[Jonathan Marshall, solicitor and counsel for complainant.
James M. Scofield, solicitor and counsel for defendants.]

United States Circuit Court—Southern District of New York.

COMBINED RUBBER AND METAL SPRING.—THE NATIONAL SPRING COMPANY vs. THE UNION CAR SPRING MANUFACTURING COMPANY.

Blatchford, Judge.

This suit is brought on renewed letters patent granted to the plaintiff Dec. 13, 1870, as assignee of Erasmus T. Russell, for an "Improvement in combined india rubber and steel springs," the original patent having been granted to Russell, as inventor, November 29, 1863, and extended for seven years from November 29, 1867.

A patent of this character and other vehicles composed of a column of india rubber and a spiral metal spring, which encloses it and cooperates with it, and also prevents it from spreading, is valid, notwithstanding a previous patent for a spring composed of a hollow column of india rubber enclosing a spiral metal spring, and prevented from spreading by metal rings.

A renewed patent held valid which claimed a spring constructed of an india rubber column enclosed in a spiral metal spring, although it was conceded in the original application that such a spring was described in a previous patent, it appearing that it was not so described.

Although the original patent, as represented the india rubber column as being of india rubber, yet a renewed patent was sustained which claimed an india rubber column in unqualified terms, without alluding to the latter.

The renewed patent was held valid, although it claimed the rubber column whether solid or hollow, and the original patent made no mention of a hollow column.

It was held to be no objection to the renewed patent because it suggested that any material which was the equivalent of india rubber might be used instead of it, such as animal or vegetable fiber, cutta percha, etc., although these materials were not mentioned in the original.

The validity of a patent is not impaired because the invention is embraced in a prior English patent. If, previous to the date of the latter, the American patentee had reduced the invention to practice.

Where the assignee of the inventor filed and completed their application for a renewal before July 20, 1870, it was held that their oath to it was sufficient without that of the inventor.

Under the act of March 3, 1871, the oath of the assignee is sufficient upon an application for the renewal of a patent originally issued before July 20, 1870; the oath of the inventor is required only when the original patent issued after that date.

[J. P. Ritz and George Gifford, for plaintiffs.
H. C. Woodruff, for defendants.]

Recent American and Foreign Patents.

Improved Waste Valve and Overflow.

James Foley, Brooklyn, N. Y.—The end of the pipe leading to the basin is coupled with a casting or T, in the lower part of which is formed a conical valve seat, and with its lower arm is coupled a pipe leading to the sewer. The upper part of the T coupling is connected with the end of a larger pipe, which is secured to a stand. Within the large pipe is placed a smaller pipe, around the lower end of which is formed a ring flange, upon which is placed a rubbering to form the valve. By this construction, when the valve is closed and water admitted into the basin, it will rise in the large pipe until it reaches the level of the upper end of the small pipe, when it will flow off through the same. When the pipe is raised, opening the valve, the water will flow off through the sewer pipes, having a wholly unobstructed passage, in which there is nothing for hairs or other rubbish to lodge against and thus obstruct the outflow.

Improved Mechanism for Operating Patches, Shears, etc.

Charles H. Reynolds, Williamaburg, N. Y., assignor to himself and Henry C. Richardson, of same place.—In this machine, when the free end of a lever is moved to the rearward, the arm of the lower jaw will be moved downward and the arm of the upper jaw will be moved upward, bringing the jaws together with immense power. An illustrated description of the apparatus will be found on page 102 of our current volume.

Improved Signal Light.

James C. McMullin, Chicago, Ill.—The object of this invention is to furnish a signal lamp for railroad trains and other purposes, which indicates by the successive appearance of the light thrown through lenses of different colors or sizes from one burner, the distance of the light to be determined by the gradual appearance and relative position of the lights. The invention consists of a signal lamp which is provided with one or more tubular arms, with reflectors and lenses of different colors at their ends, spread at suitable distance, and lighted by one common burner. A signal lamp is provided with one or more tubular arms. At the distance of one, two, or more feet, are a reflector and lens. The reflector is preferably placed under an angle of forty-five degrees to the axis of the arms, so that the whole body of light is thrown forward through the lens as the rays are reflected under the angle of incidence of the light. Lenses of different colors or sizes may be employed, and thereby the distance of the train determined by the successive appearance and position of the lenses. It has been found by practical tests that in a signal lamp having red and white eight inch lenses placed at a distance of thirty-four inches from each other, nothing but the red light is shown at a distance of one and one fourth miles. At a distance of one mile, red is shown with a rim or fringe of white at that side where the white lens is situated. At three quarters of a mile, red and white are both shown distinctly and separately; and at a distance of half a mile a considerable space appears between them. Any number of lenses can be illuminated at the same burner if placed at the ends of the connecting arms.

Improved Children's Carriage.

Julius Sues, Louisville, Ky.—A child's carriage is supported on front wheels by curved sills or bars and strong lateral springs, firmly bolted to the body and also to the rear end of the bars, the front end carrying the axle of the front wheels. By placing the front part of the body on springs, not only an up and down motion, but also a rocking motion, of the carriage is obtained, and the elasticity of the same increased. The hind part of the body is supported by two additional curved springs, of swan-necked shape, which are interposed between the usual elliptic supporting springs and the body. The front end of the spring is firmly attached directly to the body of the carriage, or to an intermediate bracket-shaped casting. The rear part of the spring is attached to the back of the body, near the upper part thereof. The support of the body by the springs is thereby strengthened, and the constant upward jarring of the springs arrested.

Improved Sleigh.

John A. Reigfrid and Chester B. Borden, Seneca Falls, N. Y.—The knees and the hub are cast in a single piece, and the hub fits on the beam as an ordinary wagon wheel fits on an axle. Traces are attached permanently to the knees and to the under side of the beam, so that they may be readily detached from the beams. The hubs are made about the length of ordinary wagon hubs, so that the wheels will fit on the beams in place of the runners. The beams then become axles. The change from runners to wheels and from wheels to runners is very readily made.

Improved Stop Valve.

Richard S. Gillespie, New York city.—This invention is an improvement upon double seated valves, some of which are provided with a headed pin or spreader and two disks by the introduction of rollers that may act on the principle of a toggle joint. When a valve is forced down, a pin strikes the bottom of the case and forces another pin up against the lower end of the valve stem. As the valve stem moves further down, both pins are forced inward against the outer rollers, which force the middle rollers outward, forcing the faces of the valve against the valve seats. The rollers thus operate as a double toggle joint, pressing outward in lines at right angles with the valve stem. In raising or opening the valve, the first movement of the valve stem removes the pressure of the pins from the rollers, the pressure of the rollers from the parts of the valve, and the pressure of the valve faces from the valve seats, so that the valve can be raised without any friction between its faces and seats.

Improved Reading and Copying Stand.

Charles E. Wells, West Pawlet, Vt.—The book to be exposed on the rack is securely fastened thereto, after being placed on the projecting lugs at the lower end by carrying a top slide piece with top lugs down. The slide piece moves in a central slot of the rack, and is also provided with pivoted arms having a lateral piece at their end with sliding book fasteners. Similar arms with upward extending fasteners are applied along the lower part of the rack. These rods are swung forward as required by the thickness of the book, and the fasteners then applied to hold the leaves till they are turned over. As the fasteners rest only lightly thereon, the turning and placing in position of the leaves will occasion no difficulty.

Improved Carriage Wrench.

Henry Cutler, Ashland, Mass.—The adjusting handle consists of two parts, one chambered out to receive an eccentric, which is thus turned. The eccentric is governed in position, as it is revolved, by a pivot, where it enters a hole in the stock head. The jaws are levers, and the eccentric operates on their upper ends, the fulcrums being the pins. A spring between the jaws keeps them spread apart; but when the eccentric is turned, the outer ends of the jaws are forced toward each other to gripe and hold the nut. With this wrench a nut may be removed and replaced without touching it with the fingers.

Improved Method of Retouching Photographic Negatives.

Claude L. Lambert, Paris, France.—A large negative, after having been properly exposed, developed, fixed, and finished, is covered on both sides with a sheet of thin paper or other semi-transparent material capable of retaining the coloring matter to be afterward employed. Wherever necessary, either on the collodion side or on the reverse side, an impalpable galvano-plastic powder, or other finely pulverized substance answering the same purpose, is applied with a stump. The effects of light and shade may thus be modified, toned, or heightened, and such a high degree of finish imparted as will render any subsequent retouching of the positive paper print unnecessary, the sharpness of the lines being restored by the aid of a lead pencil. The negative, after thus being treated, is placed in the pressure frame with a sheet of ordinary sensitized paper, prepared either with salts of silver or of chromium, to obtain a perfect positive. Should the lines of the negative be too sharp or well defined, they may be softened in the positive proof by first partially printing it in contact with the large negative, and then completing the impression after having interposed a sheet of very thin glass between the negative and the paper.

Improved Seed Dropper.

Hermann Koeller, Camp Point, Ill.—To two cross bars are attached runners and seed hoppers, to the middle parts of which is secured a tongue. A slide receives a reciprocating movement to drop the seed from the revolutions of gear wheels, and may be adjusted to a longer or shorter stroke. To one small gear wheel is attached a wheel consisting of arms, the outer ends of which are notched to receive a chain, and to the lower side of which is attached a ring to support the same. In using the machine, in coming to the end of the field, the driver slips a spring ring upon the link that dropped last to the ground, after dropping the last hill before turning, for a mark. He then counts the links that lie crosswise, and puts another spring ring in the link he wishes to begin to drop from, for a mark in starting. After turning around, the flanged chain wheel should be set so that the machine will begin to drop at the marked link. This will bring the hills in accurate check row.

Improved Combined Throttle and Governor Valve.

Allan Talbot, Richmond, Va.—This invention relates to novel means to be used in connection with a governor for starting, stopping, or instantly changing the speed of a steam engine without the employment of shifting belts or other mechanism.

Improved Bath Tub.

Asa C. Brownell, Brooklyn, N. Y.—This tub frame is so constructed that the sheet metal lining cannot buckle by influence of shrinkage or swelling of the body of the tub.

Improved Combined Check and Martingale.

Louis Barron, Woodstock, Vt.—The object of this invention is to provide a combined check and martingale, or in other words a check rein which, by an easy adjustment, is adapted to serve the purpose of a martingale. It consists of a strap split into two other smaller straps, the single strap fastening by means of a ring to the check or water hook, and the two smaller straps passing through keepers on the crown piece of the bridle, connected by a sliding loop on the face of the horse, and fastened to opposite sides of the bridle bit by means of detachable fastenings.

Improved Wheel.

Lewis H. Rogers, South Avon, N. Y.—The object of this invention is to provide a wheel for vehicles of such an elastic construction as shall facilitate the easy movement of vehicles, and which shall at once be strong, light, and durable. It consists of a metallic hub having two sets of screw-threaded stems projecting radially from the same, to which are fastened small plates held to said stems by a nut and washer, there being between the said washer and plate an elastic pad. Said plates are attached on each side of the stems to metallic spring spokes, and said spokes are securely fastened to clips that are riveted to a metallic felly. Said felly is preferably made with a concave periphery, and between the felly and the tyre is placed a rim of rubber or other elastic substance.

Improved Portable Fence.

William C. Kay, Como, Miss.—This invention relates to that class of wooden fences which are portable. It consists of but two essentially different parts, the rails and the improved connection for the same, which latter consists of two symmetrically formed sections, made of inclined stakes, to which are attached strips of stuff varying in length from about three feet at the bottom to one foot at the top. Said stakes cross each other at about eighteen inches from the top, and are braced by a rail resting in the fork formed thereby. Said strips are securely fastened at one end to the stakes, and as they incline toward the earth the strips of one stake cross those of the other, forming locks thereby into which the rails are placed.

Improved Spring Chair.

William T. Doremus, New York City.—To the front and rear parts of a chair seat are attached two iron bars which are made with a bend to pass through slots in the end of a plate framed upon the head of a screw. Bolts pass through holes in the bars and plate, through rubber blocks placed above and below said bars and plate, through small rubber blocks interposed between the bars and the plate, and through washers placed above and below the blocks, and have hand nuts screwed upon their lower ends, so that, by turning said hand nuts in the one or the other direction, the rubber blocks may be compressed, more or less, to give any desired elasticity to the chair. The small blocks operate as a yielding but positive stop to the forward movement of the chair seat, while the larger blocks allow it to have a greater and more elastic rearward movement. The screw screws into a long socket which has a flange upon its upper end and a screw thread cut upon the outer surface of its lower end, to receive a nut. The pedestal is made in sections, meeting in its center around the socket. The parts of the pedestal are firmly held together, and the screw socket is so firmly supported that it cannot work loose.

Improved Combined Sulky Plow and Cultivator.

Newton J. Skaggs and Lorenzo W. True, Tallapoosa, Ala.—The main framework of this machine has a space through which rows of plants or grain can pass, so that the machine can be drawn over said rows without injuring said plants or grain. Three plow beams are placed in each frame. The ends of the beams are connected by bolts which pass through them and through blocks interposed between them, and between them and the side bars of the frames, so as to keep the said beams in their proper relative positions. The forward ends of the beams are pivoted to the frames, so that the rear end of the beams rise and fall as the unevenness of the ground may require, and enable the plows to be raised from the ground when necessary. The beams may be adjusted at a greater or less distance apart, according as larger or smaller plows are to be used. The plow standards fit into semi-cylindrical recesses formed in the lower sides of the beams. By raising inner standards and leaving the outer standards in working position, the machine will be adjusted for marking off the land.

Improved Range Chimney Bottom Plate.

Hemilton C. Garwood, Jersey City, N. J.—A rod extends directly through the front wall of the chimney for working a valve at the opening of the top of the chimney bottom plate for effecting the ventilation. The rod is connected to the valve by a slotted arm and a stud pin.

Improved Shirt Bosom.

William Hay, New York City.—This is a shirt bosom reinforced or lined and strengthened with a coarse material in such a way as to make the bosom more durable. The side plaits are made of fine linen folded so as to be of three thicknesses. The central plait is formed of one thickness of fine linen in its middle part, but has its edges folded so as to be of three thicknesses. The middle plait is made in one piece with one of the side plaits, and has a strip of coarser material inserted in it, the edges of which enter the edge folds of the said plait.

Improved Seal Lock.

Solomon Wright, Fernald, Vt.—A metallic flanged box contains a bolt having a stem upon which there is a spiral spring. This spring bears against a partition plate. Another plate has an arm which extends to or past the bolt. There is a pin in the bolt with which the arm engages when the lever plate is turned upon its hinge. This action of the plate throws back the bolt and releases the cap. The cap is a flanged box having an aperture, and is rigidly attached to the hump. The cap is placed over the box, thus confining the seal, leaving so much of it exposed to view as is seen through the aperture. When the cap is placed on the box, the edge of the recess in the cap strikes and forces back the bolt; but when the cap reaches the bed flange of the box the spiral spring reacts, and the end of the bolt enters the recess and securely fastens the cap and confines the seal card. To prevent the card seal from being replaced after it has been cut and the lock opened, on the outside of the lever, ribs run longitudinally on the face of the plate, which force the card outward when it is cut or torn. When it is desired to open the cap, the seal is broken with the end of the finger, which allows access to the end of the lever plate. The seal card may be cut or torn, so that the plate can be pulled out, thereby drawing back the bolt and releasing the cap.

Improved Horse Detacher.

Amos Barker, Nebraska City, Neb.—On the ends of the whiffletrees are two lugs to receive the tug eyes, and they have a hole formed through them to receive bolts, which also pass through the tug eyes, and thus connect the horses. The bolts are pivoted to a lever, which is pivoted to the center of the whiffletrees, and to it is attached a cord which passes back to the dashboard of the vehicle, so that, by pulling upon the cords or straps, all four of the tugs may be instantly disconnected from the whiffletrees. Similar arrangements are attached to the neck yoke for securing the breast straps to it. By this arrangement the tongues are disconnected from the whiffletrees, and the breast strap from the neck yoke, at the same time. The ring of the bridle bit is secured in place by a hook formed upon the end of a lever pivoted to a block. By suitable construction, as the neck yoke drops, the strain will operate the lever to release the bit ring, and at the same time the strap will slip from the said lever, thus detaching the cross reins and freeing the horses from each other at the same time they are freed from the whiffletrees and neck yoke.

Improved Trunk.

William J. Large, South Brooklyn, N. Y.—This improved trunk is so constructed that the operation of raising the lid will also raise the tray to give free access to the interior of the body of the trunk, and will enable the lid to be locked in place when only raised sufficiently to give access to the tray.

Improved Ice House for Preserving Meats, etc.

Daniel T. Conklin, Brooklyn, N. Y.—The roof is pyramidal in form. The sides of the ice box are provided with doors sliding in grooves in the corner posts of said box, so that all or part of them can be raised, more or less, according as a greater or less cooling effect is required to be produced. The articles to be preserved are hung in the space between the walls of the house and the ice box. The roof of the ice box is also made pyramidal in form, and its peak extends up to the peak of the house. The peaks of both roofs have holes formed through them for the escape of impure air, etc. With this construction the space in the upper part of the ice house and ice box to be cooled uselessly is very greatly diminished, so that the same quantity of ice will produce much better effects than in ice houses constructed in the usual manner. The corner beef vat is placed between the forward end of the ice box and the front side of the house.

Improved Sawing Machine.

John M. Linnell, Monticello, Iowa.—A treadle pivoted to an ordinary saw horse is extended to one side to project beyond the horse standard, and provided with an inclined lever arm which is connected with the bifurcated end of the saw frame. The rear part of an extension of the lever is connected to a crank wheel shaft and balance wheel at the opposite side of the saw horse. The balance wheel is weighted at one side for the purpose of carrying the crank wheel into position to be readily moved by the treadle and arm, avoiding the position of the same on one of the dead points for starting. A reciprocating motion is imparted to the saw frame by the arm and extension. Said frame is made of curved shape with a saw blade cutting in both directions, clamped adjustably and detachably therein. The machine is operated by rocking the treadle platform with the feet, pressing with one hand the upper part of the saw frame, and feeding with the other hand the sticks to the saw.

Improved Rotary Pump.

Hiram L. Houghton, Charlestown, N. H.—This invention consists of a hollow cylinder with closed ends, containing a rotary disk in the middle portion. The disk carries blades in longitudinal and radial slots, both in itself and in the shaft. These blades are shifted forward and backward by cams on each end of the cylinder to cause them to press the cut-off and rims over the suction pipe, and carry the water up to and deliver it at the discharge pipe. The suction pipe is divided, and a branch enters into that chamber in which the blades are thrown to pass the cut-off in the principal pumping chamber; and a passage is formed through the cut-off to a branch of the discharge pipe, whereby whatever effect may be obtained by the blades in that chamber is utilized.

Improved Heating Stove.

Stiles Cook, Magnolia, Iowa.—In this invention the products of combustion are caused to take a circuitous route to the escape flue, in order to secure more perfect utilization of heat, that is to say, they are returned through the stove to be reheated, after passing through an exterior vertical flue, and their course at starting directed upward from the grate, or downward through the same.

Improved Bolting Reel.

Moses French, Harrodsburg, Ind.—The cloth has strips arranged along the seams to attach it to rods which are suspended from the ribs by other rods. The cloth strips are connected to the rods by hooks, and the rods are arranged to turn and roll the cloth on them for stretching it transversely. By this arrangement the cloth can be stretched tight at any time after it has stretched so as to bag without unfastening and readjusting it. The inside is relieved of the ribs of wood which carry up the meal and throw it down, so as to force through the brown and dark matters which discolor the flour; and the bolting cloth, being entirely untouched by the ribs, will not cut or be injured by insects which gather in the cracks, as in the common reel.

Improved Vehicle Seat.

Darwin V. Miller, Weedsport, N. Y.—This invention consists in an improved spring seat formed of two sets of spring slats slotted at their ends and drawn together at their centers over a frame interposed between them. An upper set of spring slats are attached by cross bars to the middle set, and have bars at their ends to keep the persons sitting upon the seat from slipping off.

Improved Automatic Gas Lighter and Extinguisher.

George S. Dunbar, Pittsfield, Mass.—A metal case screws on the lamp post, and has a passage for the gas to pass along one side of the chamber to the burner, in which passage is a stop valve to shut off the gas and extinguish the light, when it is let fall, by a cam which is turned for the purpose by the clockwork contained in the chamber. The cam is connected to the shaft of the clock gear by its hollow journal which extends from the gas passage into the chamber. The valve has a pressure spring above it for pressing it firmly on its seat when the cam lets it fall. Strong clock springs turn the train. A wheel turns the cam back to set at the same time that it winds up the springs. The extent to which it is turned back determines the time the clock will run before extinguishing the light, and the extent to which it is turned back is governed by an adjustable collar. The cam may be set for dropping the valve at any predetermined time by shifting the collar to the mark on a scale corresponding to the time wanted. A bar is provided with match-holding fingers to carry a match at the same time that it is used to wind up the clock, and strike it against a striking plate; and then present the burner to ignite the gas jet; thus allowing the winding and setting of the clock and the lighting of the gas all to be accomplished by one operation.

Improved Washing Machine.

Charles Bagnall, Amity, Iowa.—Levers are oscillated by working a frame. To the inner end of each of the levers is pivoted a bow. To the ends of each bow are attached the ends of a bar to which are pivoted three tubes. The shanks of presses are fitted into the lower ends of the tubes, and are held in place by coiled wire springs placed in the upper part of the tubes. By this construction the presses can yield to accommodate themselves to the different thicknesses of the mass of clothes that may be in the boiler.

Improved Car Coupling.

Charles F. Wilkinson, Reuben Mochamer, Jacob B. Ziegler, and Charles Snyder, of Latimer, Pa.—This consists of a draw hook with inclined front part, fitted rigidly to the car frame, and set into a recessed bumper frame. A link-shaped clevis is pivoted to the hook, and a curved latch piece closes over the end of the same. The link slides, on the approach of the cars over the hook, and drops into the recess back of the hook, forming thereby the intimate coupling. For uncoupling, the link is swung up, and taken out of the hook, and the drop latch is then placed in an inclined position on the outer side of the latter, ready for the detaching of the cars without any chance of recoupling.

Improved Car Brake.

Edmund I. Hockaday, Pleasant Hill, Mo.—A sliding bar is applied to the under side of the car, provided at both ends with buffer heads. Its whole length is somewhat less than the distance from drawhead to drawhead, in order to allow for the compression of the drawhead springs. It connects with the brake mechanism by a chain with double end parts, so that the brake may be operated by pulling the sliding bar in either direction. The tender is provided under the rear drawhead with a short sliding buffer rod, which is operated, by means of a pulley and chain, from a brake shaft and wheel at the forward end of the tender. The buffer rod is guided under suitable inclination back of the rear truck of the tender, and projects, when in regular position, beyond the drawhead far enough to take up nearly the entire slack space between the tender and first car. On the discovery of sudden danger, the engine is reversed, or its motion is retarded, so that the momentum of each car carries it forward the full length of its slack, and produces the action of the buffer rod of the tender on the sliding bar and brake of the first car, which carries back that of the second, and so on till the whole train is acted upon by the brakes in a perfectly automatic manner. In order to release the brakes and back the train, the engine is slightly moved forward, and a brake wheel connecting chain is released, so that the buffer rod drops out of position and discontinues its action on the sliding bar.

Improved Boot Blacking Machine.

Bartly Palmer, Armonk, N. Y.—This invention consists of a horizontal shaft, which is rotated by a hand wheel or treadle, and provided with two wheel-shaped brushes, of which one takes up the blacking from a box placed adjustably on a pivoted bracket, transferring it to the boot, while the other wheel, of rounded V shape or concave cross section, polishes the boot when brought in contact therewith.

Improved Cotton Seed Huller.

Paul J. Martin, Paris, France.—This invention relates to a construction and arrangement of screws and wedges for securing the knives of the concave in place, and for adapting them to be adjusted toward the cylinder. The effect of the operation of the machine on the cotton seed, which passes from a hopper down between the stationary concave and revolving cylinder, is to remove its fibrous outer covering or envelope by the grinding or rubbing action of the knives or sharp-angled bars fixed on said concave and cylinder.

Improved Roller for Winding Paper.

Brantley G. Read, Lyons, Iowa.—This invention consists of a rod for fastening the end of a paper sheet to a roller on which the sheet is to be wound. The rod is connected to the roller by a swinging arm at each end, which are pivoted eccentrically to the roller, and so as to let the rod drop into a little groove in the side. The paper sheet is attached by raising the rod, folding the paper sheet over it, and letting it fall back into the groove. The tension of the paper holds the rod in place as it passes under when the roller is set in motion to wind on the paper, and the arms by which the rod is connected keep it from shifting around.

Improved Washing Machine.

Daniel C. Mitchell, San Marcos, Tex.—The suds box has a false bottom. Four perforated upright boards are hinged together to form a clothes box, which rests upon the false bottom. In using the machine, the clothes to be washed are placed in the clothes box and a crank is operated, the effect of which is to work the boards upon their hinges, alternately compressing the clothes in opposite directions, and allowing them to become again saturated, washing them clean in a very short time.

Improved Chimney Cap.

David Boyd, New York City.—The flue has an enlarged portion attached thereto by making a series of small V-shaped openings in its lower end, and then compressing the end to the flue. A collar surrounds this connection, forming a sort of cup to catch the condensed gases which run down upon the flue, and discolor and stain whatever they touch. The liquid which adheres to the inside surface of the enlarged portion runs down and passes through the opening into cups and is carried off.

Improved Hot Air Furnace.

Charles Clark, Minneapolis, Minn.—A horizontal conical distributing radiator, with top extension cones, extends at the top of the fire box along its full length, and is connected, by cylindrical or conically enlarged top flues, with the same. Vertical tubes extend sidewise from the top radiator to horizontal drums, which are placed longitudinally sidewise of the fire box. The front ends of the base drums are provided with doors for cleaning. The rear ends carry a lateral radiator of pyramidal shape. The rear drum has a series of air flues passing through the same in the longitudinal direction, and is also connected near its top part by a direct flue with the top radiator, and by a curved top flue through the shell to the chimney.

Improved Churn.

James C. Babb, Knowlton, Wis.—Arrangements are provided so that a complete circulation of air is established through the milk being churned, by suitable construction, when the crank is turned, shafts and their attachments will be revolved in opposite directions, the milk will be thrown into violent agitation, and a current of air will be forced through it, bringing the butter in a very short time, and developing all the butter there may be in the milk.

Improved Toy Pistol.

Charles Nelson, East New York, N. Y.—This is a toy revolver with a solid rotating cylinder, having a number of annular side recesses, into which paper caps are securely placed and discharged in regular order by the action of a hook-shaped hammer striking thereon through a recessed slot of the top part of the revolver.

Improved Axle Skein.

Jeremiah J. Hutchins, Red Oak, Iowa.—This invention consists of a hollow cast metal thimble skein, having the hollow portion screw threaded to screw on the axle for attaching the skein thereto. The threads are made right and left for different sides of the wagon, in order to have the pitch so that the skeins will not work loose by friction of the wheels revolving on them when the wagon moves forward.

Improved Burglar-Proof Skylight.

Moses T. Williams, New York City.—The opening is protected by a burglar-proof grating, formed of bars of iron attached to the frame, which are fixed for covering one half of the opening. The other half is covered in a similar manner, but the bars are attached to a sliding frame, which, when closed, is secured by a hook. The windows on the sides of the skylight swing to a horizontal position and are self-closing. The cover of the skylight is mounted on rollers and traverses back and forth over the stationary part of the roof; and the hatch is operated by means of two cords. The window cords also extend down into the apartment below, so that one or more may be opened by night or day for purposes of ventilation. The opening in the roof may therefore be left open at all times and protected from burglars when the windows are open as well as when they are closed.

Improved Hand Rest.

Roses Willard, Vergennes, Vt., assignor to Frederick W. Coe, of same place.—This hand rest and memorandum book is composed of several tablets, made of any suitable material, which are hinged together so that they open and close similar to a book. The rest is adjustable, as to thickness by raising and throwing back one or more of the leaves.

Improved Medical Compound or Bitters.

Homer D. Torritt, of Waynesborough, Ga.—This remedy, for rheumatism, neuralgia, dyspepsia, liver diseases, and similar complaints, consists of powdered podophyllin, nitrate of potash, gamboge, and powdered sugar mixed with rye whisky.

Improved Artificial Flower.

Philipp Knorpp, New York City.—The term brilliants is given to articles produced in a variety of different forms by a suitable alloy of lead and tin, into which, when in a molten state, the dies are dipped. The dies are cut of the cheaper kinds of precious stones of suitable size, which are faceted in any conceivable design, so as to impart to the surface of the alloy the appearance of brilliants. In the present invention, leaves are made with a brilliant surface, in any desired size, shape, and design, as described. A series of such leaves are then arranged together and fastened at the center, and rows of smaller leaves arranged at the inside, with a pistil in the center. To the under side of the flower is then soldered a pin, by which the brilliant flower may be readily attached to the costume.

Improved Whip.

Dexter Avery and Charles C. Pratt, Westfield, Mass.—This invention consists of a whip the body whereof is composed of fibers arranged or built upon a small center core of whalebone, and gined and compressed, the whalebone being in the upper part and projecting beyond the termination of the tapered body for forming the body of the lash.

Improved Neck Yoke.

Minor S. Trowbridge, Plattville, Wis.—This invention consists of sliding breast strap connections to a neck yoke, for extending or shortening the connection of the horses to allow them a certain limit of lateral play. The object of this is to accommodate the animals, to some extent, to a choice of the roadway. The connections are coupled to an equalizing rocking plate at the middle of the yoke, so as to cause them to shift alike, and thus always balance, so that one horse will not have an undue advantage of the other in respect of the leverage of the yoke.

Improved Road Scraper.

Peter C. Post, Paterson, N. J.—This invention consists of two scraping blades arranged for scraping the earth together in a ridge. They are pivoted at the middle to draft bars, and connected at the front end by chains to said bars. At the rear they are connected by chains, and the draft bars are joined together by an adjustable bar, all so that the scrapers can be adjusted to certain different conditions adapted for different conditions of the road. This scraper is especially designed for scraping the earth from the gutters along the side up to the middle portion, for rounding up the road bed.

Improved Hub or Vehicle.

Morse L. Poirier and Delphis Guilmont, Green Bay, Wis.—This is an improved attachment for hubs and axles, which prevents the oil from escaping from either end of the hub and running over its outer side, and also prevents sand and dust from getting in and causing the axle arm and box to wear. It consists in a band made with an inwardly projecting shoulder or flange upon the middle part of its inner surface to adapt it to be attached to the inner end of a hub. A rubber sleeve placed upon the axle arm fits into the flange of the band, so as to prevent the escape of oil. A cap made of rubber also fits into a band at the outer end of the hub.

Improved Subsoil Plow.

Andrew L. Manning, Booneville, Miss.—The slotted rear end of a bar rests against the rear side of the standard, opposite the rear end of the beam. The bar is then bent forward at right angles, and extends along the side of the beam, and is slotted so as to be secured to the side of the beam adjustably, in order that it may be conveniently moved forward and back, to adjust the pitch of the subsoiler, as may be required. The subsoiler can be readily raised and lowered to adjust it to work at any desired depth in the ground.

Improved Derrick.

Elias O. Long, Farmington, Cal.—This invention consists of a base-supporting part of suitable strength, to which is firmly secured a mast with a sliding extension piece, having pivoted top arms and brace ropes swiveled thereto, and suitable steadying brace ropes connecting its top with the ground. When the derrick is placed in position for hoisting, a rope, passing over pulley blocks of one arm and the base part, raises and lowers the load, as required, while the other is braced for relieving the side strain. For the purpose of transferring the derrick, the extension standard is lowered down alongside of the mainmast, which causes also the swinging down of the pivoted arms sidewise of the same. The top brace ropes are then released with their stakes and suitably wound up, and the derrick may then be drawn away to be placed into position at any other point, as desired. For storing the derrick entirely out of the way, the standard may be detached from the base part and bundled up thereon.

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J. G. H. can keep his cistern water fresh by the means described by M. A. G. on p. 156 of our current volume.—J. P.'s mineral specimen has not reached us.—J. H.C.'s query as to an amalgam is not intelligible.

—F. H. F. will find a description of the Wilson process of making steel direct from the ore on p. 15, vol. 39.—C. A. B. does not send sufficient data as to calculating the power of a locomotive engine.—C. will find directions for waterproofing cloth with rubber varnish on p. 282, vol. 39.—A. H. Y. will find directions for making nickel salts on p. 187, vol. 39.—C. P. H. will find a full description of the first locomotive in Smiles' "Life of George Stephenson."—J. C. T.'s wife will find a description of painting on glass on p. 123, vol. 39.—F. G. will find a recipe for liquid glue on p. 250, vol. 39, and an explanation of the pressure of the wind on p. 378, vol. 39.—X. X. X. will find directions for polishing meerschaum on p. 155, vol. 31.—S. H. S. should consult a soap boiler.—N. G. N. should apply to D. Van Nostrand for Auchincloss' book on "Link and Valve Motions."—W. N. can galvanize castings by the process described on p. 29, vol. 24.—C. D. E. can kill ants by the means described on p. 234, vol. 27.

(1) A correspondent says: I have read with much interest the very able articles on "Practical Mechanism," written for your valuable paper by Mr. Rose; and find that they contain much information, useful not only to apprentices but also to men who have worked for years at their trade. But I beg leave to differ from Mr. Rose on some points of the article published under date of August 15, in which he says: "The only clearance necessary is to ease off the top of the teeth backwards from the cutting edge, which will give the teeth sufficient clearance to make them cut clean, and leave the sides of the thread to fit the thread being cut." I maintain that it is necessary to have clearance on the top, bottom, and sides of the teeth of a tap, in order to make it cut freely; otherwise it will jam its way through instead of cutting. I think that all practical machinists, who have used taps with clearance only on the top of the teeth, as proposed by Mr. Rose, especially for tapping steel, will agree with me on this point; such taps require as much power to turn them back as to force them in, and will frequently snap off in the hole. In another part of the article, Mr. Rose says: "Three flutes are all that are necessary to small taps, which leave the top stronger and less liable to wobble, especially in holes that are not round, than if it had four flutes. Taps of a larger size may have more flutes, but the number should always be an odd one, so that the tap may do its work steadily." My experience has been that, for a hole not round, a tap with four or more flutes is better than one with three. The engraving

represents the outline of a hole not a true circle. B is a section of a tap with three flutes. When in the position shown, the point, A, does not touch, and the diameter of the hole being greater across CD than where the other two flutes, E, F, of the tap are cutting, the tap will be forced back until the point, A, touches, and each tooth in succession, as it comes around, will drop into the same place; thus the tap will follow the irregularities of the hole. A spiral form of flute is the best. A. Taps will cut freely and clean without having clearance on the sides or bottom of the thread, as evidenced

(2) F.C.M. asks: What difference is there in the nature of the power disengaged by the action of dilute acid on the metallic plates, as in a cell battery, and that evolved by the friction machine commonly used for medical purposes? A. There is still much uncertainty as to the real effects of electricity on the human system, the cases in which it is to be applied, and the best mode of applying it. Practical men prefer the use of currents to that of static electricity, and, except in a few cases, they prefer discontinuous to continuous currents. There is, finally, a choice between the current of the battery and that of induction. Electrical currents should not be applied in therapeutics without a thorough knowledge of their various properties. They ought to be used with great prudence, for their continued action may produce serious accidents. Matteucci, in his lectures on the physical phenomena of living bodies, expresses himself as follows: "In commencing, a feeble current must always be used. This precaution now seems to me the more important, as I did not think it so before seeing a paralytic person seized with almost tetanic convulsions under the action of a current from a single element. Take care not to continue the application too long, especially if the current is energetic. Rather apply a frequently interrupted current than a continuous one, especially if it be strong; but after 20 or 30 shocks at most, let the patient take a few moments' rest."

(3) G.R.McC. asks: Is there any simple method by which glass and china ware may be marked with a name or initials? A. Glass ware may be indelibly marked by means of a diamond, or very hard steel.

(4) W. H. M. asks: What is the meaning of cold pressed castor oil? A. Castor oil is made by pressing the castor oil bean in a cold or warm state. When pressed cold, it is called cold pressed castor oil.

What work on chemistry do you consider the best? A. If you desire an elementary work, we would recommend Bridge's edition of Fownes' "Elementary Chemistry." A more advanced work is Miller's "Elements of Chemistry."

(5) C.O.D. asks: 1. How can I keep the head of a banjo from becoming dry and wrinkled? With what can I clean the fly dirt off without injuring the head? A. Try a small quantity of powdered rosin. 2. Does it damage the strings to always keep them in tuning order, and to leave the bridge always in a standing condition? A. Yes.

How can I remove flesh worms from the face? A. Bathing the face with bay rum has been recommended, but perhaps the better recipe would be to abstain from immoderate diet and eat only plain food.

(6) I. I. Y. asks: 1. What can I use to harden butter in summer instead of ice? A. Numerous devices for the production of a low degree of temperature by artificial means have been fully described in the SCIENTIFIC AMERICAN, many of which might be made applicable to your purpose. 2. What can I use to color butter yellow? A. Butter is often artificially colored by aid of annatto, turmeric, or infusion of calendula flowers.

(7) C. H. M. says: You stated recently that the artificial employment of electricity would aid, sometimes induce, and accelerate the crystallization of substances. Please explain, more specifically, under what arrangement or circumstances this is the case, and to what extent. A. Every metal is thrown down in a crystalline state, when there is no evolution of gas from the negative plate, and no tendency thereto.

(8) S. H. G. asks: Do the born blind ever "see stars," resulting from a blow or strain? Pressure with the thumb and finger on the closed eyelids can be made to produce sensations of color. These tints, in certain conditions of the nervous system, are exquisitely beautiful, and have no connection with the memory. They are simply colored pictures evolved out of the darkness by mechanical pressure upon the ball of the eye. Are the blind susceptible of this? If so, they may have ideas of color without having ever seen a ray of light. A. Violent concussion will produce "stars" even in a blind person. You could obtain better answers to the remainder of your question by consulting a person devoid of sight, than from us.

Can the locust crop out west be utilized for stock, or otherwise? A square acre of solid living meat ought to be worth something in this age of the world. A. As far as we know, this has not yet been done.

(9) O. H. asks: Can you give me a recipe for making gelatin, such as is used in making molds for molding plaster of Paris? A. Gelatin is formed by the action of boiling water on white fibrous tissue, cellular tissue, the skin, organic constituents of bone, etc. When the solution is evaporated to dryness, it leaves the gelatin as a brownish yellow mass. Common glue is an impure form of gelatin, and is generally employed for making such molds as you speak of.

(10) H. asks: Does the color black attract heat? A. A black substance is one which absorbs all rays of light which fall on it, and converts them into heat, with a corresponding rise in temperature.

(11) F. H. asks: In a discussion on the advance of chemistry, I stated that one chemist had succeeded in making alcohol from its elements. On being asked what the substances used were, I named graphite, hydrogen, and oxygen. One gentleman objected and said graphite was not an element. I insisted it was. Is graphite an element in the sense in which I used it in the discussion? A. No. Graphite, though a form of carbon, is not pure C, as most specimens contain iron. Instead of graphite, you should have said carbon.

(12) A. D. B. says: I have a large barometer hanging on the wall; just under it, about 4 feet away, are the steam pipes which heat the room. As the barometer does not indicate rightly, can the steam pipes underneath have any influence on it? A. In all observations with barometers, whatever be their construction, a correction must be made for temperature. Mercury contracts and expands with different temperatures; hence its density changes, and consequently the barometric height, for this height is in the inverse ratio of the density of the mercury; so that, for different atmospheric pressures, the mercurial column might have the same height. Accordingly, in each observation, the height observed must be reduced to a determinate temperature the choice of this is quite arbitrary, but that of melting ice is always adopted. By the aid of tables, which have been prepared for this purpose, the height of the barometer is readily reduced to zero.

(13) H. W. says: I am told that a 1 inch belt running at 1,200 feet per minute will transmit 10 horse power. I am using a 4 inch belt. Am I using 4 horse power? A. There have been careful experiments made which show how much power a belt will transmit under average conditions; but it is difficult to say how much a belt does transmit, in any particular instance, without a test. See p. 207, vol. 28.

(14) E. B. asks: Does each point on the circumference of a wagon wheel, as it touches the ground, come to a perfect rest? A. Yes.

(15) T. A. J. says: In silver plating German silver spoons, the battery seems to work well; but when I come to burnish the spoons, the coating peels off. Can you tell me how to make a good job of it? A. Place the articles to be plated in strong lye water to remove all grease, and then for a moment in dilute sulphuric acid. Wash in clean water and place immediately in your bath. Care should be taken to handle the work as little as possible in placing it in the bath.

(16) C. H. M. says: We have a hand car worked by a perpendicular rod from a walking beam. Will the car run any easier with this power applied at the end near the perpendicular rod than at the other end? A. No.

(17) T. C. W. asks: Which is the coldest, ice 10 inches thick with snow on one side of it, or ice 26 inches thick, solid? A. The ice which is made from the coldest water will last the longest. 2. Does not lake ice frozen in or near Chicago last longer in a water cooler than ice frozen in Kentucky? A. Yes.

When water is boiling, can it be made hotter by having a heavy fire under it? A. No.

What is that liquid which barbers use in shampooing? A. Borax is commonly the principal ingredient of the compound.

Can a locomotive be constructed to run 75 miles an hour? A. It is doubtful whether the locomotive could be kept upon the track at such speed.

(18) F. D. B. asks: Can I make a miniature electric machine with a glass plate only 1 1/4 inches in diameter? Will it produce electric sparks in fifty (or less) rapid revolutions? A. If perfectly constructed, electrical action would undoubtedly take place, as in larger machines; but on so small a scale, we doubt much if any visible phenomena would occur. The presence of electricity might be determined by the use of a delicate electrometer.

(19) B. A. J. says: I have a wire connection between a water wheel and my house, which is 500 feet distant. Do the wires increase the danger of the house from lightning? A. Yes. You should have an extension from the wire into the ground, and the terminal should have an enlarged surface in the ground. As to your other question, try the experiment.

(20) H. H. asks: How are carbon cylinders or plates for galvanic batteries made? A. Powdered charcoal is put into a mold, then plunged into a concentrated solution of sugar, after which it is dried, and exposed to an intense heat in a covered vessel. As to your other queries, address a manufacturer.

(21) J. McC. says: I am running 4 hydraulic pumps, using luscied oil for getting on the pressure. The diameter of plunger is 1/2 inch, with 5 1/2 inch stroke. Each pump has a receiving valve and check valve. The openings in pipes are 1/2 inch, with an average length of about 10 feet. Safety valve 1 lb., lever 2 lbs., with a weight on it 30 lbs.; distance of fulcrum 1 1/2 inches; distance from center of safety valve to where the 30 lbs. weight is fastened on, 13 1/2 inches. Opening under the safety valve, 1/2 inch. The hydraulic press cylinders are 1 1/2 inches in diameter. How many lbs. pressure does it take to raise the safety valve off its seat, so as to allow the oil to escape through an opening above the seat? How many lbs. pressure are there on the 1 1/2 inches press cylinder, and how many to the square inch when the pump raises the safety valve, loaded in the above way, off its bearing? A. You do not send quite enough data; but the pressure is about 2,500 lbs. per square inch when the valve is lifted.

(22) A. P. S. asks: What publication would be of the most use in helping me to run an engine? A. We do not know of any work that will aid you very much. You will find many useful hints in Bourne's "Catechism of the Steam Engine." We may add that a person who learns to run an engine by reading a book will have to learn it over again when it comes to the actual practice. At least, this is true in the present condition of the literature of the subject.

(23) J. H. G. says: I have a lead-lined tank, the seams of which are soldered and are corroding. Please tell me what kind of varnish to use to prevent this, and also to prevent injurious effects of lead in newly lined tanks. The varnish must be insoluble in water. A. Tinning will be the best resource.

(24) W. E. B. says: In your issue of August 29, in your answer to G. T. P., you give the following formula: $A^2 = \frac{360a}{2\pi R}$ and $C = \sqrt{2R^2 - 2R^2 \cos A}$. In place of the latter, I think the following much more simple in practice: $C = 2R \sin \frac{1}{2} A$.

(25) W. M. K. says, in reply to B. H. S., who states that his steam pipe is 3 inches, and his connection from the boilers to the steam drum 3 inches in diameter: If you make your connections to the steam drum 8 inches, you will have no more trouble. It will equalize the pressure in the three boilers. [We believe that the best way to fix the boilers is as we have already indicated: Arrange them so that the water cannot be forced from one into the other.—Eds.]

(26) H. L. M. says, in answer to I. S. N., who asked how to straighten a rifle barrel: Take two pieces of hard wood, one about 30 inches long and thick enough to stand the pressure required. Take off about half an inch of the thickness in the middle, leaving it full on the ends. Put your rifle barrel with its hollow side against it. Then take the other piece of wood, 3 or 4 inches long and about 1/2 inch thick, and put it on the other (the round) side of the barrel, and then put the whole in a strong vise, and screw up till the barrel is straight.

(27) C. B. says, in answer to T. S. S. who asked as to wooden linings to locomotive drive wheel tyres: Locomotive drivers do sometimes have linings of wood beneath the tyres. According to a recent method the wheel is cast with a number of projections, like teeth, distributed at short and regular intervals on the periphery. Into the spaces between these teeth are driven blocks of wood somewhat thicker than the length of the teeth, and over these blocks the tyre is shrunk on.

(28) A. McQ. says, in reply to G. W. S., who asks if there is any device for taking steam out of a boiler by a tube, and conveying it under the grates of the fireplace to keep the fire down when the engine is stopped: In some steam fire engines, a small tube from the upper part of the boiler conveys steam and discharges it over the top of the flues for the purpose of checking or extinguishing (as the case may be) the fire in the fire box.

(29) J. A. M. says: To soften the tone of a violin, string it up to the required pitch; take a small gum elastic band, and make it fast to one side of the violin

bridge; then stretch it over the strings close to the bridge, carrying it down to one of the notches on the other side, and make it fast there. The tension of this small band, being supported by the strings, produces almost the effect of the common mute, with the difference that the power of the tone is preserved in its full purity, while it seems that this small band absorbs all that harsh noise which is more the result of friction than any musical quality contained in the instrument. I have tried this effectually on all the different sizes of instruments, from the smallest down to the double bass, and I find that the effect is very pleasing, and would, I think, by good players on any of the instruments, be pronounced beautiful. The tone may be gradually diminished by the use of additional bands, without lessening its real purity.

(30) A. C. H. says, in reply to F., who asked if there was such a flower as the thousand dollar plant: There is a plant called the thousand golden (not dollar) plant; it grows in Switzerland, and is used to a great extent in medicine. The botanical name is *erythron canadense*. It has red or white flowers, and is about 1 or 2 feet high.

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

B. B.—It is iron pyrites, of no value.—S. R.—If you wish to know the value of an ore, you must send the ore, not the reduced metal. The specimens sent are reduced since.—H. V.—It is granular sulphide of iron.—W. H.—It is an iron ore, containing a large percentage of silica and sulphur, and a small percentage of manganese. It contains none of the precious metals.—R. W. B.—They are grasshoppers (Packard) or *caloptenus apterus*. Mr. Scudder states that a third (whether belonging to the same species or not is still uncertain), has invaded at different times nearly all the country lying within the boundaries of the United States between the Rocky Mountains and the Pacific Ocean. The smallest one sent by you is probably the one referred to by Mr. Scudder.—J. W.—They are rings from the fossil stems of various species of *crinoids*.—J. H. S.—It is a hard sandstone, inclosing scales of sulphide of iron.—T. J. R.—No. 1 is a siliceous rock, inclosing fine particles of iron pyrites. No. 2 is a small and regular crystal of quartz.—A. F. M. A.—The acorn-shaped mineral is a deposit of sulphide of iron. Your well water must contain a large percentage of iron.—A. J. H.—It is laumontite, or a hydrous silicate of alumina and lime.—C. H. W. & Co.—It is a very rich quality of iron pyrites.—D. B. B.—It is a coarse quartzose sandstone, utterly unfit for a fertilizer.—A. V. V.—Ten of your specimens are sulphate of lead distributed through limestone. No. 11 is sulphate of lead in quartz rock. No. 12 is iron pyrites in quartz rock.—J. W. S.—It is a special variety of white cast iron, known as *spiegelisen*. It is largely used in the manufacture of Bessemer steel.—A. H.—Magnetite is magnetic oxide of iron, of a certain crystalline form and chemical composition, containing in the purest varieties, 74 per cent of metallic iron. We regret the loss of your specimens, but must again repeat, to you and other correspondents, that we report immediately on all minerals received by us.—We have received a blue pasteboard box, 2½ inches, without any label or name. It contains many small specimens of quartz rock, through which are disseminated specks of altered muscovite, of no practical use.

P. J. K. asks: What is the best method to destroy a lot of rats that infest my house?—G. U. F. asks: Who are the best writers on ventriloquism, explaining the art in full?—W. F. B. asks: Is there any way by which a person can tell if his own breath is offensive?—A. B. asks: Can any one give me information concerning the history, past and present, of the children and grandchildren of Robert Burns, or his brother Gilbert?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Channeling the Bars of Rivers. By O. P. S.
On Locusts and Grasshoppers. By H. J. S.
On the Weight of the Atmosphere. By J. B. T.
On Sea Sickness. By W. M.
On Drawing a Parabola. By F. H. R.
On Making Copper Alloys. By A. E. O.
On Some New Galvanic Batteries. By L. B.
On a Discovery in Missouri. By C. I.
On Bees and Honey. By W. A. B.
On Practical Mechanism. By W. H.
On Small Engines. By N. T. W., and by N. G. N.
On the Locust Plague. By J. W.

Also enquiries and answers from the following:

W. H.—J. E. D.—H. V. M.—E. C. M.—J. M.—H. M.—H. F.—F. L.—W.—J. W. 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 enquiries analogous to the following are sent: "Please to inform me where I can buy sheet lead, and the price? Where can I purchase a good brick machine? Whose steam engine and boiler would you recommend? Which churn is considered the

best? Who makes the best mullage? Where can I buy the best style of windmills?" All such personal enquiries 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.]

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APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

30,655.—SEED DRILL.—H. Moore. Nov. 4.

EXTENSIONS GRANTED.

29,760.—HAMMER.—D. Boeklen.
26,785.—SEWING MACHINE.—D. Haskell.
29,789.—CULTIVATOR.—E. S. Huff.
29,790.—CATTLE TIE.—G. Hall.
29,816.—PRINTING PRESS.—J. E. Priest.

DESIGNS PATENTED.

7,634.—RUBBER OVERSHOE.—E. F. Blackford, Malden, Mass.
7,635.—CAP.—J. Harney, Brooklyn, N. Y.
7,636 to 7,646.—CARPETS.—O. Heineke, New Utrecht, N. Y.
7,647.—FUR JACKET.—M. Hillas, New York city.
7,648 to 7,661.—CARPETS.—H. Horan, East Orange, N. J.
7,662 to 7,669.—CARPETS.—L. G. Malkin, New York city.
7,670 to 7,674.—CARPETS.—E. J. Ney, Dracut, Mass.
7,675 to 7,679.—CARPETS.—H. Nordmann, New York city.
7,680.—CARPET.—G. W. Piggott, New York city.
7,681 to 7,684.—CARPETS.—W. H. Smith, Enfield, Conn.
7,685 to 7,687.—CARPETS.—J. H. Smith, Enfield, Conn.
7,688.—FLOW BRAN.—W. H. Wilder, Washington, D. C.
7,689 to 7,691.—CARPETS.—L. G. Malkin, New York city.
7,692 to 7,695.—CARPETS.—J. T. Webster, Phila., Pa.
7,706.—SPOON HANDLE.—G. Wilkinson, Providence, R. I.
7,707.—SKIRT.—J. W. Blackham, Brooklyn, N. Y.
7,708.—DRAWER PULL.—F. E. Guerin, New York city.

TRADE MARKS REGISTERED.

1,302.—BEER.—Chs. Bottled Beer Co., Cincinnati, O.
1,303.—IMPLEMENTS.—Keystone Manf. Co., Sterling, Ill.
1,304.—TOOTH CLEANER.—D. G. Strawn, Boston, Mass.
1,305.—GAS REGULATOR.—Ward & Co., St. Louis, Mo.
1,306.—WATERPROOF GARMENTS.—A. K. Young & al., Boston, Mass.
1,307 to 1,340.—WHISKIES.—Ellis Block & Sons, Chs., O.
1,341.—WIKER.—I. Bush & Co., St. Louis, Mo.
1,342.—WHISKY.—Hoffmiller Bros., Cincinnati, O.
1,343.—TIME PIPER.—F. H. Mather, West N. Brighton, N. Y.
1,344.—WHISKY.—Shields & Co., Cincinnati, O.

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 Release.....	\$30
On application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (3½ years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
AUGUST 13 TO 22, 1874.

3,738.—G. W. Harrison, Lansing, Mich., U. S. Improvements on pitman connections, called "Harrison's Pitman Connection." Aug. 13, 1874.

3,739.—T. E. Mullins, Hopewell Corner, New Brunswick. Improvements on steam cooking apparatus, called "Mullins' Improved Family Steamer and Condenser." Aug. 13, 1874.

3,740.—J. W. Herington and J. W. Stoakes, Mill Point, Ont. Improvements on horse collars, called "Herington's Improved Horse Collar." Aug. 13, 1874.

3,741.—R. Christie, Hamilton, Wentworth, Ont. Improvements on reaping and mowing machines, called "Christie's Improved Tiller and Guard for Reaping and Mowing Machines." Aug. 13, 1874.

3,742.—J. N. Miller, Bellefontaine, Ohio, U. S. Improvements on shifting seat buggies or convertible carriages, called "Miller's Convertible Buggy." Aug. 13, 1874.

3,743.—H. E. Wells, Van Wert, Ohio, U. S. Improvements on lumber drying kilns, called "Wells' Lumber Drying Kilns." Aug. 13, 1874.

3,744.—B. Teats, Central City, Colorado, U. S. Improvements on furnaces for roasting ores, called "Teats' Ore Roasting Furnace." Aug. 15, 1874.

3,745.—S. S. White, Philadelphia, Pa., U. S., assignee of N. Stow, Binghamton, N. Y., U. S. Improvements on dental engines, called "S. S. White's Dental Engine." Aug. 15, 1874.

3,746.—W. Watson and D. Watson, Somerville, Middlesex county, Mass., U. S. Improvement on friction mechanism for loose pulleys or gears, called "The Watson Pulley Friction Clutch." August 22, 1874.

3,747.—W. Abercrombie, Hamilton, Ont., assignee of R. L. Greenlee, Chicago, Cook county, Ill., U. S. Improvements in sash and door clamps, called "Greenlee's Sash, Blind, and Door Clamp." August 22, 1874.

3,748.—F. Wallace, London, Middlesex county, Ont. Improvements on machines for making matches, called "Wallace's Self Feeding and Backing Match Making Machine." August 22, 1874.

3,749.—J. Spratt, Fer Emina, St. Martin's, Guernsey Channel Islands, and now of London, England. Improvements on solidified tea, called "Spratt's Solidified Tea." August 22, 1874.

3,750.—H. Harmer, Southampton, Bence county, Ont. Improvements on the working of railway switches, called "The Safety Switch Guard." August 22, 1874.

3,751.—J. H. Cleveland, Buffalo, Erie county, N. Y., U. S. Improvements on tuckers for sewing machines, called "J. H. Cleveland's Tucker." August 22, 1874.

3,752.—C. F. Gardner, London, England, and E. Pocock Paris, France. Improvements on machines for lasting the uppers of boots and shoes, called "Gardner & Pocock's Boot and Shoe Laster." August 22, 1874.

3,753.—G. S. Lacy, New York city, U. S., and U. C. Allen Glen's Falls, Warren county, N. Y., U. S., assignees of A. C. Crondal, New York city, U. S. Improvements in gas regulators, called "Crondal's Improved Gas Regulator." August 22, 1874.

3,754.—H. Beauchamp, Montreal, Montreal Dist., P. Q. Améliorations aux machines à laver, dite "La Laveuse à Valve de Puissance." August 22, 1874.

3,755.—W. Franz, Bucyrus, Crawford county, O., U. S., & W. Pope, Crestline, Crawford county, O., U. S. Improvements on knitting machines, called "Franz & Pope's Improved Automatic Knitting Machine." August 22, 1874.

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