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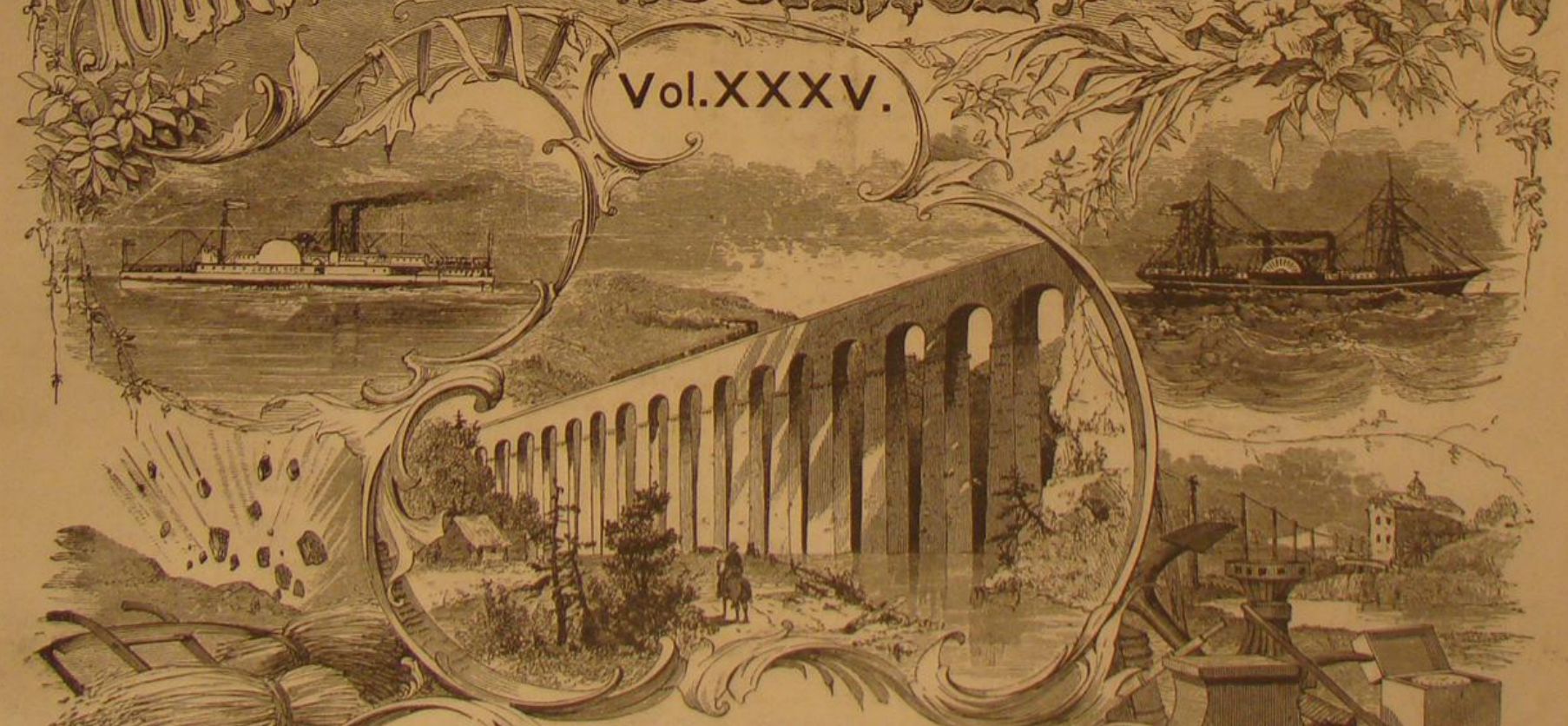
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NEW YORK, JULY 1, 1876.

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A SINGULAR COLLISION.

The engraving on this page, selected from the pages of the *Railroad Gazette*, was made from a photograph taken on the spot, and is therefore a correct representation of the scene. It has been stated that the managers of the road on which the accident occurred paid a large sum of money for the negative, with a view to prevent the circulation of copies and publication of the picture; but one copy at least escaped their vigilance, and the result is before our readers. Our contemporary, like ourselves, is unaware of the locality of the accident, all particulars having been carefully kept from the public; but the C 3443 on the stock car may be a clue as to the rolling stock composing one of the trains, although the interchange of railway cars is so frequent as to make it difficult to determine on which line such an accident actually occurred. The trains were certainly not passenger trains, as both engines are freight locomotives; and if happily no one was killed or injured, the railroad authorities might be able to conceal from the public the singular catastrophe.

Of the violence of the collision, there can be no doubt; and it doubtless occurred on a straight piece of line, or one or both of the engines would have been thrown from the track laterally. The interlocking of the driving wheels, the rupture of the side bars, the complete and clean division of one cylinder longitudinally (leaving one half attached to the cylinder head in which the piston rod is at rest), together with the upheaval of probably 60 tons dead weight, show the tremendous force with which the leviathans must have met, and the speed at which they must have been running, to

cause such utter destruction when they were suddenly brought to rest. Perhaps some of our readers will give further details of the occurrence, and tell us on what road it happened.

THE GALLAHUE ROTARY ENGINE.

We have recently had occasion to examine the operation of a new rotary engine devised by Mr. A. C. Gallahue, applied to the propulsion of a launch some thirty feet in length. The construction of the machine, briefly described, includes two hollow cylinders whose surfaces run in contact with each other, and the shafts of which are connected by exterior gear wheels. In the peripheries of these cylinders are pistons (two in each cylinder) which are set out against the side of the shell by interior bolts and nuts. To these last the steam has no access. In each cylinder, at the extremities of the diameter, perpendicular to that joining the pistons, are made transverse grooves, so that in passing the point of tangency the piston of cylinder No. 1 enters the groove in cylinder No. 2, and vice versa. It will be observed that there are no sliding abutments, and that the points where wear may be expected are at the edges of the pistons and at the ends of the cylinder. In the first instance, said edges are hardened, and the wear is taken up by leaf springs, inside the cylinders, provided with set screws. At one end the cylinders abut directly against the head. Between their other ends and the opposite head are placed two disks, between which is fibrous packing. Set screws, passing through the head, act on the outer disk, so

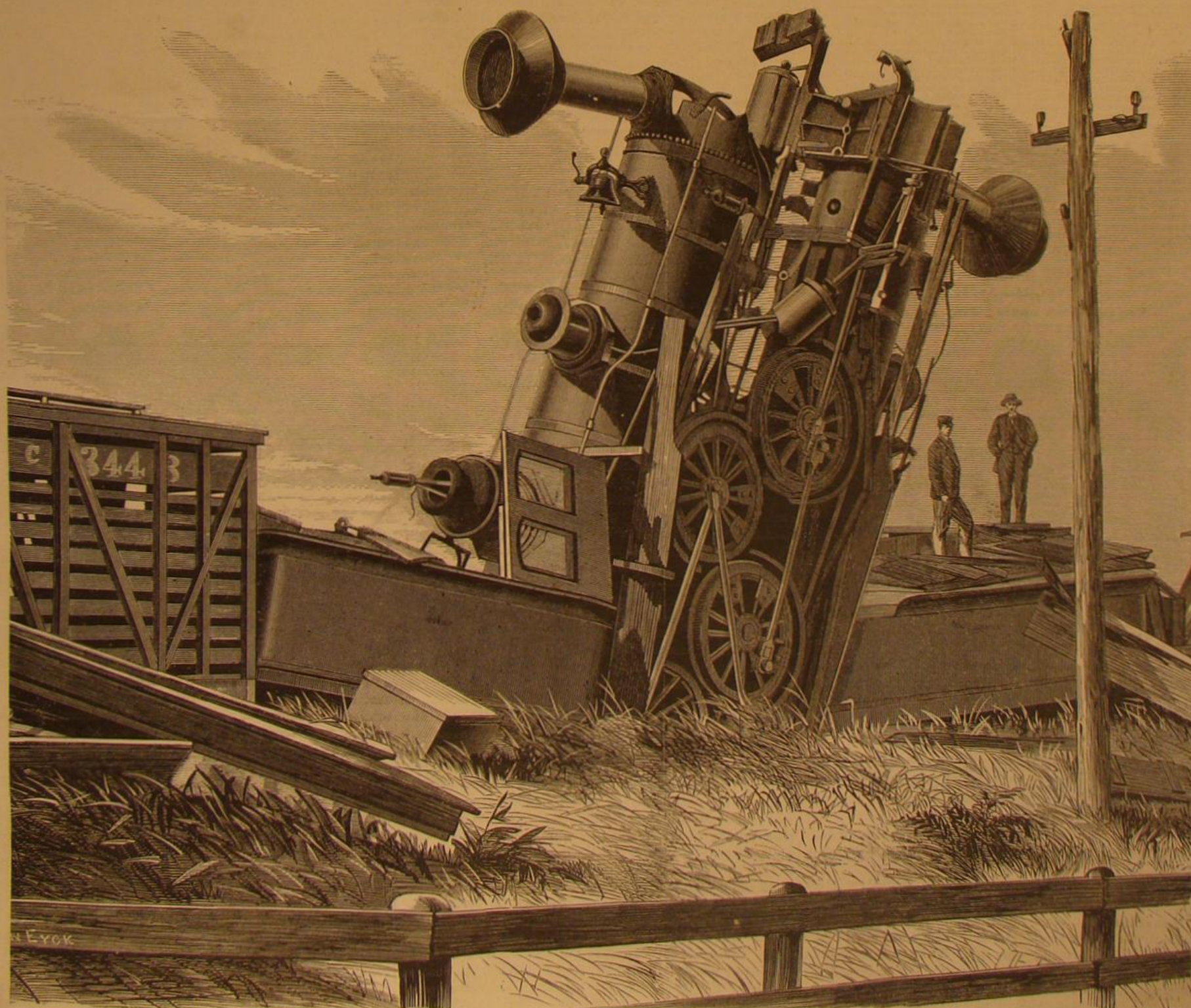
that, by setting these up as becomes necessary, a tight fit ensues.

Making 180 revolutions at 80 lbs. of steam, the inventor rates the engine we saw—which occupies a floor space of but 18 inches square, and has a piston area of 15 square inches—at 12 horse power. We can state that the machinery worked smoothly and without jar or pound, and that, whether standing still or working, there was no evidence of steam being wasted by blowing through. The exhaust was clearly and sharply apparent, and the manipulation of the engine, whether reversing, going ahead, or holding, was effected with facility.

The inventor informs us that in smooth water a speed of over twelve miles an hour has been maintained. Under proper conditions, we think that the engine would be found well suited for boat propulsion, as well as wherever light power is required. For further particulars the reader may address Messrs. A. C. Gallahue & Co., Morrisania Station, New York city. For prices, see advertisement on another column of this issue.

Selenium Experiments.

R. J. Moss has discovered that, when a bar of selenium is placed in the exhaust tube of a Sprengel pump and the air exhausted, the selenium becomes electrically conductive in the course of ninety hours. The selenium is then found to be covered with a delicate film of mercury, from the globule contained in the pump; and the conductivity is ascribed to this film.



A REMARKABLE RAILWAY ACCIDENT

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Contents.

(Illustrated articles are marked with an asterisk.)

Alloy for models (37).....	12	Lily culture.....	7
Answers to correspondents.....	11	Locust pest, the.....	9
Aquarium in New York city.....	5	Locusts, the.....	9
Belgian centennial exhibit, the.....	5	Mercury, expansion of (1).....	11
Birdseye view, a (23).....	11	Moon and the ecliptic, the (26).....	11
Bleaching oils (9).....	11	Moon, apparent size of the (23).....	11
Bleaching steels (15).....	11	Mustard, fermenting (10).....	11
Boiler furnace for slack, etc. (35).....	11	Naphtha, benzine, and gasoline.....	7
Boiler furnace, hot blast.....	11	New books and publications.....	9
Boilers for small engines (39).....	11	Patent decisions, recent.....	9
Boilers, pressure in (27).....	11	Patents, American and foreign.....	10
Bronze on copper and brass.....	11	Patents, official list of.....	10
Business and personal.....	11	Permanganate of potassa (25).....	11
Car bridge, railroad.....	11	Poles of the earth (25).....	11
Casks, filling pores of (14).....	11	Potato bug, the.....	11
Centennial exposition, the.....	11	Power, force, and speed (29).....	11
Centennial, scenes at the.....	4	Pressure in oil wells (31).....	11
Civil engineer's convention.....	11	Pressure in tin vessels (30).....	11
Coffee as a deodorizer.....	11	Railway accident, remarkable.....	11
Collisions, a singular.....	11	Red calcium light (7).....	11
Cultivator, a novel.....	11	Ropes, fireproof (18).....	11
Diamonds, cleaning (31).....	11	Sawing steel bars, etc. (16).....	11
Drill chuck, improved.....	11	Scientific relics, historical.....	7
Dyeing with artificial alizarin.....	6	Scorpions of Egypt, the.....	7
Earth's heat, the.....	2	Selenium experiments.....	6
Emery wheels, speed of (37).....	11	Sewing on buttons, device for.....	1
Engines, dead centers of (16).....	11	Silk, cleaning.....	7
Engines, horse power of (17).....	11	Soda water (15).....	11
Farmer's foes, the.....	9	Spontaneous combustion.....	11
Fence stakes on a hill (8).....	11	Steam in a pipe (25).....	11
Fishes, cleaning (27).....	11	Steam jackets on cylinders (31).....	11
Fishes, nest-building.....	7	Stove makers, Canadian.....	3
Furnace radiation (34).....	11	Sulphate of potassa, new.....	6
Gas burner, self-regulating.....	11	Surface plates, making.....	8
Ginger ale, Belfast.....	11	Telegraph sounder wire (22).....	11
Grease from hats, removing.....	7	Testimonial, a misapplied.....	3
Gunpowder as a motor (1).....	11	Ventilation, window.....	12
Ice ponds, look to your.....	4	Water, power of (35).....	12
Iron, fiber in puddled.....	11	Wire, iron and steel.....	3
Iron vessels, strength of (12).....	11	Wood, bending (36).....	12
Japan at the centennial.....	11	Wooden water pipes (32).....	12
Kerosene and galvanized iron.....	11	Working men's homes.....	2
Lightning rods (24).....	11		

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 1.

For the Week ending July 1, 1870.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876. With 9 illustrations. —Interior of the Women's Pavilion. 1 engraving.—Gold Rolled Shafting.—Gould Fire Engine, 4 cuts.—Langen and Otto Gas Engine, 4 engravings.—Architecture of Main Building.—First Engine in America.—Phosphor Bronze.—English Iron and Steel Exhibits.—Steam Engine Exhibits.—Shapley, Hoadley, Williamson, Griffiths and Wedge, N. Y. safety Steam Power Co., Fleming & Son, Fleck, Goldie & McCulloch, Brook.—The U. S. Department.—Brazilian silkworms and silks.—The Krupp Gun and other Krupp Exhibits.—Woodworking Machinery.—Armstrong Piston.—Paper-Making Machinery.—Wire Rope.—Saw Sharpener.—Improved Loom.
II. ENGINEERING AND MECHANICS. 9 engravings.—Crank Shaft of U. S. Trenton, 2 figures.—American Steel Tires.—New Alpine Tunnel.—Bursting of a Fly Wheel.—Convention of American Society of Civil Engineers.—Centennial History of Engineering.—Railroads of the World.—Express Engines.—Midland Railway. 2 large engravings.—The Steam Locomotive.—Water Supply for Towns and Villages, by C. D. A. FIELD, C. E.—Raising the Vanguard.—New Ice Machine.—The Collins screw Propeller, 3 figures.—Water Supply, Sycamore, Ill., 1 figure.—New Tide Power, 1 figure.
III. ELECTRICITY, LIGHT, HEAT, ETC.—Electric Transmission without Wires.—Discovery of Gallium, 19 figures.—New Rays of Calcium.—Studies of Matter and Life, by Professor H. J. SLACK: Modes of Motion, Ether of Space, Wave Forces, Limits of Vision, Size, Motion, and Force of Atoms, Phenomena of Reproduction, Mental Phenomena.—Nature of Thermo-Electricity.—Facsimile Telegraphy.—Electric Light.
IV. CHEMISTRY AND METALLURGY.—Osmium.—Native Platinum.—Isobutyl Acid.—Crystallization of Meteoric Waters, 3 figures.
V. AGRICULTURE AND MISCELLANEOUS. 2 engravings.—The Chinese in America.—Turner's Prize.—Fly Wheel Dangers.—The Kentucky Shower of Fish.—Disposing of Raw Manure.—Dublin Spring Cattle Show.—Prize Northrop's, 5 engravings.—Large Poultry Yard.—The Opossum.—Mexican Alabaster.

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NEW INVESTIGATIONS ON THE EARTH'S HEAT.

The theory ordinarily accepted as accounting for the creation and present condition of the earth is based on nebular hypothesis, and assumes that the globe, at one time gaseous, subsequently became molten, and is in that state now, with the exception of a comparatively thin crust, estimated to be about to be about 60 miles in thickness. Our knowledge of the interior condition of the earth, however, is mainly speculative; and the strongest support to the above theory is met with in the increase of temperature noted on descending into mines and like excavations. This increase is estimated to be about 100° per mile; so that, supposing it to continue through a distance of but 100 miles, or $\frac{1}{3}$ part of the earth's radius, a temperature of no less than 10,000° Fah. must exist at that depth below us. Such a temperature would liquefy all solid substances with which we are acquainted, and vaporize many solid elements. On the other hand, it may be questioned whether the effect of the immense pressure on the earth's interior, due to the action of the imprisoned vapors and to the superincumbent weight, must not suffice to remove the limits of the solid crust far below the above estimate; so that liquefaction may begin only at a distance of several hundred miles from the surface, and there may be still sufficient viscosity in a large part of the remaining interior portion to prevent free movement of the liquid nucleus.

We have said that our knowledge is but speculative, and its principal confirmation is found in the fact that, wherever excavations have been made, the increase of temperature noted is met with. From this, however, it follows that, if the interior of the globe is in a state of fusion, the relative distances necessary to descend in order to produce like augmentations of heat must be comparatively less as the center of the earth is approached. The heat coming from the interior, transmits itself by conduction while traversing spheres more and more vast; and supposing the conductivity of the mass to be uniform, the temperature of the exterior, layers of the globe should diminish in proportion as their volume augments.

Recent investigations by Professor Mohr, of Bonn, at the deepest well in the world, have adduced results altogether at variance with the preconceived estimates referred to above, and which, if hereafter substantiated in other localities, will tend to throw grave doubts on the igneous theory of the earth. The well in question is located at Sperenberg, near Berlin, Prussia, and has been sunk to a depth of 4,000 feet. The thermometric record is as follows:

Depth	Thermometer (Réaumur)	Increase per 100 feet
700 feet	15.654°	
900 "	17.849°	1.097°
1,100 "	19.943°	1.047°
1,300 "	21.939°	0.997°
1,500 "	23.830°	0.946°
1,700 "	25.823°	0.896°
1,900 "	27.315°	0.846°
2,100 "	28.906°	0.795°
3,390 "	36.756°	0.608°

The third column decreases in arithmetical proportion, showing for each descent of 100 feet equal differences of 0.050° or $\frac{1}{20}$ ° Réaumur, equal to 0.11° Fah. Applying this ratio to the depths below 700 feet, and between 2,100 and 3,390 feet, Professor Mohr forms a table as follows:

Depth	Increase per 100 feet	Depth	Increase per 100 feet
100 to 200 feet	1.35°	1,500 to 1,700	0.896°
200 " 300 "	1.30°	1,700 " 1,900	0.846°
300 " 400 "	1.25°	1,900 " 2,100	0.795°
400 " 500 "	1.20°	2,100 " 2,300	0.745°
500 " 600 "	1.15°	2,300 " 2,500	0.695°
600 " 700 "	1.10°	2,500 " 2,700	0.645°
700 " 900 "	1.097°	2,700 " 2,900	0.595°
900 " 1,100 "	1.047°	2,900 " 3,100	0.545°
1,100 " 1,300 "	0.997°	3,100 " 3,300	0.495°
1,300 " 1,500 "	0.946°	3,300 " 3,390	0.445°

Continuing this, the author finally determines that, at a depth of 5,170 feet, there will be no further increase of temperature, and that the heat indicated at that distance will be true to the center of the earth. Obviously also this temperature will not very greatly exceed that marked by the thermometer at 3,390 feet, or 35.756° Réaumur, equaling 114.701° Fah.; so that, according to these observations, the highest internal heat of the globe falls below that of boiling water.

WORKING MEN'S HOMES.—SIR SYDNEY WATERLOW'S LONDON ENTERPRISE.

The problem of providing healthy and comfortable homes for the working classes is one with which students of social science have largely dealt in Europe, and one which, ere very long, must in this country demand earnest and thoughtful consideration. It is an undeniable fact that, so long as working men are compelled to live in the vicinity of squalor or filth, or are crowded into tenements where every sanitary precaution is neglected, their condition, both moral and physical, must suffer; and the legitimate result is the injury and depreciation of the class in whose well-being the prosperity of the community in great measure depends. For economical reasons, if none other, society cannot afford this undermining of its foundation; and hence it follows that, philanthropy aside, it is to the interest of all to keep the subject agitated until some amelioration of the present state of affairs is accomplished.

Relief from the overcrowded tenement is, perhaps, nowhere more needed than in New York. Rapid transit, when gained, will do much towards improving matters by opening cheap homes in the suburbs; but even then an immense number of people will still be obliged to live in the heart of the city. For them, and for their brethren in other populous localities, as well as for working men in factory towns, improved homes are urgently needed; and until the same are

provided, the epidemics which yearly afflict the denizens of tenements, and are due most frequently to foul and impure air, may be expected. Nor can we hope to materially decrease the number of the intemperate so long as the attractions of the bar room are set off against cheerless and comfortless homes.

There are two ways of accomplishing the required end, namely, either the workmen may coöperate or capitalists can promote the matter as an investment. Both plans have been successfully tried in England. It is certain that to wait for philanthropy to do the work is not wise. On one hand, philanthropists like George Peabody, or Peter Cooper, or Baroness Coutts are few and far between; and on the other, a majority of working men possess a feeling of independence to which the notion of accepting any benefit savoring of charity is especially repellent. Experience has shown that the working man will prefer poor and even unhealthy quarters to the best accommodations, so long as the latter savor of the almshouse in disguise. While such schemes are necessarily based on philanthropy, that fact is best kept in the background, and the project should be put on a dollars and cents basis, which precludes the idea of obligation.

Now as to the two practical ways: The practice of coöperation has been a favorite one among English working men for many years, and it has worked marvelous results. It is based on the sound policy of cash payments, and dividing the profits of trade among members. Land and building societies are two of its forms. A working man desiring a house joins a society, who effect the lease for him. Instead of paying his landlord, he pays a certain subscription and interest to the society; and when his subscriptions are paid up, the association buys the house and conveys it to him. Those who do not purchase houses receive a dividend and bonus on their shares. The Permanent Building Society, of Leeds, England, has furnished healthy tenements for about two hundred families. There are also towns and villages in Lancashire where very large sums have been saved. In Burnley, the Building Society, of 6,600 investors, in one year saved \$800,000. This society has assisted in hundreds of cases by advancing money on mortgages, which are repaid by easy instalments. It will be seen that these societies aid men to keep themselves by saving money to buy their own homes; and when it is considered that no such wages, even proportionately to cost of living, are paid in England as American workmen receive, the results show wonderfully the advantage of the habits of thrift thus promoted.

Passing to the second plan, this is also divisible. It may be carried out by individual employers for the benefit of their employees, or by corporations for the benefit of the whole working class in general. The former would be the course in manufacturing villages and towns, the latter in great cities like New York. We can best exemplify the working of both by example. In South Lancashire, the cotton spinning mills of the Messrs. Ashworth have been in operation for some seventy years. Owning a large tract in the vicinity, the proprietors have built complete villages. The cottages are of stone, two stories, and very comfortably arranged. The rentals are at fair prices. The men are paid regularly, and they in turn as regularly pay their rent. Schools are provided. In a word, so well organized and controlled is the great establishment that crime and misery are practically unknown. Drinking shops are abolished, there has never been a case of theft in the place, and great numbers of the men have become owners of their own houses. At Saltaire, where the vast wool-spinning works of Sir Titus Salt are located, 756 houses are rented by the work people. Each house is separate in all its appointments, has every sanitary convenience, and the rent is within the operative's means. There are no drinking houses; but in their place are public laundries, baths of all kinds, libraries, schools, reading rooms, and, in fact, Saltaire is as near Utopia as the most enthusiastic social reformer might hope.

So much for single-handed work. Great as are its results, they are exceeded by those achieved by the Industrial Dwellings Company in London. Here is a corporation based on a philanthropic foundation, but conducted on business principles, which render its working a model for future emulation. Some fourteen years ago Sir Sydney H. Waterlow (who, by the way, is now in this country, serving as chairman of the English jury on the Paper and Stationery Department of the Centennial, and to whom we are indebted for the following facts) erected at his own expense a block of dwellings in the heart of London, provided them with every convenience, and rented them to about 80 families at sums sufficient to yield a fair return on the outlay. So satisfactory were the results that a company was formed, with a capital of \$250,000, to erect more buildings on a similar plan. The capital has from time to time been increased, and at present the total resources are about \$5,000,000. The income is 11 per cent on the cost of the property; and for the past five years, there has been a large surplus profit after paying 5 per cent dividends. There are now 1,596 tenements in occupation, accommodating 6,750 people; others are in progress, and the present capital will provide 2,799 tenements, to accommodate 12,115 people.

The buildings are of brick, ornamented with copings of artificial stone, made on the spot by the company, from Portland cement and coke breeze. This is easily and cheaply molded into tasteful forms, and is remarkably durable. The tenements, which are entirely separate, contain from two to four or five rooms; and every one, whether large or small, contains a compact little kitchen fitted with a range, boiler, clothes chest, and sink, and is provided with an abundance of water. The closets are detached from the tenements, and are separately ventilated. There is also a neat contrivance

for dust, which is thrown down a shaft to a receptacle in the cellar, whence it is removed. The height of the rooms averages 8 feet 6 inches, and the superficial area about 130 feet. The rent averages 50 cents per week per room. A suite of five rooms costs \$5.75. In other words, for about the same or a little less money than it costs in this city to hire a floor in a rookery, or in a building in which, in nine cases out of ten, sanitary laws are ignored, the working man may obtain a pleasant, comfortable home: better, it appears, in many respects than the French flats which rent here at from \$500 to \$750 per year, for a suite of rooms.

The effect of the above project has been a marked improvement in the moral, physical, and social condition of the working people who have availed themselves of the advantages offered, and a greatly diminished sick and death rate, as compared with London generally. It also has served to show how a work of genuine philanthropy and charity may be accomplished without impairing the self-respect of the beneficiaries, and may at the same time, afford a fair interest to the investor.

THE FARMER'S FOES.

The terrible pests which have wrought such ruin on the agriculture of whole districts of this country have appeared; and they have commenced their detestable industry with undiminished vigor. A correspondent in Iowa says: "Potato bugs are more numerous this year than they were last;" one in New Jersey reports: "Our State is particularly infested with potato bugs;" and similar accounts from Pennsylvania, Virginia, New York, and Massachusetts have been published in the columns of our contemporaries.

Professor Riley, State entomologist of Missouri, in his valuable report for 1875, states that, although the beetles were very numerous last spring, they became comparatively scarce and harmless, and did not become multiplied till the third brood had developed, by which time the crop was sufficiently matured to be out of danger. He reports that a beetle (*Lebia atriventris*, black-bellied lebia), half an inch long, has been seen to destroy the potato beetles in Maryland, and the common crow has been observed to devour them, and even to dig them out of the ground whither they had retired to hibernate.

Among artificial remedies and preventives, Paris green seems to maintain its lead, and some new facts as to its use have recently been published. The poison can be cheaply manufactured as follows, but much danger will be avoided and trouble saved by buying it already prepared of dealers. Dissolve 2 lbs. sulphate of copper in 1 gallon hot water, in a stone jar. In another jar put 1 lb. white arsenic and 2 lbs. pearlash in 44 lbs. hot water, and stir till dissolved. Mix when needed in the proportion of 1 part of the former to 5 of the latter. Use with a sprinkler. Professor Riley states that the potatoes themselves show no trace of injury from arsenical poisoning; and he quotes Professor Kedzie to the effect that the soil is uninjured by the use of Paris green. Even water from the soil will not become poisonous unless the Paris green is used in excess of the requirements of insecticidal purposes.

The locusts are now commencing business, and giving, by their numbers and activity, some indication of the prospects of the season. Our readers are familiar with the doleful history of this plague, and of the devastation of large sections of Kansas, Missouri, Iowa, Nebraska, and other States by it. Professor Riley's observation of the nature and habits of the locust is laborious and careful; but the remedies yet discovered seem to be much out of proportion to the extent of the disaster. Destroying the eggs by shallow plowing, burning the unfledged young, cutting off the march of the adult insects by digging ditches, catching them in nets and seines, and burning sulphur seem to be useless against foes which occupy the land, not by counties merely, but by whole States, and which are as the snowflakes for multitude, and multiply with great rapidity. "Every bushel of locust eggs destroyed is equivalent to 100 acres of corn saved," says Professor Riley. The encouragement of game birds and sparrows is recommended, and the distinguished scientist believes that this will be found to be one of the best means of checking the increase of the species; but he justly adds that national means of averting the evil must be used, if anything can be done at all. To this end, our legislators may well address themselves; and the diffusion of sound practical knowledge on this subject is a work which Congress might take up in perfect assurance that it could not be more usefully employed.

A MISAPPLIED TESTIMONIAL.

One of those erratic geniuses with which every editor is more or less familiar, through his persistent seeking to ventilate absurd theories in our public journals, recently advertised a lecture in this city, on "Magic Reciprocals, a Mathematical Revolution." The announcement in the daily newspapers stated that the discourse was to be given at the request of a number of our best known citizens, headed by Mr. Peter Cooper and Mr. William Cullen Bryant; and at the door of the hall, a printed copy of the very flattering invitation, with signatures appended, was handed to every comer. While it is, of course, possible to doubt the authenticity of the document, the fact nevertheless remains that the statement that the lecture was asked for by these gentlemen was paraded in the papers repeatedly without eliciting contradiction from them. The result was that a goodly audience, including several scientific men, gathered to hear about the supposed discovery. Instead, they listened to a jumble of utterly absurd mathematical assumptions and misstatements, mixed with metaphysics and a notion of the

Darwinian theory apparently imbibed from some misinformed religious newspaper. The gist of the theory was the assertion that a point is the reciprocal of a straight line; supported by not a shadow of logical reasoning, but by a series of elaborate drawings in colored inks of right lines, forming figures somewhat analogous to the multifarious curves produced by the geometrical chuck used in engraving bank note plates.

While no one can dispute the right of anybody to believe and to promulgate any mathematical nonsense that may please him, many, we think, will, like ourselves, regret the support, tacit or open, perhaps unwittingly, afforded by the signers of the invitation. If these gentlemen did append their names, they have simply asked public confidence in a theory which a moment's examination must have shown them was ridiculous; if they did not, then a word of contradiction from any of them would have exhibited matters in their true light. Some of these gentlemen, who have done valuable service toward the spread of scientific knowledge, will, we think, agree with us in the view that their countenance of such proceedings, whatever their private opinion may be regarding the inventor, is to be deplored, since it tends to bring the cause of Science into disrepute through conveying to people the idea that false and unfounded theories have been regarded by the learned as of genuine scientific importance. At the same time, the effect also is to place the charlatan or visionary enthusiast on a level, in the minds of many, with those eminent scholars who have aided so greatly to disseminate useful information through the medium of the popular scientific lecture. It would be better if the indiscriminate giving of laudatory testimonials could be confined where the practice belongs, among the vendors of quack nostrums. Nothing is more certain than that, as regards mechanical inventions, reports of actual results through use alone are valuable; while true scientific discovery speaks for itself, and is superior to any one's opinion.

THE CENTENNIAL EXPOSITION.

A material change in the programme of the agricultural display has been made through the decision of the authorities that there shall be no competitive field trials of farm implements. As these trials have been announced in the prospectuses of the Exposition for the past two years, and as many exhibitors have made special preparations to undergo the tests, it certainly seems rather late in the day to abandon them now. The reason given is that such experiments, while they may demonstrate the excellent working of the apparatus, afford no idea of relative durability, a very important consideration to the user. It should be understood, however, that only the competition is ruled out. An exhibition of threshers and separators in operation at Schenck's Station, fourteen miles from Philadelphia, is now in progress, and on June 26 grass was to be cut, and on July 5 the wheat will be ready for reaping.

The attendance at the Exposition has been large latterly, and sufficient, if maintained, to secure its financial success. An unfortunate dissension arose a short time ago (but no longer exists, as we are informed), between the Centennial Commission and the Board of Finance, involving a conflict of the authorities, mainly regarding financial matters. Both boards have done good service, and it is greatly to be hoped that the organization and management may not devote to useless disputes the energy which has thus far contributed so greatly to the success of the enterprise.

THE BELGIAN EXHIBIT

in Machinery Hall is well calculated to excite general surprise at its extent when the small size of the country is considered, but is not, on the whole, to be wondered at when we recall the rapid progress in every industrial pursuit made by the Belgian people. A pair of Corliss engines built by P. Van Den Kerchere, of Ghent, are remarkable for admirable design and workmanship, and are considered by many engineers to be in some respects superior to the great Corliss machine itself. The largest apparatus exhibited is one for boring and tubing mine shafts and wells below the water level. Special interest attaches to the various railway exhibits, as the railroads of the country are among its largest sources of revenue. The different specimens of rails exhibited are of an improved pattern, and some are so arranged as to do away with the wooden sleepers common in this country. There are also new varieties of the street car rails, and new designs for holding such tracks in place. Next comes a large number of different sized railway buffers and springs, made of forged iron and used on railway cars to deaden the force of concussion. There are also numerous specimens of car couplings and wheels. Among the general machinery are two spinning machines with specimens of products, and a lift and force pump having a continuous piston motion, raising water to any height. There are, besides, specimens of connecting rods for engines, the process of bellied turning, an interesting model of a system of machinery for the utilization of greasy waste, from railroads, from suds of wool scouring, residue of palm oil, etc.

JAPAN

We have already alluded in some detail to the fine Japanese display in the Main Building. The agricultural exhibit bears the same marks of completeness and admirable selection. All the various process of silk culture, from the hatching of the eggs to the production of the silk, are fully explained by models, charts, etc., from the government office for experimental silkworm breeding at Tokio. Here are shown the large hampers made of bamboo and used in carrying the mulberry leaves from the field to the place of rearing; also the boxes used for keeping the leaves fresh for two or three days for the young worms. Then come the

bamboo baskets for separating the parts of leaves of different weight, and the knives used in cutting them from the branches, together with the chopsticks for handling the worms, as the perspiration from the fingers is considered injurious to them. A very fine series of mulberry leaves and modes shows the process of cultivation in different soils; also specimens of insects injurious to the trees are also exhibited. In fine, the visitor has only to use his eyes to learn an immense amount of interesting information regarding the great silk industry of the Japanese empire.

Tea culture is illustrated by diagrams, showing modes of cultivation of the plant and specimens of the teas, together with examples of the method of packing. The manner in which the Japanese woods are displayed is especially good. Each particular variety, of the hundred or more exhibited, is shown both dressed and in a rough state, and beside it are placed portions of the bark and a few leaves from the tree. Each specimen is distinctly labeled with its name, an improvement which would greatly facilitate inspection if it could be carried out through all departments of the Exposition.

If any one is curious to know something of Japanese food, he will find displays of cured fish and hams, pickled fruits, sauces, and bottles of mineral waters. Some of the sauces which take the place of the omnipresent Worcestershire or catsup are produced from a variety of curious ingredients. Soy is made of fermented wheat and beans mixed with table salt; another, called nagaoka, is made of clean pounded barley, wheat, and soja hispida (a kind of bean), malted, with salt. These substances are brewed together, kept for about three years, and are then ready for use.

Bamboo is so extensively used in Japan that the large extent of the exhibit might well have been expected. From high poles, thick enough to form supports to a house and 20 feet in length, down to the most delicate wicker work and nets, the useful reed is presented in every conceivable form. A separate section is devoted to the display of shells, skins of fishes, horns, and feathers of various kinds; another is filled with barks and dye stuffs, another with a beautifully arranged collection of cereals. In fact, the Japanese display is surpassingly good; and if the visitor undertakes to study the resources of any one country as evidenced in the Centennial, he can devote himself to the examination of none with more pleasure and profit than to those of Japan.

IRON AND STEEL WIRE.

The visitor need not expect to find all the metal exhibits in Machinery Hall, although presumably this department is the proper place for them. Some of the finest are in the Main Building. The Washburn and Moen Wire Works, of Worcester, have erected a huge column 12 feet high, built of coils of clean new wire, each coil being of immense length. One shown to us weighs 525 lbs., and is over a mile long, and is made from American pig iron without weld or joint. The same concern exhibit ramrod wire in great bunches, a column of glistening broom wire, scores of coils of pin wire, steel furniture wire, belt hook wire, telegraph wire, clothes line wire, and whole heaps of wire for general purposes. Certainly few can realize to how many different ends wire is applied. Here, for example, is the fine steel material used in pianos, another variety for making wire gauze window screens, and a new invention for tying hay bales in lieu of the wooden withes now employed.

A magnificent specimen of forging is exhibited by Phillips, Nimick & Co., of Pittsburgh. Interspersed with saws and saw steel of all shapes, tastefully arranged upon the walls, are immense bars of iron, bent cold into knots as if by the hand of some giant. There are a great wrought iron expansion joint for water pipe, rolled in two half circles and welded so as to resist a tremendous pressure, Sligo Special, or SS, plates that have withstood pressures of 77,000 lbs. per square inch, and the Sligo fire box, 106 inches in diameter, having 64,000 lbs. tensile strength. Near by, in the display of Hussey, Wells & Co., of Pittsburgh, is a homogeneous crucible steel boiler plate of 76,000 lbs. tensile strength. Beside it is an axle which has had five blows alternately, first on one side and then on the other, by a drop hammer weighing 1,600 lbs., falling 25 feet. The metal is bent slightly, but not broken.

Stove Making in Canada.

The American Stove Manufacturers' Union held a meeting in Philadelphia on June 15 last, and the first business attended to was the appointment of a committee on patent laws. The subject of patent protection has recently been brought before the notice of the Union by the alleged piracy of American designs by Canadian makers. General Rathbone informed the meeting that he saw in the Main Building of the Centennial Exposition, in the Canadian department, a stove of his own pattern, another of a pattern belonging to the firm which the President, Mr. Jewett, represented, and many other standard American works. He said that stoves were sent to Canada, and casts made of the patterns, which the Canadian manufacturers obtained letters patent for and sold as their own designs; and not only that, but they had the effrontery to send the same pattern to the Centennial Exhibition to obtain premiums for originality of design. He hoped the matter would be brought to the attention of the Centennial authorities, and such measures taken as would prevent the Canadians from receiving rewards for designs and articles which did not now and never did belong to them. President Jewett held that it was a swindle upon the public. Mr. Spear had suffered in the same manner. It was agreed that the committee on patent laws draw the attention of Congress to the necessity for a treaty with Canada of a reciprocal character.

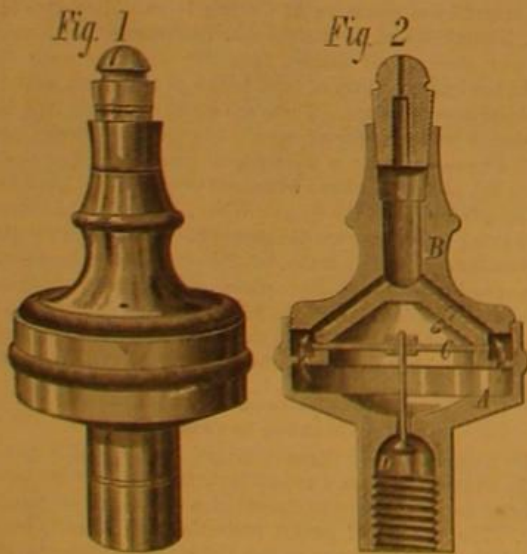
IMPROVED HOT BLAST BOILER FURNACE.

We illustrate herewith a new construction of boiler furnace, the object of which is to save the loss of heat due to waste through grate bars, through imperfect combustion of oxygen with the gases evolved, and through the frequent admission of cold air into the fire chamber. The manufacturers claim that double the number of cubic feet of air is required by natural draft to produce combustion that is necessary when a forced blast is used, because the needful amount of oxygen can be more perfectly combined with the gases at a point in the furnace where combustion is possible. Thus the heat ordinarily expended in elevating the temperature of the surplus air admitted is saved. This is done as follows: All the air admitted to the fire is conveyed from the fan, shown in the rear, through pipes, A A, along the fire bed to the airtight fire chamber, D, and under the grate. It thence passes up through the improved grate bars to the fuel, and is also forced back through the small pipes, B B, to the cross perforated pipes, C C, distributing the heated oxygen at proper points under the boiler, to unite with and assist in burning the escaping gases. The air is obviously heated before it enters the fire, the heat of the cinders, clinkers, and refuse of the furnace being utilized for this purpose, by pushing the hitherto unused material over the bridge wall and into the pit back of bridge wall, where it assists in heating the pipes, A, and, when cool, can be withdrawn at the door shown. It will be observed that there are no ash pit doors to be opened, and that there is no necessity of throwing open furnace doors to check combustion, that end being easily effected by stopping the air blast. Thus the furnace is protected from the injurious effects of sudden changes of temperature. On the improved grate, we are informed, all dust, shavings, tan bark, and other refuse will burn as well as the best lump coal. Besides thus producing economy, through the air arriving at the point of combustion already heated to the proper temperature by heat otherwise wasted, the general construction is such as to insure a cool and pleasant fire room, a condition hardly possible so long as fires are cleaned and hauled through the furnace doors. This furnace can be easily applied to boilers already set.

A large number of commendatory testimonials are submitted, showing that from twenty to thirty per cent of fuel is directly saved by the invention. For further particulars relative to sale of patent, address the manufacturers, Messrs. U. B. Stribling & Co., Madison, Ind.

MCMILLAN'S SELF-REGULATING GAS BURNER.

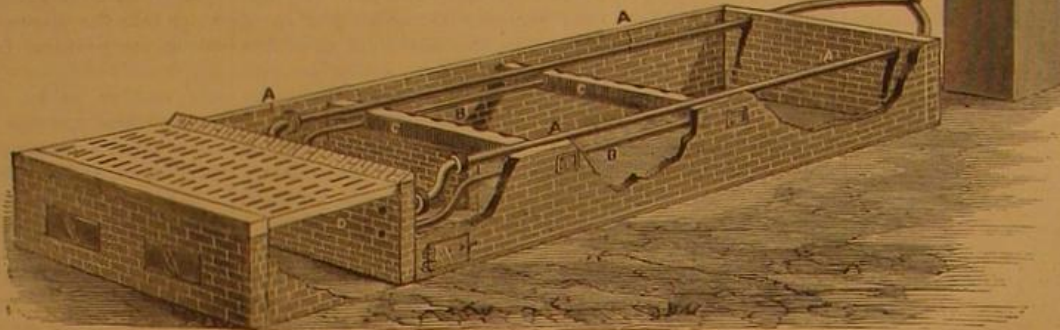
It has been demonstrated by experiment, by M. Lemoine, that, in order to obtain the greatest amount of gas light at least cost, the following rules should be remembered: 1. A good burner will produce four times the amount of light that a



poor one will, the quantity of gas burnt being equal. 2. The intensity of the light increases with, but in a greater ratio than, the size of the slit. 3. The increase of illuminating power varies with the decrease of pressure. 4. The gas should be burnt at the lowest possible pressure. 5. The pressure should remain constant; and 6, the pipes should be large enough for the amount of gas carried through them.

In the new gas burner, illustrated herewith, it is claimed that the conditions stated in rules 4 and 5 above given are fully realized, and uniformity of flow and economy in the consumption of gas are combined with a simple, cheap, and durable construction. The engravings represent the device in full size, both exteriorly, Fig. 1, and in section, Fig. 2. The base section, A, forms a cylindrical chamber into which the lower concave part of the tip section, B, is hermetically secured. C is a flexible diaphragm of leather or other suitable material, which is interposed and fastened between the sections; this supports centrally the stem of a valve, D, which opens and closes from below the entrance aperture of

the gas, according to the pressure of the latter on the diaphragm. The diameter of the chamber, in A, is larger than that of the diaphragm, so that, concentric with the diaphragm, there is an annular channel into which the gas flows through suitable apertures, as indicated by the arrows. The gas then passes by the inclined channels in the upper section to the delivery tube, and is there fed to the tip at any position of the upper section, without necessitating any special adjustment of the same to the gas-conveying channels, as the communication is established as soon as the sections are united. The flow is thus evenly maintained and is independent of the pressure below the valve. The regulating attachment may be kept within small compass, so as to be of ornamental appearance, and may be used to support the



STIBLING'S HOT BLAST BOILER FURNACE.

usual glass globe. The pressure at the tip of these burners when in use is stated to be about two tenths of an inch water pressure. It gives full flame with only five tenths pressure on the supply pipe, and will do no more with a pressure of thirty inches. Testimonials are submitted, showing in one instance a saving of twenty-six per cent of gas burnt in a period of eight months.

Patented through the Scientific American Patent Agency by D. D. McMillan, January 26, 1875. For further particulars address E. H. McMillan, La Crosse, Wis.

SCENES AT THE CENTENNIAL.

The extent and variety of the Centennial show afford many interesting and characteristic scenes to the observant visitor. In the upper part of the engraving on our following page is shown one of the entrances with the crowd congregated thereat. The entrance to the Grand Plaza, from Belmont and Elm avenues, is next shown, and a view of one of the stations on the narrow gauge railroad that runs all round the grounds, affording much economy of time and labor, is also given.

The lower part of the picture is occupied by a view of a number of the principal buildings erected by the different States for the accommodation of their commissioners and delegations, which we have described so recently that any lengthy details of the structures which are represented in the engraving will not be necessary. The view represented was made from a point near the English government building, looking in an easterly direction along what is known as State avenue, on which most of these buildings are situated. The New York building, shown on the left hand of our picture, is a showy and convenient structure, with ample piazza room. The Governor's room, office, and the ladies' apartments are handsomely furnished and hung with paintings. Massachusetts has erected the building next in the line; it is somewhat old-fashioned in style, but thoroughly commodious in design and arrangement. The Connecticut building stands next; and though small, it is large enough for the purposes for which it is intended. New Hampshire has a plain square structure fifty by fifty-five feet, situated east of Connecticut cottage; beyond it are the headquarters of Wisconsin and Illinois. Indiana comes next, with a building of striking appearance. A little further to the eastward we come to one of the most substantial structures of the State group, that of Ohio. It is built of dressed stone from the quarries of that State.

The engraving is selected from the pages of *Harpers' Weekly*.

Window Ventilation.

A writer in the *London Sanitary Record* gives the following instructions for making a cheap window ventilator: Take two pieces of board a quarter of an inch thick, one inch wide, and as long as the lower bar of the window; three narrow pieces half an inch thick and one and a half inches long, one end being cut with the bevel of the window stool. Nail these pieces across one of the long slats, one at each end and one in the middle, placing the short side of each piece even with the lower edge of the slat. Nail the other slat on the opposite side of these short pieces, bringing the upper edge of the slat even with the square end of the short pieces. This will make a compound bar with half an inch between the slats, and one slat half an inch higher than the other when the whole is turned upon its edge. Place the whole under the lower window sash, with the higher slat on the outside. The air can then pass under the outer sash, between the two slats, and enter the room over the top

of the inside slat, having an upward motion which will cause it to mingle rapidly with the warm air of the room and thus prevent any sensible draft. By thus raising the lower sash, a space will be left between the top of the lower sash and the bottom of the upper sash, through which another thin layer of air may enter the room at some distance from the layer at the bottom of the window. The air must also enter with an upward current, causing it to speedily mix with the hot air in the upper portion of the room. This arrangement is especially adapted to secure safe window ventilation in bedrooms.

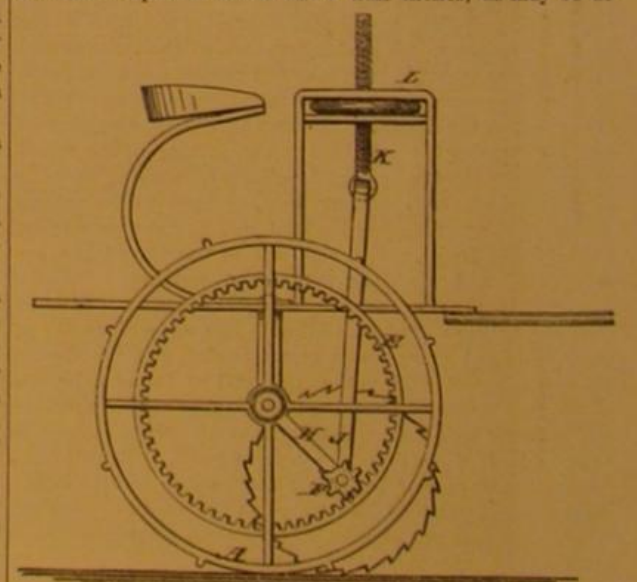
Look to your Ice Ponds.

There is a prevalent notion that ice purifies itself by the process of freezing. This is not based on trustworthy scientific observation, and, indeed, is not true. In the recent annual report of the State Board of Health of Massachusetts are given the details of an outbreak of intestinal disorder, clearly attributable to the contamination of impure ice. The malady broke out last summer in one of the principal hotels at Rye Beach, N. H., and, while not attended with fatal effects, extended to a large number of people. After long and unavailing search, the cause of the trouble was found in the pond whence the ice used in the hotel had, the winter before, been taken. The outlet whereby the body of water emptied itself had become obstructed, so that the water was rendered nearly stagnant. At the lower end where the feeding brook entered, and over a space 500 feet long by 150 wide, had accumulated a homogeneous mass of putrescent matter, composed of

marsh mud and decomposing sawdust. This foul matter, held in suspension in the water, was conveyed by currents and winds to every part of the pond, and an analysis of the melted ice showed it to be heavily charged with such impurities. It is obvious, from this, that the same care given to wells and other sources of drinking water should be given to the bodies of water from which the usual ice supply is gathered.

A NOVEL CULTIVATOR.

Mr. James C. Stone, of Leavenworth, Kansas, has patented, through the Scientific American Patent Agency, May 2, 1876, a new cultivator, which pulverizes the soil and cuts up weeds by means of a series of circular saws. These are attached and driven in the simple manner represented in our engraving. On the drive wheel, A, are formed toothed gear wheels, E, which mesh the teeth of small gear wheels, F, attached to the saw shaft. The latter rotates in bearings on arms, H, which ride upon the journals of the axle at the inner ends of the hubs of the wheels, A, so as to keep the wheels, F, in gear with the wheels, E, however much the shaft may be raised. The saws are placed upon the shaft at a distance apart of three and a half inches, as may be de-

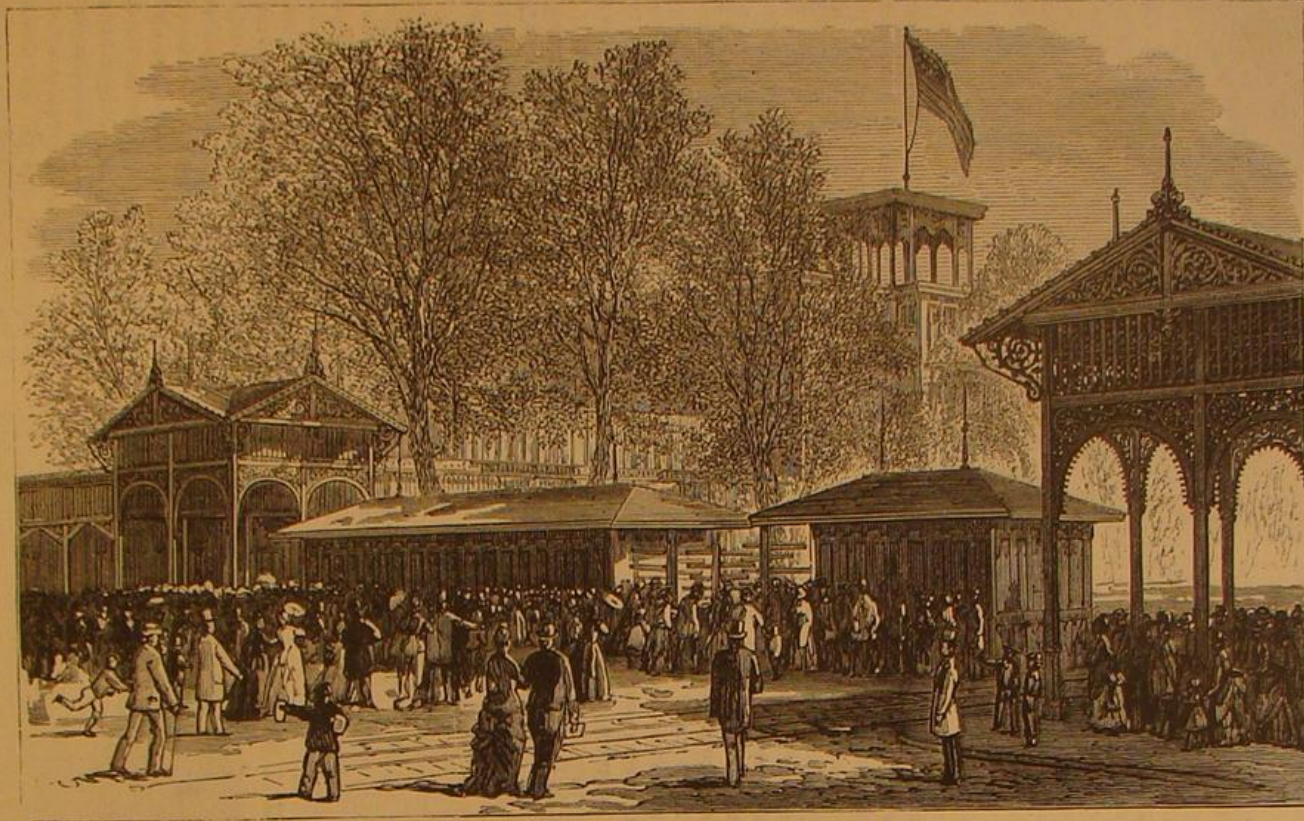


sired, or as the character of the land to be operated upon may require. To the center of the ball, attached to the saw shaft, is pivoted the end of a screw, K, which passes up through a hand nut, L, swiveled to a bracket, attached to the frame, so that, by turning the said hand nut, the saws may be adjusted to enter the ground to any desired depth, or may be raised from the ground. The axle is suitably bent to accommodate the saws.

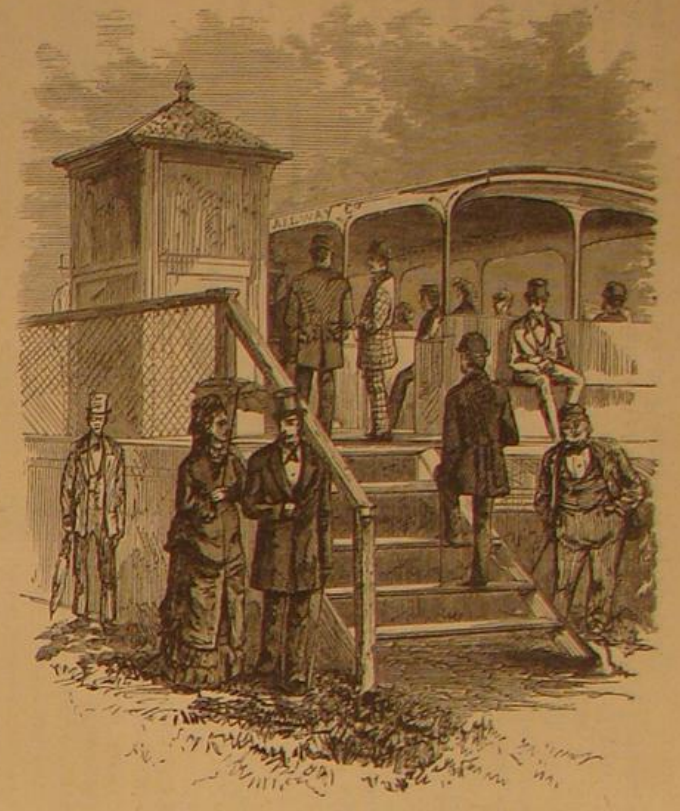
THE Belfast ginger ale, which has for the last few summers become quite a popular beverage, may be made as follows: Powdered double refined sugar, 16 ozs.; bicarbonate of soda, 3 1/2 ozs.; citric acid, 4 1/2 ozs.; concentrated essence of ginger 1 1/2 ozs.; essence of cayenne 4 drachms; essence of lemon, 40 drops. The soda, acid, and sugar must be carefully dried separately, at a temperature not exceeding 120°; and the sugar before drying must be thoroughly incorporated with the essences, to which a small quantity of caramel as coloring may be added. This forms a powder, a dessertspoonful of which will make a tumblerful of the drink.



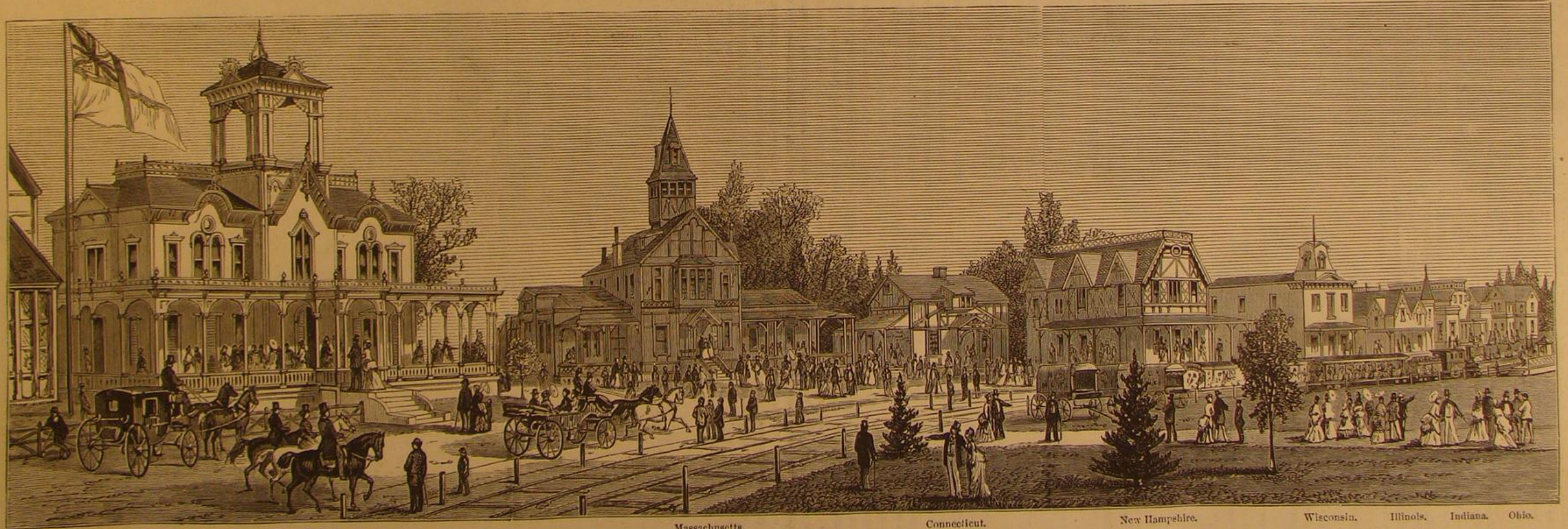
AT THE TURNSTILES.



ENTRANCE TO GRAND PLAZA—ELM AND BELMONT AVENUES



RAILWAY STATION, IN THE GROUNDS.



New York.

Massachusetts.

Connecticut.

New Hampshire.

Wisconsin.

Illinois.

Indiana.

Ohio.

THE CENTENNIAL—STATE HEAD-QUARTERS, ON STATE AVENUE.—FROM SKETCHES BY THEO. R. DAVIS.

IMPROVED SAFETY BRIDGE FOR RAILROAD CARS.

The invention herewith illustrated is a gang plank and guard railing, designed for connecting car platforms, so that train employees and passengers can pass from car to car without danger while the same are in motion. The guards may be folded into a narrow compass so as to be out of the way when the cars are uncoupled.

The gang plank, Fig. 1, is hinged to an end piece which is rigidly secured to one platform, and is provided with fixed upright posts suitably connected to the platform railing. A pivoted guard rail extends along each side of the plank to movable upright posts, A, and is constructed in the form of lazy tongs, the folding of which is permitted through the lower ends playing in slots in the post, as shown in Fig. 2. The movable posts, A, are strapped to the platform railing, and are provided with guide rods, B, to which the gang plank is connected by swinging crank arms, C, shown in Fig. 2. These arms have sliding sleeves at their point of connection to the rods, B, so that the guards adjust themselves to the varying length of the platform during the motion of the train. They produce, when the gang plank is swung up, during the coupling or uncoupling of the cars, the simultaneous folding of the guard rail, and also the opening out of the same when the plank is lowered. The railing may be applied loosely to the platform or hinged to the fixed posts of the latter, so as to be swung sidewise. The device is equally well adapted to the gang planks of steamboats.

Patented through the Scientific American Patent Agency, May 16, 1876. For further particulars address the inventor, Captain L. F. Frazee, 194 Grand street Jersey City, N. J.

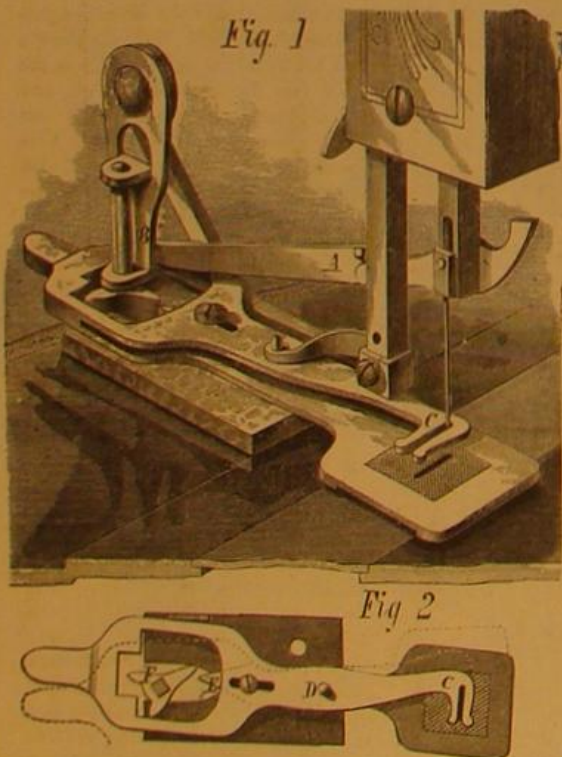
Captain Frazee will be remembered by many of our readers as the genial and popular captain of one of the steamboats that used to ply between New York and Long Branch.

Dyeing with Artificial Alizarin.

Forster proposes to add a fatty acid to the color, in order to produce upon cotton with artificial alizarin a red resembling Turkey red. He mordants with alumina, and dyes in an alizarin bath containing soap, neutralized with sulphuric acid. The mixture of alizarin and fatty acid, which separates out in fine flakes, dyes the tissues readily, and gives bright and solid colors—red, rose, and purple.

A NOVEL DEVICE FOR SEWING ON BUTTONS.

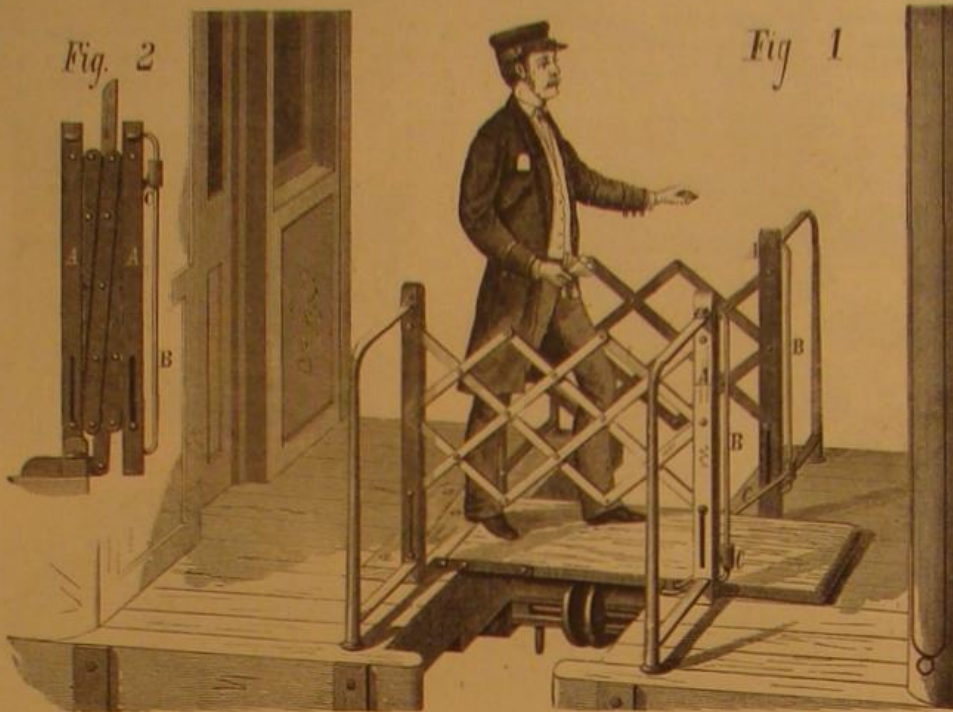
We illustrate herewith a very ingenious little attachment designed to render the sewing machine available for the sewing on of any kind of button. The device is simple and easily made and operated. In brief, it gives to the sewing machine a new capability, and for this reason will doubtless meet a ready welcome.



It is obvious that, in order to give a button the necessary movement under the needle so that the latter can pass backward and forward from hole to hole, a different feed motion from that usually found in sewing machines is needed. And, moreover, such motion must be adjustable according to the distance between the holes in the button. This seems to be neatly accomplished in the present device.

A, Fig. 1, is an arm attached to the needle bar of the machine and jointed to the bar, B, which is pivoted to the inclined standard shown. C is the clamp for holding the work, and vibrates freely on the pivot, D, Fig. 2. Between the parts of the clamp is a bar, E, the pointed end of which protrudes into the opening in which is a cam, F, secured in a

shaft which is attached to the bar, B. At each descent of the needle bar the cam, F, is carried backward, so that one or the other of its rear projections strikes the angles of the clamp plate, Fig. 2, and so turns its pointed forward end to either hand. When the needle bar rises the arm, A, swings the bar, B, forward, and the cam is carried in the same direction, so that it acts alternately first on one side and then on the other of the angle piece, E. This obviously vibrates the clamp and work under the needle. The piece, E, can be

**FRAZEE'S SAFETY BRIDGE FOR RAILROAD CARS.**

shifted along the plate and adjusted by the clamp screw shown, so as to regulate the throw of the clamp according to the distances between the holes of the buttons. The attachment can be adapted for use on any sewing machine, and is also suited for sewing on hooks and eyes, buckles, etc.

Patented through the Scientific American Patent Agency, April 4, 1876. For further particulars address the inventor, Mr. J. W. Fries, Salem, Forsyth county, N. C.

The Aquarium in New York City.

New York city is at last to have an aquarium. The subject of providing this most valuable means of study has been discussed repeatedly for the last ten years, and we, in common with others, have frequently advocated the establishment of a finny menagerie in Central Park. There is a probability of an aquarium being built in our great pleasure ground sometime in future; but before that collection is fairly begun, we doubtless will see finished the work recently started by private enterprise. The nearest approach to a large aquarium New York ever possessed was due to Mr. P. T. Barnum, who exhibited a number of tanks containing rare fish and a white whale (which some skeptics declared was of india rubber) in his old museum, which stood where the Herald building now is located. It is worthy of remark that to Mr. W. C. Coup, Mr. Barnum's former executive officer, is due the inception and undertaking of the present enterprise.

Work is already well advanced on the building, which is located on the plot of ground recently occupied by the Colosseum, at the corner of Broadway and 35th street. The edifice, says the *American Architect*, will be one story in height, of brick, with large sash lights at the sides; and one immense skylight will form the roof. The tanks will be placed at a distance of three feet from the side walls, giving room for a passage, to accommodate pipes, and also to facilitate the passage of attendants. Light for the tanks will come from above, the spectator looking through a plate glass front. The sides of the tank are to be composed of slabs of slate, while rockwork will slant up at the rear. There will be a storage reservoir of a hundred thousand gallons, where a supply of salt water will be kept. This water will be conveyed from the river in barrels, and kept from stagnation by aeration, for which purpose air pumps worked by engines will be provided. The middle of the floor will be occupied by large tanks, built partly above and partly below the surface of the ground. These great tanks will be reserved for the white whale, sharks, and other large fish. Small tanks will be placed at convenient points; and when in running order, the establishment will be able to accommodate all classes of fresh and salt water fish.

Mr. Coup recently succeeded in capturing two white whales alive, in arctic waters, and in transporting them safely to a tank prepared for them in his building. Both, however, committed suicide in their endeavors to break through their narrow quarters, cutting themselves so severely, on projecting edges, that they bled to death.

Origin of Fiber in Puddled Iron.

The grain or absence of fiber is generally produced by the fusibility of the manganiferous or alkaline scoriae, by the softness of carburized or phosphuretted iron when heated, and by the high temperature at which the puddling is conducted; the fiber, on the other hand, results from the sparing fusibility of partially peroxidized scoriae, and from the comparatively low temperature of the puddling.—*M. H. Le Chatellier*

Historical Scientific Relics.

A remarkably interesting exhibition of scientific apparatus is now open in South Kensington, London. The enterprise was organized under government auspices, and is international. The collection includes not only apparatus for scientific research and for the teaching of science, but also any objects in any way connected with these. The end of the display is instruction and not advertisement, so that there is no competition and nothing in the shape of awards. Papers will, however, be read, descriptive of the articles exhibited.

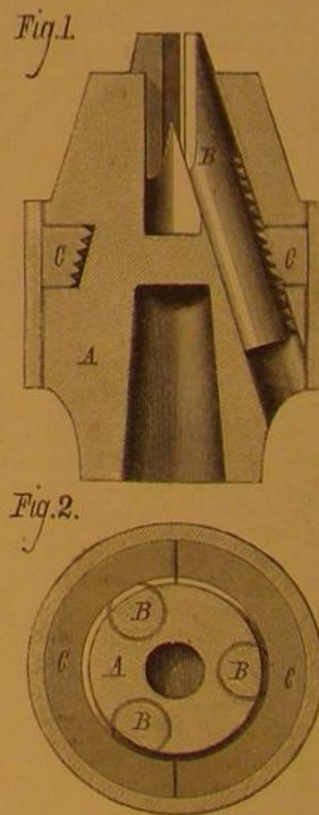
The most interesting part of the collection is that which includes modes and apparatus which are historical. Probably no such gathering of the results of the initial conceptions of some of the greatest discoveries and inventions in the world has ever before taken place. Among these are Bramah's original hydraulic press, the Comet, Puffing Billy, and Rocket engines; Newcomen's original model of his engine, a large collection of Watt's models, an unfinished steam cylinder made by Papin (1699), Sterling's model of his air engine, a link motion made by W. Howe in 1842, Symington's engine made for Dr. Miller in 1788 (the first engine used for steam navigation), the original model of the Eddystone lighthouse, and a bar lathe of Watt's. Still more interesting are the original apparatus with which Faraday obtained the magneto-electric spark; the original air pump and Magdeburg hemispheres of Otto Von Guericke, portions of the traces by which the horses were attached to one of the hemispheres being still left; also a stereoscope made by its inventor, Sir David Brewster, a "thunder house" made by Priestley, Galileo's telescope and several other of his instruments, Sir Francis Drake's astrolabe, the apparatus used by Joule in ascertaining the mechanical equivalent of heat, Black's pneumatic trough, a quadrant belonging to Tycho Brahe, a telescope by Huyghens, Babbage's calculating machine, Whitworth's original gages, the original Wheatstone bridges, and Armstrong's hydro-electric machine. There are hundreds of other exhibits, all connected with some great scientific achievement.

New Sulphate of Potassa.

The composition of this salt is: Sulphuric acid (SO_4) 44.9; potassa (K), 50.6; water (H), 4.6. The formula $\text{SO}_4\text{K} + \frac{1}{2}\text{H}_2\text{O}$ would require: Sulphuric acid, 43.7; potassa, 51.3; water, 5.0.—*M. J. Ogier.*

ALMOND'S IMPROVED DRILL CHUCK.

We illustrate herewith a new and simple drill chuck, so constructed that the jaws have a large amount of bearing surface, and hence will keep true for a long period, that no dirt can enter the working parts, and that there is a direct connection between the jaws and the machine spindle, so that the parts become, it is claimed, as one piece.



The body of the chuck, A, Fig. 1, is turned of 1 1/2-inch steel and is pierced with three guideways to receive the jaws, B. These are made of Stub's best wire, hardened at the gripping ends, and with the temper drawn to a blue at the part where the screw thread is cut. The thread engages with a corresponding thread in the embracing nut, C, made and applied in halves as shown in Fig. 2. As the curves are alike, the jaws are prevented from turning on their own axes, although they are free

to move endwise and towards the center, when the nut is revolved. The nut is hardened to a temper corresponding to the threaded part of the jaws. The latter have a slight twist, so that the tendency of the drill in the work acts to tighten their edges on the tool rather than to loosen them. The device, as a whole, is durable, compact, and cheap; and since all its parts are cylindrical and produced in the lathe, they may be easily duplicated.

Patented by Mr. T. R. Almond, February 8, 1876. For further particulars address the agent, J. M. Montgomery, 103 Fulton street, New York city. See advertisement in another column.

NEST-BUILDING FISHES.

The *Anabatis* form one of the most remarkable of all species of fishes, owing to their capability of living for a long time out of water, a power which has formed in them some curious habits. The *Anabatis scandens*, or climbing perch, of India, has been known to live for six days out of its appropriate element; and some will sometimes quit the water and wander over the land, so far from any stream or pond that they were formerly supposed to have dropped from the clouds. The German naturalist Daldorf states that he once saw one of this species which had climbed a tree to a height of five feet; but this is stated by other observers to be an impossibility. This power is due to the peculiar structure of the pharyngeal bones, which, in a cavity in the base of the skull, are dilated into voluminous laminae, forming cells in which a supply of water may be carried for the purpose of keeping the gills moist.

But the gourami's instinct is more peculiar than that of any other member of the tribe. By their united labors, the male and female construct a well built nest, in which the ova are deposited, and which protects the young fry from the thousand enemies by whom infantile fish are pursued and tormented.

The body of the gourami is of a brownish color, varied with some golden tints on its sides; the belly is of a silvery brown. The conformation of the fish is high from its belly to back, and the body is narrow; the head is short, the mouth small and protracile. The scales are large and round. The fish is properly herbivorous, but will eat insects and earth worms; and it is so voracious that, says M. Dabry de Thiersant, the creoles of the Mauritius call it the hog of the river.

The gourami, like most other *Anabatis*, is found throughout the East Indies, and is a valuable food fish of delicious flavor, resembling that of the European carp.

Many attempts have been made by the French to acclimatize it on this continent, especially in Cayenne; but little success has been met with. In Algiers, other attempts have been made, and greater encouragement followed. At the Cape of Good Hope and in Australia, the experiments were entirely successful.

Our engraving of the gourami and its nest is selected from the pages of *La Nature*.

THE SCORPIONS OF EGYPT.

That indefatigable naturalist, Mr. Frank Buckland, has recently published the following account of a fight between a mouse and a scorpion, the illustration (representing the thick of the combat) having been drawn on the spot by a spectator:

"In February, 1868, I received a box by post containing two live scorpions, kindly presented to me by my friend, the late lamented J. Keast Lord, who had caught them under a stone at Heliopolis, in Egypt. Wishing to test the power of the scorpion's sting, I got a glass globe and turned in one of the scorpions. A mouse having been caught in the trap, I thought I might just as well let the scorpion try his powers upon it as the cat. I therefore shook the mouse into the glass with the scorpion. The scorpion, an average-sized one, immediately resisted the affront; and the mouse, who had never evidently seen a scorpion before, did not know whether he was his friend or his enemy. Not liking the continued jumpings of the mouse, the scorpion twisted and began brandishing about his sting. The mouse shortly crossed his path. The scorpion instantly lunged his sting into him. This challenge woke up the mouse, who began to jump up and down like a jack in the box. When he became quiet, the scorpion again attacked the enemy, with his claws extended like the pictures of the scorpion in the zodiac. He made another shot at the mouse, but missed him. I then called 'Time!' to give both combatants a rest. When the mouse had got his wind, I stirred up the scorpion once more, and, as 'the fancy' say, 'he came up smiling.' The mouse during the interval had evidently made up his mind that he would have to fight, and not strike his colors to a scorpion as he would to a cat. When, therefore, the scorpion came within range, the mouse gave a squeak and bit him on the back; the scorpion at the same moment planted his sting well between the mouse's ears on the top of his head (see engraving). The scorpion then tried to retreat, but could not, for one claw had got entangled in the fur of the mouse. The mouse and scorpion then closed, and rolled over each other like two cats fighting, the scorpion continually stabbing the mouse with his sting, his tail going with the velocity of a needle in a sewing machine. When the scorpion got tired, the mouse got hold of his tail with his teeth and gave it a sharp nip. The mouse seized the opportunity, and immediately bit off two of the scorpion's side legs. He then

retired, and began to wash his face. I had expected, of course, that the poison of the scorpion would have killed the mouse, but he didn't seem a bit the worse for it. When I examined him the next morning, he was quite lively and well; and had nearly eaten up the whole of the scorpion for his breakfast. Of course I rewarded the mouse for his plucky conduct by giving him some milk, and by letting him go in a place where it was not likely the cat would find him.

"Scorpions are inhabitants of hot climates; they live among stones, logs of wood, etc., in such places, in fact, as those inhabited in England by wood lice and centipedes, etc. They are said to attain the length of twelve inches in Bata-



THE GOURAMI (OSPHRONEMUS OLFA).)

via; and along the Gold Coast, I have heard (but hardly believe it) they are found as big as a good sized lobster; the general size is about three inches long. It not unfrequently happens that scorpions are brought to England in timber ships, etc., and I have received more than one scorpion thus brought over."

Lily Culture.

Much non-success in the cultivation of lilies arises from working in too much fresh manure, which has come in contact with the bulbs and caused them to decay. If the following treatment is given them, but little fear of failure need be apprehended: In the fall, after the stems are ripened off or killed down with frost, lift all the bulbs; and if the soil is of a loamy nature, procure some fresh muck (the most preferable being that in which the native lily luxuriates) and shake all roots or weeds, etc., out of it; then put a good covering of it on the bed, also a good manuring of well decayed manure, and trench the bed about 18 inches deep, keeping the manure well to the bottom of the trench, so that most of it shall be below the base of the bulbs, incorporating at the same time the peat or muck well with the soil. After the trenching is done, level the bed on the sur-



FIGHT BETWEEN A SCORPION AND A MOUSE.

face, and plant the bulbs in rows, about one foot apart for small bulbs, larger ones further, and about the same distance in the rows, putting them into the ground from six to eight inches deep. Before severe frosts set in, cover with a good protection of rough horse manure or any such material, which will help to keep them from getting too much frost. In the spring, before the bulbs start, remove the covering and they will come up strong and vigorous. When planting the bulbs, surround each one with a good handful of river sand.—*Cultivator and Country Gentleman.*

To remove grease stains from silk hats, use first turpentine and then alcohol.

Naphtha, Benzine, and Gasoline.

The distinction between the three above-named articles, which exists only in degree of their specific gravity, is clearly set forth in *The Grocer* as follows:

"Among the chief products of petroleum, which enter largely into every-day trade, and about which very little is known even by those who handle them, are naphtha, benzine, and gasoline, all of which are the first results of the distillation of petroleum. The application of the three names is oftentimes confused, though there is a practical difference between the products, which may be easily determined by the simple use of an hydrometer. The first result of petroleum distillation shows a gravity of 90°, and the distillation from that down to 86° gives what is known as gasoline, which is used almost exclusively in patent gas machines for the manufacture of burning gas, a very fine light being obtained from its use. It is also employed as a carbonizer of coal gas, and, when properly applied at the meter, and with improved burners, it adds greatly to the richness of the flame. The gas companies use gasoline as an admixture for their product, in which case it becomes an adulterant, because of the imperfect means employed in its use.

The distillation from about 74° down to 68° is termed benzine, which is largely used by painters as a substitute for spirits of turpentine; the latter, being more oily, produces a much heavier paint, giving a better finish and being much more durable, but benzine is a quick dryer, and, being cheap, is especially adapted to rapid and low-priced work. The scouring establishments also use very large quantities of this product, and it is deodorized and sold in small bottles, under various names, for removing

grease from clothing and similar purposes. When first taken from the still it is highly odorous, and that disagreeable feature is only removed by means of re-distillation and treatment with sulphuric acid. The goods that are bottled and retailed in that way frequently have some fragrant perfume added to counteract the pungent odor, which cannot be entirely removed from the benzine by any manner of treatment. Benzine is sometimes used for burning, but is exceedingly dangerous, and should never be employed for that purpose.

The heavier gravity product of the still, ranging from 62° to 65°, is termed naphtha, and is the lowest distillation unmixed with oil, which distills over at about 62°. Naphtha is used in the manufacture of varnish, oil cloths, and patent leathers. It is also largely employed in connection with india rubber, of which it is the only perfect solvent, being vastly superior to spirits of turpentine. We have shown in this brief space the proper gravity of these different products, and persons who have occasion to use any of them can easily protect themselves against impositions by applying the hydrometer test to which we have already alluded.

The finer burning oils are made from distillation ranging from 51° down to 45°. Most of the high test oils show a gravity of about 47° to 48°, but this is too heavy for a very fine free-burning oil, and the finest product made has a gravity test of 50°, and a fire test of 150° Fah. This gives a perfect light, and may be used with absolute safety. The low priced kerosene oils, testing down as low as 116° Fah., and under, and of 46° to 48°, are being superseded by the better grades; and the good results are shown in the very rare reports of injury to life or limb from the use of an article which, because of its impurity and danger was, a few years ago, very generally condemned."

Cleaning Silk.

The following mode of cleaning silk garments has been successfully tested. The garment must first be ripped and dusted. Have a large flat board; over it spread an old sheet. Take half a cup ox gall, half a cup ammonia, and half a pint tepid soft water. Sponge the silk with this on both sides, especially the soiled spots. Having finished sponging, roll it on a round stick like a broom handle, being careful not to have any wrinkles. Silk thus washed, and thoroughly dried, needs no ironing and has a luster like new silk. Not only silk but merino, barège, or any woolen goods, may be thus treated with the best results.

For the benefit of people who, like a large proportion of the inhabitants of this city, reside in localities where disagreeable odors from slaughterhouses, oil works, or bone boiling establishments are prevalent, we have tried various fumigating compounds, such as pastilles, etc., in order to determine which best overcomes such stenches. We find none so efficacious as simple burnt coffee. Grind the roasted berries moderately fine, moisten the powder slightly, and throw 1 oz. or so on a pan of hot coals. The odor seems to remain in a room even when the windows are opened.

A NEW METHOD OF MAKING SURFACE PLATES.

BY JOSHUA ROSE.

It has been for many years accepted as an indisputable fact that a true surface plate could only be produced by means of hand scraping. Now the hand scraper in reality makes a series of shallow cavities, the tops between the cavities having a surface bearing. The finer the scraper, the greater is the number of cavities, and therefore the greater is the number of bearing spots; so that a finely fitted pair of surface plates present the appearance of closely dotted bright bearing surfaces combined with adjacent scraper marks which had no bearing. The depth of a majority of these marks is undoubtedly very slight, but any one who has used a surface plate for any length of time is aware that, while after a time most of the scraper marks become effaced, yet many of them remain, demonstrating that some of them were deeper than others; and this is sure to be case, no matter how carefully the scraping be performed, because the scraper is not at all times equally sharp, and hence cuts deeper at some times than at others. The difference may, it is true, be very slight, but still it exists, and is a detriment to the amount of its extent. Scraped surface plates may be made so nearly true that a plate, say 12x8 inches, will lift 2 lbs. per inch on a small surface applied to a large one, or the two plates of the size mentioned will have between them a vacuum of about $\frac{1}{2}$ lb. per inch of area when one completely covers the area of the other, and of about $1\frac{1}{2}$ lbs. per inch when one surface only covers one half of the other; while, when one surface covers one third of the other, the vacuum will be increased to about $1\frac{1}{2}$ lbs. per square inch of the surface in contact. It must, however, be a well scraped surface to give results of such a standard of excellence.

In the early days of the mechanic's art, surface plates were finished by grinding them together with fine emery; this, however, was found objectionable, in that the softer parts of the iron would grind away more quickly; and as no method of overcoming this defect was discovered, the practice of scraping was introduced, and it has held its own to this day as the most perfect method of obtaining a true surface, notwithstanding that it produces simply an area of fine hills and hollows. These hills and hollows may be sensibly leveled by well rubbing the plates together, it is true; but cast iron, of which it is found most desirable to make surface plates, wears under such conditions, so that a very hard skin is formed upon the contacting high spots, and they finally get very bright and so hard that it is impracticable to wear away the high places. If a plate of cast iron, after having been finished, is well rubbed upon a wrought iron or brass true surface, the high spots upon the cast iron will abrade much more rapidly, but still not sufficiently to render it practicable to abrade the surface so as to efface the scraper marks, and still keep the surface plates practically true.

Surface plates of wrought iron may be scraped true, and then rubbed together until the scraper marks are very nearly all effaced; but such plates are very subject to wear, and consequently soon get out of true. Scraped surface plates of cast iron have therefore, hitherto, been the only ones made. Some three weeks ago, however, a mechanical correspondent of the SCIENTIFIC AMERICAN wrote to the editors a letter enquiring what were the specific objections to getting up surface plates with files and emery paper; and the enquiry was handed to me to answer in the columns of "Answers to Correspondents." The first impulse was to reply that true work could not be produced by the use of files and emery cloth or paper. Upon further consideration, however, the conclusion was reached that it was practicable to make, with such tools, surface plates superior to those produced by the scraping process. Having then in my possession a new surface plate made at the Freeland tool works, which plate was one of a pair exhibited at the American Institute Fair in 1873, and having also the mate to the above, which had been in use for some time, and was deeply scratched all over and indented in several places by careless use, I took the latter and smooth-filed it all over until the indentations and scratches were effaced, and then commenced the truing, using the new plate to test with. When the marks showed that the plate under operation bore about equally all over, a superfine smooth file was used until the previous file marks were obliterated, and the test marks again showed about evenly in all parts of the plate. Here it may be well to observe that it is not to be supposed that the flat surfaces of these files were used indiscriminately upon the surface under operation. Each file was chalked before being applied to the work, and then a few light strokes of the file were made; after which the teeth of the file were closely examined for the dark spots, which spots indicated which teeth stood the highest. Then only such parts of the file were used as showed the teeth in the middle of the width of the file to be cutting, and which were cutting without any action of the teeth beyond them after passing an area of teeth which were not cutting. By this means I could so place the file that the cutting teeth had contact with the part of the surface requiring to be filed, and yet be assured that no other part of the file was doing execution. An 8 inch Grobet file, of the finest cut, was the next one used, a dead smooth not being at hand. The advantage of using a Stubs' dead smooth would have consisted in that Stubs' and other dead smooth files are made harder than the superfine dead smooths of Grobet, which latter, applied upon a cast iron surface, soon lose their grip, because they are not made sufficiently hard for such duty. They are, however, the truest cut files I have ever handled, and suited my purpose admirably. After having, with the Grobet file, effaced all the marks made by the superfine smooth file, and

fitted the plates until the marks showed evenly all over. No. 1 French emery paper was applied, first lengthwise and then crosswise of the plate. The paper was wrapped, in not more than two folds, around the file, which was done to preserve the edges of the plate from becoming rounded from the action of the emery paper. Care was also taken not to rub the emery paper too much upon the edges of the plate, for fear of rounding them; because rounding these edges would have rendered it impracticable to have finished them without scratching the surfaces, for the following reasons: No matter how much care is exercised, two plates having very smooth surfaces cannot be put together by placing one on top of the other, and then worked without scratching their surfaces; because the very dust in the air will be sufficient, upon such fine faces, to deeply score them. The proper way is to clean the face under operation with an old linen rag, and the test plate with a piece of rag about two inches square that has had two drops of oil put on it. After cleaning them, the palm of the hand should be passed all over the test plate, and then it must be wiped with a piece of clean rag and again applied to the test plate, this process being repeated several times, so that the amount of oil upon the test plate shall be barely sufficient to tarnish it. Then we pass the hand over the plate under operation to remove any particles of dust, and apply the test plate, putting it on one corner of the other, balancing it until its surface is level with the other (the two faces contacting over about an inch of area); and then, while pressing the faces together, we slide the top plate horizontally over the lower one. Then, if the edges of both plates are true and sharp, they will remove from the surfaces of both plates those particles of dust which would slide under a rounded edge, and get between the surfaces and scratch them. Our next operation is to move the test plate upon the lower one, backwards and forwards as well as sideways, until the marking spots which were at first dark have become bright through abrasion. The emery-papering process is to be continued until the file marks are effaced all over the plate; while at the same time the test surface plate marks are distributed evenly all over, that is to say, in spots of about equal area and at equal distances apart.

The next procedure is to find a means to apply the emery, cloth to the high spots, where the test plate marks showed without touching the unmarked spaces between them, which is to be accomplished by wrapping small pieces of No. 1 French emery paper around a small piece of round wood, of about $\frac{1}{2}$ inch in diameter, the sharp corner being chamfered off for a distance of about $\frac{1}{4}$ inch. The emery paper should not make more than two complete circles of covering around the wood, and should be brought to bear upon the plate at the chamfered edge of the wood. To prevent the emery paper from cutting in lines, it is moved in circles, say $\frac{1}{4}$ inch diameter, and pressed firmly upon the plate upon the bright marking spots. By this motion, I find the emery paper is less liable to cut out the softer parts of the grain of the iron; while at the same time, another advantage is gained in the fact that, the surface of emery paper in contact with the plate being less than $\frac{1}{4}$ square inch, it cuts very freely at first, but becomes glazed very rapidly, and polished after the first few strokes, an action which renders necessary a frequent moving of the paper upon the wood but is in every way desirable. After the whole of the marks left by the test have been operated upon in this manner, care being taken to operate more freely on those spots where the test marks were the heaviest, the process is continued with No. 1 French emery paper, and subsequently with numbers 00, 000, and 0000, commencing by using the 0 grade upon a file and rubbing it lengthwise and crosswise of the plate, and finishing by the piece of wood and circular motion. Grade 00 is first applied in very short strokes of the file, taking care that the paper near the end of the file only is used, so that it can be brought to bear upon the required spots only, the finishing being performed as before. During the use of the 000 and 0000 emery paper, the test plate is not supplied with any lubricant whatever, but is kept bright and clean and rubbed until the marking upon the plate under operation has a shining area only; until at last it becomes impossible to detect that the test plate bore any harder on one place than another, the vacuum between the two being but little greater than that obtained between two finely scraped surfaces. A fine film of oil is then to be placed upon the test plate, which is then freely applied in order to give it a better bearing if possible. This object was, in the first case, only partially successful, however, since it was too tedious. After some little consideration I determined to pass a piece of fine oilstone over the surface; and selecting a piece with an unusually fine grain, I filed its surface flat and beveled off one edge to a broad bevel; then taking a separate piece of cast iron, I wore the bevel and the face of the oilstone true, and applied first the flat face of the oilstone to my surface plate. But I found that it had no effect whatever, although applied with considerable pressure. The beveled edge of the stone was then applied, and it had the effect of slightly dulling the polished surface. Upon again applying the test plate, I found the vacuum was increased; but the surface did not work quite so evenly, and 0000 emery paper moved in circles was again brought into requisition, with the result that the vacuum became so great that it was only with great difficulty that the upper plate could be moved horizontally upon the lower one, that is, providing that they were put together as before described. If, however, they were put together without being pressed one to the other, the film of air between them would cause the upper one to glide about like a piece of ice placed upon smooth ice.

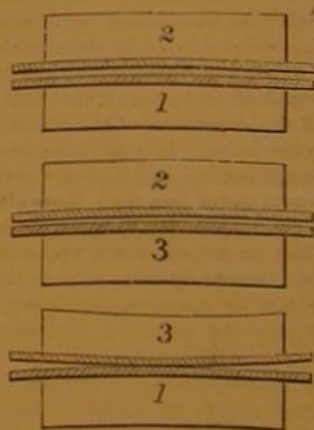
It now became a problem as to how to finally finish the surface. The marking appeared as a continuous glaze all

over, there being apparently no high or low spots; and yet the color of the metal appeared slightly varied in places, notwithstanding that the surface was bright and smooth to a high degree. Continuous rubbing of the plates together was at first tried, but without apparent effect, since the bearing seemed equal all over. The plates were then put together, allowing a film of air to be between them, and one plate to, as it were, float upon the other; the top one was then touched sufficiently to set it in motion, in all directions; and if any one part of the plate was found to act as a center of motion more frequently than the others, out of a test of about twenty motions, that part was very lightly touched with worn emery paper of the 0000 grade.

The result thus obtained is as follows: The plates in question are 12 by 8 inches; and placed one fairly over the other, it takes 200 lbs. to pull them apart vertically and about 150 lbs. to move one horizontally upon the other. A small piece of cast iron surfaced on an area of 7 inches will maintain on either of the plates a vacuum of 5 lbs. per inch of area.

These plates are now in the Machinery Hall of the Centennial, and may be seen in the space occupied by the Putnam Machine Company.

For the benefit of those who may desire to make a surface plate, it may be as well to here describe the method by which it may be obtained. First, then, the plates should be provided on the back with three resting points, two being at one end (one near each corner of the plate) and the other being at the opposite end and in the middle of the width of the plate. By this arrangement, the plate will lie on the bench resting at all times on three points, without rocking, even though the surface of the bench be uneven; which plan will protect the plate from the deflection due to its own weight. Between these resting points, there should be ribs to support the plate and to prevent still further deflection. In the Whitworth plates, these ribs run straight from each resting point to the others, thus forming a triangle, and cross ribs are also introduced. The plates, three in number, which we will designate as Nos. 1, 2, and 3, should be planed first on the three resting feet, and then on the edges and lastly on the faces. Nos. 1 and 2 are first fitted together and then No. 2 is fitted to No. 3. Now it is obvious that, in fitting No. 1 to No. 2, we have had nothing to guide us as to



making either surface true. One plate may bear upon two diagonal corners only, while the other may bear upon all four corners or all round the edges. In this case, we know that the one bearing upon two corners only is at twist, but the other may be hollow, or both may be hollow. Still we have no alternative but to fit them together. We may, it is true, test both surfaces with a straight edge, which must be used as follows: It should be wiped quite clean and placed upon the surface plate in various positions, as lengthwise, crosswise, and across the corners of the plate; and while in each position, we must take hold of one end, and, without placing any vertical pressure upon it, move it laterally back and forth a little, say about two inches, to see where it takes a fulcrum on the surface of the plate. If the center of its movement is at the center of the surface plate, then the surface of the plate is rounded, or highest in the middle. If it moves on the plate, first most at one end and then most at the other, the surface is hollow; while if it moves with an irregular and shuffling movement, it denotes that the surface is as true as the straight edge will test. Plates 1 and 2 having been fitted together, we take No. 2 and fit it to No. 3, not operating upon No. 2 at all. We next take No. 3, and try it to No. 1. Now if 3 and 1, when tried together, show each other to be rounded, it is proof that No. 1 is rounding to half the amount of difference between it and No. 3, as shown in our engraving, from which it will be observed that the two nearest together faces of Nos. 1 and 2 may fit together, one being rounded and the other hollow. No. 2 may be taken as a gage whereby to fit No. 3, their surfaces being made to fit perfectly. But if we take No. 3, and apply it to No. 1, they will disagree to twice the amount that No. 1 varies from a true, flat surface. We next refit Nos. 1 and 3 together, taking, as nearly as we can judge, an equal amount off each of them; and then taking No. 1, we recommence and fit No. 2 to No. 1, No. 3 to No. 2, and finally No. 3 to No. 1, taking half the amount of difference, between them, off each; and we then repeat the whole operation until all three plates applied indiscriminately fit each other perfectly.

Repeated applications to copper or brass of alternate washes of dilute acetic acid and exposure to the fumes of ammonia will give a very antique-looking green bronze.

The Civil Engineers' Convention at Philadelphia.

The eighth annual convention of the American Society of Civil Engineers is now in session in the Judges' Hall at the Centennial. The meeting opened on the 13th of June, Mr. G. S. Greene, C. E., of New York, presiding. Among the papers thus far read is one by Mr. T. G. Ellis, of Hartford, on the Centennial History of Engineering, in which he reviewed progress in this science over the past century. All the facts presented by Mr. Ellis have been fully noted by us in the series of editorials in American progress which recently appeared in these columns. The first regular business transacted by the members was the discussion of a previously published essay, by Mr. C. Bender, on the theory of continuous girders in relation to economy in bridge building. Mr. Pettit, architect of the Main Exhibition Building, read a paper on the character of the engineering work, therein giving the reasons for the adoption of the plan selected. The peculiarity of construction is that it is like the framework of a table. The long iron supports carry the dead weight, and the trusses resist the side pressure. A good test of its stability was made in February last, when a wind having a pressure of 18 lbs. per square foot caused no perceptible vibration. The amount of iron used was 8,340,000 lbs. The iron, flat, angle, and round, measures 141 miles in length and if made into a cubic block, it would measure 25 feet 10½ inches on each edge. There is 1 square foot of glass for each 4 square feet of surface covered. Mr. Pettit also described the general plan of installation of exhibits; and Mr. Schwartzmann, architect of Memorial Hall, explained his construction of that edifice. Complete abstracts of all papers read will appear in the SCIENTIFIC AMERICAN SUPPLEMENT.

Correspondence.**The Locust Pest.**

To the Editor of the Scientific American:

The facts mentioned by your correspondent J. F. Dunwoody, of Louisiana, Mo., are interesting, and, for one, I am always glad to get such exceptional facts; but they do not invalidate the other facts recorded by me in the article on locust prospects from which you condensed in a recent number. That locust eggs are destroyed by excessive moisture, and especially by alternately soaking and drying, I have abundantly proved by experiment; and I do not doubt the correctness of the observations of the Minnesota Commission. My conclusions as to locust injuries in 1876 are also most thoroughly substantiated by the experience of the past two months, which, considering the contrary opinions very generally entertained and promulgated last winter, is very strong proof of the correctness of the statements upon which my opinions were based. It is not improbable that eggs in a tenacious slough bottom, continuously covered with water for months, would suffer less than those alternately soaked and dried in a porous soil, on the same principle that vegetation under like conditions would rot sooner in the latter case; and if Mr. Dunwoody were to state the circumstances attending the fact he mentions with more explicitness, so that we could know the nature of the slough bottom, and feel confident that the locusts observed subsequently to its drying up actually hatched there from eggs laid before it was overflowed, we should without doubt find that his observation admits of an explanation in harmony with the opinions which he thinks it invalidates.

As to freezing, the eggs, as I have shown in my own writings, will withstand with impunity almost any amount of it, and the young locusts may also be frozen in solid ice and yet live; but the fact nevertheless remains, and is supported by such extensive experience as not to be gainsaid, that, when the young of the Rocky Mountain species prematurely hatch in fall or during mild winter weather, they are subsequently destroyed by continued severe freezing, or by continued freezing and thawing.

St. Louis, Mo.

C. V. RILEY.

Remarkable Example of Spontaneous Combustion.

To the Editor of the Scientific American:

A singular instance of spontaneous ignition took place in my house some time ago. On entering the house about noon, I detected the smell of something burning. An immediate search was made, and upon entering the parlor I noticed smoke rising from a center table that was placed near a south window. I stepped up to the table and noticed some pieces of cotton goods on fire, which I smothered out with my hand. Alongside of the goods that were on fire lay a stereoscopic instrument that was exposed to the direct rays of the hot noonday sun. It so happened that such was the position of the two lenses that they caused a burning focus on the goods and set it on fire. Had we been absent till an hour later, the fire would have extended itself, to the destruction of the house and all that was in it.

Round Mount, Texas.

G. P. HACHENBERG, M. P.

[Accidental fires produced by lenses have frequently come to our notice. The glass globes filled with water and used to contain gold fish will converge the sun's rays to a focus of sufficient intensity to ignite light materials, and have thus started incipient conflagrations. The heavy glass bullseyes sometimes used for dead lights in ships have also produced similar effects; and we once called attention to a remarkable case where a bulb of glass, formed in a large sheet used as a window pane in a store, and due to a defect in the manufacture, proved the means of setting fire to objects displayed inside. Druggists' show globes of colored water also form powerful lenses, and we once knew of an enterprising apothecary who employed them as a cheap source of heat for his distilling apparatus. Of course there have

been many attempts to utilize the high temperature of the sun's converged rays. Huge mirrors have been built to melt refractory substances. Ericsson has devised a solar engine, and probably the latest invention of the kind is M. Mouchot's solar boiler, where the steam generator is placed in the focus of a concave reflector.—EDS.]

THE *Scientific Farmer* says that the best way to prevent overheating of compost is to pack the surface down solidly, by simply treading upon the heap with the feet (after pulverization), or, still better, to spread a little earth over the pile, taking care to pack it somewhat. Either method tends to exclude air, and thus prevents too rapid oxidation.

NEW BOOKS AND PUBLICATIONS.

ELEMENTS OF PHYSICAL MANIPULATION. By Edward C. Pickering, Thayer Professor of Physics in the Massachusetts Institute of Technology. Part II. Price \$4. New York city: Hurd and Houghton, 13 Astor Place.

Professor E. C. Pickering's first volume was received with general favor. He has now largely extended the scope of the work, and has introduced subjects not usually considered to belong to the domain of pure physics. The new volume contains an admirable chapter on mechanical engineering, including details of boilers, steam pipes, and indicator diagrams, as well as articles on speed and friction of shafting, belts, and pulleys. The friction brake and transmission dynamometer are fully explained; and some valuable methods of testing speeds of piston rods, shafts, and fly wheels, which are, we believe, entirely new, are described and illustrated. The apparatus employed in the growing science of meteorology occupies one of the most interesting chapters in the book; and the section headed "Practical Astronomy" contains a clear description of the instruments in common use for nautical and stellar observation. Tables of squares, cubes, powers, logarithms, tangents, and sines, and of the properties of metals, liquids, gases, and vapors, are added in appendices, with full explanations. The description of a good physical laboratory and a list of test experiments for students' use complete the work. The laboratory described is that under the charge of the writer, in which about 100 students are instructed every year. We cordially commend the work to all teachers of science classes, as one which they should study themselves and place in the hands of their pupils.

HANDBOOK OF ELECTRICAL DIAGRAMS AND CONNECTIONS. By Charles H. Davis and Frank B. Rae. Price \$1.50. New York city: The Graphic Company, Park place.

The authors of this work are employees of the Western Union Telegraph Company in this city; and by their joint labor, they have produced a book of the highest value to the telegraph profession. It contains engravings of all the instruments (single, duplex, etc.), relays, batteries, etc., in ordinary use, with well written and detailed descriptions. The historical portions of the book are especially commendable for their accuracy, and for their fairness to the many claimants to the credit of originating the telegraph and its details, who are frequently so numerous and so contradictory as to bewilder the reader. Thirty plates and a map of the world showing all the telegraph cables in existence are added, all being executed by photolithography. In the best style of the art. The work is one of the most complete and useful handbooks we have seen for some time.

THE INFLUENCE OF THE BLUE RAY OF THE SUNLIGHT AND OF THE BLUE COLOR OF THE SKY, IN DEVELOPING ANIMAL AND VEGETABLE LIFE, ETC., as illustrated by the Experiments of General A. J. Pleasonton and others. Philadelphia, Pa.: Claxton, Remsen, and Haffelfinger.

A good description of the purport and matter of this remarkable work appears in an article on p. 388 of our volume XXXIV. We have little to add to the description there published, except that the book itself is more eccentric than we could have believed, unless guided by a perusal of its contents. The incidents of the cure of rheumatism in a mule by putting panes of blue and colorless glass in the transom window of its stable, the cure of a woman suffering from a complication of undescribed disorders by a similar application, the cure of spinal disease by use of a bath of blue light, and many similar cases cited by the author, remove this book beyond the sphere of legitimate criticism, and place it among the many melancholy burlesques of science and inductive investigation, by the publication of which certain authors are now trying to obtain notoriety.

PRACTICAL TREATISE ON THE CONSTRUCTION OF IRON HIGHWAY BRIDGES, with a Short Essay on the Application of the Principle of the Lever to the Analysis of Strains. By Alfred M. Boller, A. M., Civil Engineer. Price \$2.50. New York city: John Wiley & Sons, 15 Astor Place.

The author states in his preface that he intends this work for the use of town committees; and he has succeeded in producing a work that will be useful to any such bodies having to provide for the construction of bridges. The points to be regarded in designing an efficient structure are enumerated and fully described; and the author's cautious advice regarding specifications and contracts will, if followed, relieve local authorities from much responsibility as to the security of the work. The book is likely to disseminate some practical knowledge of great value and importance.

THE CENTENNIAL NEWSPAPER EXHIBITION, in Fairmount Park, Philadelphia. New York city: George P. Rowell & Co., Park Row.

The publishers of this volume own the well known extensive advertising agency in this city, and the admirable display of American newspaper literature at the Centennial is due to their zeal and enterprise. A description of the very large and varied exhibit of our newspapers and the statistics of American journalism will be found in this handbook, which should be read by every visitor to the Centennial Exhibition, who will find in the Newspaper Building one of the most attractive displays to be found in the whole show.

CHEMISTRY, THEORETICAL, PRACTICAL, AND ANALYTICAL, as Applied to Arts and Manufactures. Parts V. to X. Philadelphia, Pa.: J. B. Lippincott & Co., 715 Market street.

The publication of this work was announced when the first four numbers reached us; and the subsequent ones need no comment, being printed in similarly handsome style, with the same characteristics. We must, however, again protest against the concealment of the names of the compilers. Twenty dollars is too much to pay for a book which does not establish its authenticity and accuracy by giving information as to its authorship.

PRINCIPLES OF APPROXIMATE COMPUTATIONS. By Joseph J. Skinner, C. E., Instructor in Mathematics in the Sheffield Scientific School of Yale College. New York city: Henry Holt & Co.

This treatise is likely to prove of especial value in solving those numerous problems which involve repeating decimals, as well as those in which occur measurements with instruments capable of giving only a limited degree of precision. These difficulties are dealt with by the author in a very practical manner; and his method produces results which are little at variance with those obtained by continued calculation.

THE AMERICAN SYSTEM, GERMAN. A Record of Professor C. C. Schaeffer's High School Test Course. Philadelphia, Pa.: Charles, Brother, & Co.

This book is the record of a vast amount of information, imparted to the pupils of the Philadelphia Central High School, in six lessons of 45 minutes each. Although published without any evident order or arrangement, it contains several excellent features, among which may be mentioned the construction of German sentences, the explanations of gender and *Umlaut*, and a quaint lecture on "The Philosophy of the English Language."

PRICE LISTS OF GOODS MANUFACTURED IN THE BIRMINGHAM DISTRICT, ENGLAND. Part I. London, England: Published by the Proprietors of "Iron," 12 Fetter Lane.

HIGH MASONRY DAMS. By John B. McMaster, C. E., Author of "Bridge and Tunnel Centers." Price 50 cents. New York city: D. Van Nostrand, 23 Broadway and 27 Warren street.

A practical and valuable little treatise, being No. 22 of Mr. Van Nostrand's Science Series.

SEVENTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF MASSACHUSETTS, just published, is replete with useful information. Most of the legislative publications of the Old Bay State are so; but this cannot be said of many statistical reports issued by some other States, or of a great number which are authorized and published by approval of Congress. We are indebted to the State Board of Health, each year, for an early copy of their report, from which we are enabled to extract much useful information for our readers. The document before us leaves no branch of the subject of sanitary science untouched; and the statistics, especially those affecting population and mortality, are sufficient to convince any one of the national importance of the compulsory observance of health regulations. The report, moreover, furnishes to other State and city boards an excellent mode for the preparation of such volumes, and a guide for the investigation of the subjects, which it would be well for them to follow.

DECISIONS OF THE COURT**Supreme Court of the United States.**

PATENT ERASER PENCILS.—JOSEPH RECKENDORFER, APPELANT, vs. RICHARD FARMER.

Appeal from the Circuit Court of the United States for the Southern District of New York.

MR. JUSTICE HUNT delivered the opinion of the Court. This is an appeal from a decree of the United States Circuit Court for the Southern District of New York, dismissing the bill of complaint which was filed to restrain the infringement by the respondent of certain letters patent, and for an accounting and damages.

These patents relate to the manufacture of combined pencils and erasers. The first was granted to Hymen L. Lipman, March 30, 1858, and was extended for a further term of seven years from the 30th of March, 1872.

The material parts of the specification are as follows: "I make a lead pencil in the usual manner, reserving about one fourth of the length, in which I make a groove of suitable size, A, and insert in this groove a piece of prepared India rubber (or other erasing substance) secured to said pencil by being glued at one edge; the pencil is then finished in the usual manner, so that on cutting one end thereof you have the lead B, and on cutting one end you expose a small piece of India rubber, C, ready for use, and particularly valuable for removing or erasing lines figures, etc., and not subject to be soiled, or mislaid on the table or desk."

"In making mathematical, architectural, and many other kinds of drawings, in which the lines are very near each other, the eraser is particularly useful, as it may be sharpened to a point to erase any marks between the lines; and should the point of the rubber become soiled or inoperative from any cause, such cause is easily removed by a renewed sharpening, as in the ordinary lead pencil."

The claim is as follows: "I do not claim the use of a lead pencil with a piece of India rubber, or other erasing material, attached at one end for the purpose of erasing marks; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the lead and India rubber, or other erasing substance, in the holder of a drawing pencil, the whole being constructed and arranged substantially in the manner and for the purposes set forth."

The drawings forming part of the specification exhibit a continuous sheath of uniform size, with interior grooves of different sizes: the eraser groove being larger than the lead groove.

The second patent is for an improvement upon the invention of Lipman, and was granted to Joseph Reckendorfer, the complainant, the 4th of November, 1867, and reissued on the 1st of March, 1872.

The material parts of the specification are as follows: "My invention is intended to provide a means whereby articles of greater size or diameter than the lead may be securely held in the head of a pencil of otherwise ordinary or suitable construction without mauling the body of the pencil cumbersome or inconvenient. To this end my invention consists:—

"First.—Of a pencil composed of a wooden sheath and lead core, having one end of the sheath enlarged and recessed to constitute a receptacle for an eraser or other similar article, as hereinafter stated.

"Second.—Of a pencil, the wooden case of which gradually tapers from the enlarged and recessed head towards its opposite end for the whole or a portion of the length, as hereinafter set forth.

"The receptacle for the eraser or other article is formed in the head, without too much weakening the wood, owing to the form of the sheath, while for the same reason the end of the pencil which contains the ordinary lead is not cumbersome nor clumsy, but can be readily held between the fingers, just as an ordinary pencil is."

Having thus described his invention, Reckendorfer claims:—

"1. A pencil composed of a wooden sheath and lead core, having one end of the sheath enlarged and recessed to constitute a receptacle for an eraser, or other similar article, as shown and set forth.

"2. A pencil, the wooden case of which gradually tapers from its enlarged and recessed head toward its opposite end for the whole or a portion of its length, substantially as shown and described."

HOW THE PATENTABILITY OF AN INVENTION IS DETERMINED.

The points we propose here to discuss are two: First. Is the article, patented by the plaintiff and his assignor, and for the infringement of which patents this action is brought, a patentable invention within the laws of the United States?

Second. Is it within the power of the courts to examine and determine this question, or is the decision of the Commissioner of Patents, when, by issuing a patent, he decides that the invention is patentable, final and conclusive on the point?

The plaintiff contends that the decision of the Commissioner is conclusive upon the point of invention, and that the question, as distinct from that of want of novelty, is one not open to the judgment of the court. In the natural order of things this question is the first one to be examined. For if it shall appear that the contention of the plaintiff is correct, in the respect, the question in regard to the patentability of the instrument now before us will not arise. The point will have been decided for us, and by a controlling authority.

The act to revise, consolidate, and amend the statutes relating to patents and copyrights, passed July 4, 1836, (3 U. S. Stats., 115,) is the act regulating this case.

By the 4th section thereof it is enacted "that any person having invented or devised any new and useful art, machine, manufacture, or composition of matter not known or used by others before his invention or discovery thereof, and not at the time of his application for a patent in public use, or on sale with his consent or allowance as the inventor or discoverer, and shall desire to obtain an exclusive property therein, may make application in writing to the Commissioner of Patents, expressing such desire, and the Commissioner, on due proceedings had, may grant a patent therefor." He shall make oath that he believes himself to be the first inventor or discoverer thereof, and that he does not know or believe that the same has ever before been used."

Looking at this section alone it may be safely said no one is entitled to a patent unless (1) he has invented or discovered an art, machine, or manufacture, (2) which art, machine, or manufacture is new, (3) which is also useful, (4) which is not known or patented as therein mentioned. It is not sufficient that it is alleged, or supposed, or even adjudged by some officer to possess these requisites. It must in fact possess them, and that it does possess them the claimant must be prepared to establish in the mode in which all other claims are established, to wit, before the judicial tribunals of the country.

The 11th section of the act (p. 120) provides that on the filing of any such application, etc., and the payment of the duty required by law, the commissioner shall make, or cause to be made, an examination of the alleged new invention or discovery, and if on such examination it shall not appear to the commissioner that the same has been invented or discovered by any other person in this country prior to the alleged discovery, or patented or described in any foreign publication, or been in public use, or on sale with the consent of the applicant, and if he shall be of the opinion that the same is sufficiently useful and important, the commissioner shall issue a patent therefor.

Before the commissioner is authorized to issue a patent it must appear to him that the claimant is justly entitled to a patent, that is, that his art, machine, or manufacture possesses all the qualities before mentioned. The commissioner must also be satisfied that if it possesses these qualities it is sufficiently useful and sufficiently important to justify him in investing it with the *prima facie* respect arising from the governmental approval. These restrictions are wise and prudent, are intended to secure at least a probable advantage to those who deal with the favorites of the government, for they may justly be so termed who receive the exclusive right of making or using, or vending particular arts or improvements.

THE JUDGMENT OF THE COMMISSIONER OF PATENTS NOT CONCLUSIVE.

It is nowhere declared in the statute that the decision of the commissioner as to the extent of the utility or importance of the improvement shall be conclusive upon that point, but in the section just quoted it is placed in the same category with the want of novelty and the other requisites of the statute, and it is expressly conceded by the appellant that the judgment of the commissioner on the question of novelty is not conclusive, but that that point is open to examination. On that subject the practice of the courts is uniform in holding it to be subject to enquiry.

The plaintiff's counsel, in his brief, put his argument in this form: "The commissioner, then, passes on these questions: 1. Did the applicant himself make the invention? The question is settled by his oath. This is true to the extent and for the purpose of issuing a patent, and to that extent only. When the patentee seeks to enforce his patent, he is liable to be defeated by proof that he did not make the invention. The judgment of the commissioner does not protect him against the effect of such evidence."

"The counsel says: was the invention new? This question is solved by the examination required by the act. To the same extent only. The defence of want of novelty is set up every day in the courts, and is determined by the court or the jury as a question of fact upon the evidence adduced, and not upon the certificate of the commissioner. "2. The counsel says again: Is the invention sufficiently useful and important? This the commissioner settles for himself by the use of his own judgment. It is a question of official judgment. These questions are all questions of official judgment, and are all settled by the judgment of the commissioner. His judgment goes to the same extent upon each question. He determines and decides for the purpose of issuing or refusing a patent. When the patent is sought to be enforced, the questions, and each of them, are open to judicial examination. We see many reasons why all the questions of invention, novelty, and prior use should be open to examination in each case, and we believe to be the course of the authorities and practice of the courts."

reference to some of the most recent cases, and to those decided by this court will be sufficient. A review of all the cases in this court and the various circuit courts where this question has been alluded to will not be profitable.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

For Bolt Forging Machines and Power Hammers. address S. C. Forsyth & Co., Manchester, N. H.

Baxter Wrenches fit peculiar corners. Prices reduced. Greene, Tweed & Co., 18 Park Place, N. Y.

Perfect Stave Jointer.—Patented Sept. 28, 1875. For Sale, State rights, or on Royalty. Sample Machine furnished. Address B. Barker, Ellsworth, Me.

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Baxter Steam Engine.—For Illustrated Pamphlet, address Wm. D. Russell, Pres., 18 Park Place, N. Y.

Baxter Steam Engines, Machinery Hall, U. S. C. Exhibition.—In motion, and in charge of Wm. D. Russell, Pres.—Section D.10, Col. 74. Office, 18 Park Pl., N. Y.

Hill's Patent Direct-Acting Steam Drop Hammer will be illustrated shortly in the Scientific American. Address Hill & Williams, Quincy, Ill., for circular.

"Double-Entry Book-Keeping Simplified"—The simplest and most practical book on the subject. Cloth, \$1. Boards, 75 cts. Sent post paid. Catalogue free. D. B. Waggener & Co., 429 Walnut St., Philadelphia.

For Sale.—35 in. 6½ ft. Lathe, \$400; 22½ in. 12 ft. do., \$250; 20 in. 7 ft. Stover do., \$215; 18 in. 8 ft. do., \$150; 16 in. 7 ft. new do., \$300; 13½ in. 6½ ft. do., \$125; 16½ in. 6½ ft. do., \$140. Shearman, 45 Cortland St., N. Y.

For Sale.—Bran new Engines, with gov'r, heater, pump & wheels 7x10, \$215; 8x12, \$300; 10x15, \$675; Bran new Boiler, 8 H.P., \$300; 2 H.P., \$150; 4 H.P., \$180. Shearman, 45 Cortland St., New York.

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Centennial Exhibition, Philadelphia.—Examine the Allen Governors, Machinery Hall, D. 9, Par. 71.

Machine-cut brass gear wheels, for models, &c. List free. D. Gilbert & Son, 212 Chester St., Phila., Pa.

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The French Files of Limet & Co. have the endorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, French Department, Centennial Exposition. Homer Foot & Co., Sole Agents, 22 Platt St., New York.

Trade Marks in England.—By a recent amendment of the English laws respecting Trade Marks, citizens of the United States may obtain protection in Great Britain as readily as in this country, and at about the same cost. All the necessary papers prepared at this Office. For further information address Munn & Co., 37 Park Row, New York City.

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Notes & Queries

M. J. G. can give a gloss to writing ink by dissolving a little refined sugar in it.—J. W. is confusing brass and bronze. The former is made with zinc, the latter with tin. The article on manganese bronze, p. 353, vol. 34, is perfectly correct.—C. W. T. will find particulars of a fast railway train in this country on p. 393, vol. 34. Mr. Brunel's 78 miles an hour was done on the Great Western Railway, England.—W. W. B. will find on pp. 329, 330, 352, vol. 34, a history of the progress of the past century.—A. V. W. can remove ink from writing paper by the process described on p. 154, vol. 34.—A. P. can calculate the proportions of screw-cutting gears by the method described on p. 107, vol. 34.—T. W. M. will find a description of the Gulf weed on p. 91, vol. 31.—G. T. W. will find an answer to his cannon and car question on p. 273, vol. 32. As to the relative speeds of the top and bottom of a wagon wheel, see p. 298, vol. 31.—K. L. C. will find a description of the operation of a fly wheel on p. 288, vol. 28.—J. F. S. will find on p. 329, vol. 33, a description of a battery suited to an electric light.—G. will find on p. 213, vol. 34, directions for making polishing starch for laundry use.—F. J. R. will find on p. 344, vol. 34, particulars of the fastest trains on record.—A. S. can prepare fulminate of mercury by the formula given on p. 234, vol. 30.—S. G. A. can measure high temperatures with a pyrometer. See p. 59, vol. 33.—E. E. N. will find directions for polishing metals on p. 57, vol. 34. For the best method of polishing plated work, see p. 251, vol. 33.—R. W. D. and others will find an explanation of the different speeds of points on a carriage wheel on p. 298, vol. 31.—F. W. B. and A. L. will find directions for making colored fires on p. 293, vol. 34.—G. D. can purify water for drinking purposes by the process described on p. 395, vol. 32.—O. can lacquer his fine brass work. See p. 242, vol. 34.—W. J. McL. will find on p. 376, vol. 24, a description of the use of the steam plow in this country.—J. H. M. will find on p. 74, vol. 32, a recipe for balloon varnish.—E. B. R. will find on p. 214, vol. 32, a description of a boiler injector.—C. M. N. can bleach straw hats with sulphurous acid. See p. 11, vol. 32.—D. J. T. will find on p. 348, vol. 34, a description of the deepest well.—A. A. S. will find on p. 331, vol. 32, directions for measuring the piece of timber.—E. A. M. will find on p. 189, vol. 26, directions for proportioning cone pulleys.—E. O. R. can find on p. 186, vol. 34, a recipe for a depilatory.—E. D. R. will find on p. 186, vol. 34, directions for nickel-plating his brass instruments.—B. F. J. should consult a physician.—W. F. B. does not state what his boiler covering is made of.—P. F. E.'s question is merely metaphysical.—M. B. can bronze brass castings by the method described on p. 51, vol. 33.—D. H., C. W. S., J. B. H., C. F., B. L., W. B., R. J., R. N., E. N., S. V. N., M. D., W. K., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) J. H. Jr. asks: 1. To what extent will a column of mercury expand when contained in a ½ inch pipe, 2 feet long, a gentle heat being applied? A. Mercury expands about 6018 of its volume when heated from 32° to 212°. 2. Will mercury, when confined, expand with great force, like iron or other metal when slightly heated? A. Yes. 3. Will mercury injure iron in any way? A. Under ordinary conditions, no.

1. When gunpowder is exploded, is it changed into gas? A. Yes. 2. Could a little be exploded in a strong iron vessel until a great pressure is obtained, and the gas then be used to drive an engine? A. Such plans have been proposed. Usually, however, the gunpowder is inimical to confinement.

(2) F. C. S. says: 1. I am running a small engine of six horse power, but the boiler is rated at 12 or 15 horse. How many bushels screenings ought it to take to run the engine one day? A. The question is too indefinite. 2. What kind of grate ought we to use for screenings? A. One with narrow air spaces. 3. Which is the most economical, to keep a thick or thin layer of screenings for the fire? A. That depends somewhat upon the draft; and any one can readily settle the matter for his particular case by a few trials.

(3) E. P. says: I have occasion to use permanganate of potassa solution in staining wood-work, and have had some trouble on account of its affinity for metals. Of what metal shall I make a tank 2 feet by 4 feet, and 8 inches deep, to contain permanganate of potassa solution? A. In contact with strong solutions of this salt, all of the more common metals are gradually oxidized and dissolved. Vessels of glass, porcelain, or porcelain-lined iron may be employed; or, in case these cannot be obtained of sufficient capacity, tanks or wells made of brick, and lined with large flags and good cement, could be made to serve your purpose.

(4) J. C. O. asks: What effect will kerosene oil have on galvanized iron? A. If the oil contains no free mineral acids, it will not injure the iron. Galvanize your iron on both sides.

(5) E. H. M. says: 1. I am running 5 pairs of stones, using hard coal screenings. Will the arrangement work equally for burning soft coal slack, tan bark, etc.? A. It does not necessarily follow that a furnace giving good results with refuse coal will also answer for wet tan and sawdust. 2. I get an intense heat, but am afraid my boiler will not stand it, as I have only 20 feet of

fire grate surface. Would it be better to double the grate surface, and keep a thinner fire? A. If you will send us a sketch of your furnace, we will be glad to give our opinion. From your account you seem to be doing very well.

(6) S. H. asks: Is there any way of sawing cast steel bars as large as 6x1½ inches, when hot? A. Bars of steel or iron of any size can be cut off, either hot or cold, with a circular frictional disk running at great velocity. The rim of such a saw should travel at about 20,000 feet per minute.—J. E. E. of Pa.

(7) W. K. P. asks: Will you please be kind enough to give me a good recipe for making red calcium lights, such as are used on stages, tableaux, etc.? A. Place the light in a suitable lantern provided with a large condensing lens. The color of the rays may then be varied to suit the fancy by interposing near their focal point pieces of thin, finely colored glass. The glass employed for this purpose should be small, well annealed, of uniform texture, and as thin as possible.

(8) G. T. W. asks: If there be a hill three miles over and one across the base, would it take any more stakes or palings to build a fence over the hill, three miles, than to build one across the base, one mile, if the stakes or palings stand perpendicularly? A. No.

(9) W. B. says: 1. Animal and vegetable oils will bleach in the spring when we have cool days (in the ordinary glass bleaching houses, such as are familiar to all oil manufacturers, and which resemble an ordinary hot house) much faster than they will at midsummer, when the sun is stronger and the atmosphere hot. Why is this so? An ordinary observer would suppose that, the hotter the sun was, the faster the oil would bleach; but this is not the case. A. The bleaching quality of sunlight is chiefly confined to the more refrangible rays of the upper or violet end of the spectrum. They seem to act by virtue of a peculiar reducing or deoxidizing power; while the heat rays, or those from the lower or red end of the spectrum, on the contrary, serve to stimulate oxidation and fermentation. This latter force is comparatively slow in its action in comparison with the activity of the former, and can therefore only slightly influence or retard the final results. 2. Can you tell me the reason why hothouses and forcing houses for plants are always ventilated at the top? A. You are mistaken as to the fact.

(10) R. H. says: In making French mustard, I have some trouble in bottling the same. After being bottled, it ferments and forces the corks out, and smells badly. What can I do to prevent this? A. After filling the bottles, place them loosely stoppered in a large vessel of water, which gradually raise to the boiling point. Then remove the bottles and seal them. It is common to allow the bottles to stand 48 hours before performing the above operation.

(11) F. McA. asks: With what can I clean diamonds? A. You fail to state with what the stones are soiled. Try the following list of substances in the order named: Water, alcohol, ether, hot benzole or naphtha, bisulphide of carbon, dilute acids, dilute alkalies, strong acids, strong alkalies, mechanical friction with putty powder, rouge, fine emery.

(12) F. J. says: I wish to have cast a vessel somewhat like the air chamber of a hydraulic ram, but wider at the bottom, being 7½ inches in diameter at base, 19½ inches in widest part, and 12 inches high. What is the least thickness it should have to safely sustain a pressure of 75 to 80 lbs. to the square inch, if made of ordinary cast iron, and of cast malleable iron? A. It should not be less than ¼ or ⅓ of an inch thick, in either case.

(13) J. C. Jr. asks: 1. How can I make a cheap soda water fountain for family use? A. It would be safer for you to purchase one. 2. What is the composition of soda water? A. The so-called soda water is simply water that has been supercharged with carbonic acid gas under pressure. When allowed to escape from under pressure, a portion of the dissolved gas escapes into the air, causing the effervescence or briskness of the beverage.

(14) H. S. K. says: In making small anchovy casks, the staves are cut with a bilge, and leak. The brine oozes out through the pores of the oak because they are cut with the bilge. Is there any preparation that will make them tight? A. It is common to fill the pores of the wood with hot resin. If this does not give satisfaction, try the following: Make a strong solution of glue in hot water and add a sufficient quantity of tannin to precipitate all the glue. Wash this precipitate of tannate of gelatin (artificial leather) in running water for some time, dissolve it in boiling vinegar, and while hot flow the interior of the cask with the liquid. Allow it to partially dry, and then fill the cask with clean water, allow to stand for several hours, and finally remove the water, invert the cask, and allow to dry.

(15) J. M. M. asks: 1. How can I bleach stearin at one operation? I am at present obliged to melt the stearin twice (for making candles); the first melting leaves it too yellow. A. Your method is perhaps one of the most practical and economical. 2. What is the cause of the yellowish tint? A. The color is due to a mechanical admixture of liquid oleic acid with the crystals of the solid stearic and margaric acids.

(16) J. M. H. asks: Has there ever been invented any means to destroy the dead center in an engine? A. Yes. Rotary engines have no dead centers.

(17) A. I. P. asks: 1. How can the two rules, published on p. 33, vol. 33, and p. 276, vol. 34, relating to the power of small engines, be re-

conciled? A. The first rule is for the actual horse power, and includes deductions for friction of pipes, friction of mechanism, condensation, radiation, etc. To apply the second rule, the average steam pressure, which would not be equal to the initial pressure, must be known.

(18) R. B. says: I am about to organize a fire brigade, each man to be armed with, among other things, a knotted cord 20 feet long with a hook on the end, so that he can go upon the roof of a building and sustain himself by the hook and cord from the ridge pole. Can a rope be so prepared as to be non-combustible, that is, when in use as described? A. Probably the best thing you could use would be rope of galvanized iron wire, which is very strong and quite flexible. Knots can easily be made at intervals by weaving in a single strand of wire with the strands of the rope, so as to form the rings called by sailors Turk's heads. We cannot positively recommend any of the various fireproofing solutions when life depends on their efficacy. Tungstate of soda in solution is employed for fireproofing fabrics but might not prevent charring, which would greatly weaken the rope. You might carry a core or strand of iron wire through the line, and use tungstate of soda in addition, the wire being strong enough to bear a man's weight in case the rope should be burnt through.

(19) E. O. says: Can you tell me how to treat wood so as to make a good plate for an electrical machine? A. There is no good way. Use glass or ebonite.

(20) H. M. W. says: 1. In your article on the apparent size of the moon, p. 305, vol. 34, you say that a ¼ inch hole at 23 inches distance would bring it under an angle of half a degree. What are we to understand 1° to be at that distance? A. Nearly ½ an inch, more correctly 0.47 inches. 2. In figuring I find 1° of a circle 11.46 inches in diameter to be ⅓ of an inch, which would make ¼ inch at that distance occupy 2.5°. Am I correct? A. You are correct, and so were we. If a quarter inch hole at the distance of 6 inches is seen under an angle of 2.5°, it would at a distance of 28 inches be seen under an angle of 6x2.5° divided by 28, or 0.233 inch, for which we use 0.25 or ¼ inch, intending that the hole should slightly surpass the apparent size of the moon so as to allow the observer to see the edges.

(21) A. B. asks: Does the temperature of zinc and mercury rise when a current of electricity passes through them? A. No.

(22) F. I. M. says: 1. I have made a telegraph sounder and wound it with No. 20 (English gage) wire, 20 feet on each spool. It works well enough by itself; but when I put it on a line with other instruments, it fails. I think the wire is too large. What number (American gage) of wire should I have, and how many feet on each spool? A. Nos. 20 to 23 are good sizes; but there should be about 150 or 200 feet. 2. Where can I get full instructions for making an induction coil? A. See p. 344, vol. 33, and p. 362, vol. 31.

(23) C. S. M. asks: What is a birdseye view? A. It is a view taken from above the object, and is always a perspective, except when taken looking directly down.

(24) W. says: I have a building to protect from lightning. The size of tin roof and cornice is about 80 x 114 feet, and the house is about 35 feet from a canal, about 60 feet wide and many miles long. Will a rod of ordinary construction, with the lower end of it in the water of the canal or in the wet mud at the bottom of it, have a sufficient contact to give full protection? If not, what do you recommend? A. It should be understood that all conductors offer some resistance to the passage of electricity, and that a current divides among several conductors in proportion to their conducting powers. The materials of a building are to some extent conductors, consequently, unless the resistance of the rod and its connections with the earth are almost infinitely less than that of the building, some of the charge will pass by way of the latter. As a general thing the ordinary rod offers sufficiently long resistance or is a good conductor; but the earth connections in nine cases out of ten are faulty. Water is a better conductor than damp earth, to be sure; but the fact that an equal volume of water or of earth offers very many times greater resistance than metals seems to be overlooked. In order to reduce the resistance at the junction of the rod with the earth, the latter must have great surface contact with the former, and this is only effected by using exceedingly large metallic terminals for the rods. The statement of requirements referred to is not, in the main, extravagant.

(25) M. S. S. asks: 1. Have the poles of the earth the same temperature? A. It is supposed so. 2. Have they the same length of night and day? A. Yes, when the sun is on the equator. 3. How near to the poles does the land extend? A. That has not yet been determined.

(26) G. R. T. asks: Why does the moon go farther north and south than the sun? A. Because the moon's orbit is inclined 5° 9' to the ecliptic, which causes her to go north of the equator 28° 30', and also the same distance south, while the sun goes only 23° 27'.

(27) D. H. asks: 1. What pressure ought a boiler 18 inches long and of 6 inches diameter, made of ⅝ inch copper, to stand per square inch, if bound with hoops of same metal, ¾ inch wide and 3 inches apart? A. It would be safe to carry from 75 to 80 lbs. 2. What size ought the cylinder to be in proportion to this boiler? A. Diameter ¾ x 1½ inches stroke, 3. What should be the diameter of the fly wheel? A. Make it 4 or 5 inches. What is the easiest method of cleaning old files? A. Use a wire scratch brush.

(28) D. F. asks: How much steam will it take to lift 2,000 lbs. off a ¾ inch pipe, inside diameter? A. Divide 2,000 by the area of the pipe which gives nearly 25 square inches.

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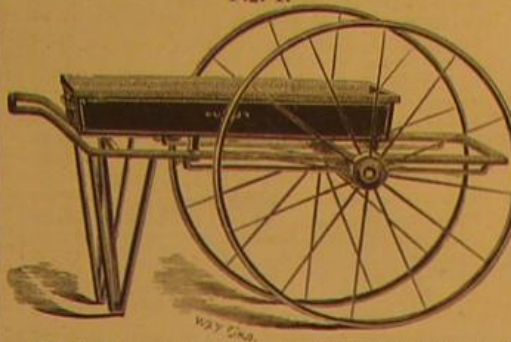
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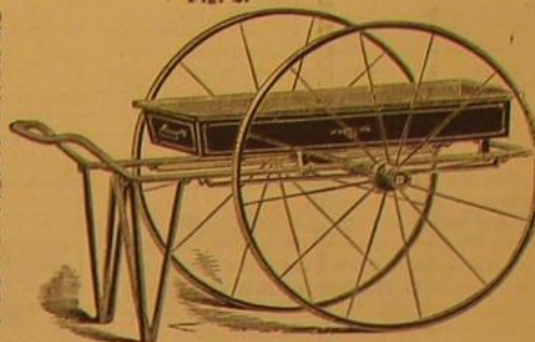
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[NEW SERIES.]

NEW YORK, JULY 8, 1876.

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IMPROVED UNIVERSAL MILLING MACHINE.

The universal milling machine has long been known as one of the most useful of machines, on account of its adaptation to produce a large range of work in the making of small tools. It is readily applied to the execution of the endless variety of small jobs which, without it, have to be done, in every machine shop, by hand labor. The size of milling machines heretofore made has been suitable for the work upon twist drills, mills with spiral or straight teeth, the cutting of small gears, grooving, slotting, and all ordinary operations of milling upon tools usually employed on sewing machine work and other light machinery, and also by gun makers.

The machine represented in the engraving is of a larger size and has important additions to enlarge its range of work. It is provided with an adjustable center for supporting the end of the arbor carrying the cutters or mills. By the use of gear-in: upon the head of the machine, it is capable of making very heavy cuts. The anti-friction form of spindle and boxes are retained, and both spindle and boxes are of cast steel, hardened and ground. All the motions for producing angles, spirals, and bevels in use upon the smaller machine are applied to this larger size. The apparatus is especially designed for use by engine and locomotive builders, and upon a heavy class of machine tools.

Further information can be obtained by addressing the makers, Brown & Sharpe Manufacturing Company, Providence, R.I. The machine itself may be seen in the Centennial Exposition, in Machinery Hall, where it is located near the large Corliss engine.

New Test for Nitric Acid in Water.

Nitric acid is one of the few acids all the neutral salts of which are soluble in water, rendering it impossible to precipitate it as we do sulphuric and other acids. A large number of tests have been proposed, and several are in use, a very delicate one being brucine, to which it imparts an intense red color. Professor A. Vogel, of Munich, employs gold leaf, which dissolves in the aqua regia formed on adding hydrochloric acid. If 1-2 cubic inches of water be mixed with hydrochloric acid and gold leaf, and evaporated, a large percentage of nitrates is indicated by the gold leaf growing smaller, and the solution turning yellow. If the quantity of nitrates is small, the gold is detected by chloride of tin; and even when very little gold has been dissolved, a light red precipitate will be noticed on standing. The advantage of this is that no sulphuric acid is employed, as this frequently contains nitric acid and other oxides of nitrogen, which make the reaction doubtful.

The Hog Bouncer—A Novel and Useful Invention.

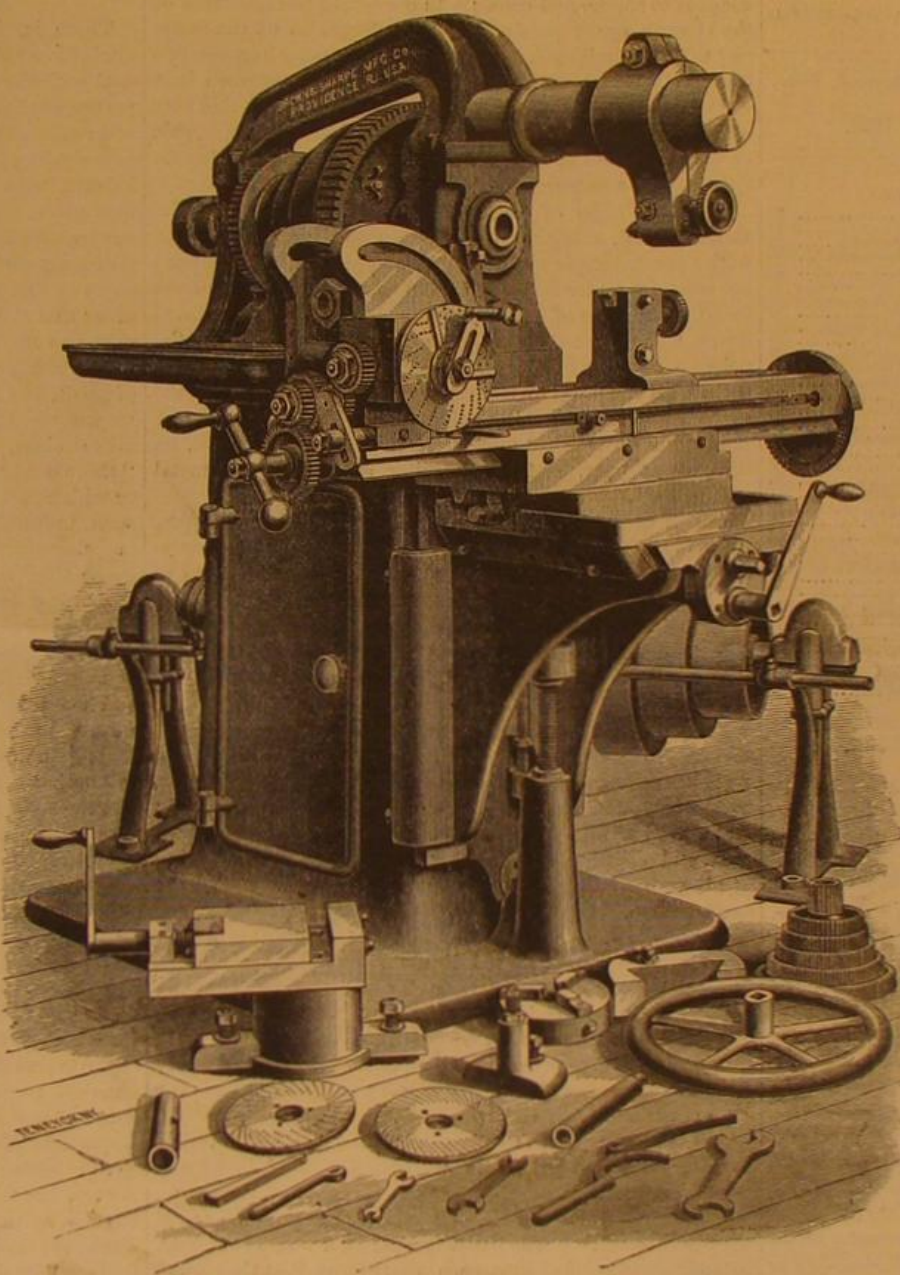
The above is the name of a simple device invented by the cattle yard men at West Albany, New York, to induce hogs to move, from the cars in which they are transported, into the yard. Pigs, as a rule, are not of accommodating dispositions; and when it comes to prevailing upon a car load of them to move along upon a narrow gangway, the first ones that start upon the plank are apt to decline to proceed further, and so block the egress of the rest. This necessitates an astonishing amount of patience and beating, besides unlimited strong language, and of course often delays a cattle train for some time. The new invention for persuading the animal to pass on is the hog bouncer, made by bringing one end of the gangway plank to a firm support; then under the other end, two double car springs are placed. A powerful lever and a spring catch complete the device. Before the car door is opened, the platform is carried down so as to compress the springs by the lever, and the catch is hooked. The hogs are then allowed to pass along the platform, and, so long as they move along properly, the plank is undisturbed; but as soon as a crowd congregates and vociferously objects to going further, the catch is sprung. One end of the platform flies about three feet upward, and the result is a shower of living porkers, shot over the heads and upon the soft bodies of the drove. They are seldom injured, but vastly astonished; and it is needless to add that the blockade is at once dispelled. The drovers find this device, ridic-

ulous as it is, very useful in saving time and trouble, especially when, as often is the case, large numbers of cattle trains are arriving and leaving.

U. S. Revenue Marine Service.—Requirements of Candidates as Engineers.

The following recent orders of the Secretary of the Treasury may be useful to persons who desire to secure places as engineers on board of revenue vessels:

No person will be originally appointed to a higher grade than second assistant engineer, nor until he shall have passed a physical and professional examination. The physical examination shall precede the professional; and if a



UNIVERSAL MILLING MACHINE.

candidate be condemned physically, he will not be examined further. The passing of an examination must not be considered as giving assurance of appointment, as the department reserves the right to select persons of the highest attainments, in case there should be more candidates than vacancies.

A candidate for an appointment as second assistant engineer must not be less than twenty-one nor more than thirty years of age; he must be of good moral character and correct habits; he must have worked not less than eighteen months in a steam engine manufactory, or else have served not less than that period as an engineer on board a steamer provided with a condensing engine, and must produce favorable testimonials from the director or head engineer as to his ability; he must be able to describe and sketch all the different parts of the marine steam engine and boilers, and explain their uses and mechanical operation, the manner of putting them in operation, regulating their action, and guarding against danger.

He must be well acquainted with arithmetic, rudimentary mechanics, write a fair legible hand, and have some knowledge of the chemistry of combustion and corrosion.

Candidates who exhibit the highest degree of practical experience and professional skill will be given the preference, both in admission and promotion.

Any person producing a false certificate of age, time of service, or character, or making a false statement to a board of examination, will be dropped immediately.

The Clematis.

Few plants, of late years, have received more attention than the clematis for out-of-door decoration, and few are better adapted for cultivating as climbers in cool greenhouses, for covering some unsightly object in the pleasure grounds, for training on a trellis, and for training up the posts of the veranda. The gorgeous flowers of most of the varieties are really very attractive the colors of the different kinds being white, blue, pink, and purple. The flowers of the native one, *c. virginiana*, are small and inconspicuous, of a greenish color. *C. vitalba*, or traveler's joy, is one of the most rampant growers in cultivation, and useful for covering quickly any large screen or trellis. Its flowers, however, are small and unattractive. From China and Japan have been introduced the most showy kinds we have, and from which have been raised most of the excellent varieties now to be found in our gardens. Of these, *c. lanuginosa* is the type. From *c. patens*, a white-flowering one, have also been raised some fine varieties.

The soil most suitable for the clematis is a well enriched, deep, open loam. There is no use in planting in poor soil, and expecting success. During their season of vigorous growth, they luxuriate in plenty of liquid manure. Attend regularly to the training of the young shoots, as they soon get entangled into such a mass that it is almost impossible to separate them. A beautiful position for training them is on some large rock in some open exposure, where they generally bloom freely, and form an inviting object. The propagation of the herbaceous kinds is accomplished by dividing the roots just as they commence to grow. The climbing kinds are generally propagated from layers and cuttings, although, for the purpose of giving more strength to weak varieties, and to produce plants quickly, budding and grafting are resorted to, using for a stock *c. flammula*, a native of Europe, from which have been raised some good varieties. Cuttings of well firmed young wood root most freely, especially if taken from plants growing in a greenhouse. They should be inserted in sand on the benches, or in pots, and get a good, brisk bottom heat, when they will soon root, and, if potted and grown in a genial temperature for a short time, then placed where they can receive more air, and keep in a cool house for the first year, will make excellent plants for putting out of doors the second year. Layering is performed upon well ripened shoots of that year's growth by cutting about half through the shoot, just under a bud, and slitting an inch or two along; then pegging into a pot filled with some porous soil. As soon as well rooted, separate from the parent plant, and treat as described for cuttings. If the layer should not be well rooted in the fall, cut off the shoot and insert as a cutting, giving a gentle heat, when it will soon emit roots from the cut portion.

Pruning should be performed with caution on the climbing varieties which produce flowers on last year's young wood; endeavor always to preserve as much as possible of it. Such kinds as produce flowers on young wood of same year should have all weak shoots thinned out, and buds that will produce good strong shoots encouraged.—*Cultivator and Country Gentleman*.

Demand and Supply in Invention.

An interesting example of the effect of the demand of a mechanical product in securing a supply is illustrated by a recent inventor's experience in his endeavors to procure steel springs of great size and power. It appears that an English inventor has been actively engaged for some time in the construction of a tramway car, to be run by the motive power exerted by steel springs. The reports state that since his earlier experiments Mr. Leveaux has, by indefatigable perseverance, induced the spring makers to astonish themselves by their productions. A band of steel has been rolled, which, when tempered into a spring, will give a draft of 3,000 lbs. Another single band of steel has been rolled, having a width of 4 inches, and a length of 184 feet. In the application of this spring power, the services of stationary engines will be needed to wind them up, and there must needs be a decided loss by friction; and the problem is simply whether the gain by the use of this silent power will offset the loss above indicated.

Центральна Наукова
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Contents.

(Illustrated articles are marked with an asterisk.)

Academy of Sciences, New York.	24	Magnetic engines (7).....	27
Air pump, proportions of (3).....	25	Milk, setting.....	18
Annealing castings (4).....	25	Milling machine, universal.....	15
Answers to correspondents.....	25	New books and publications.....	25
Aqua regia.....	25	Nitric acid, test for.....	25
Architecture, dangerous.....	25	Or-moult.....	25
Astronomical notes.....	25	Patent decisions, recent.....	25
Axles, setting metal.....	25	Patent drive well, the.....	25
Battery current, heat from (3).....	25	Patents, American and foreign.....	25
Battery troughs, coating (3).....	25	Patents, official list of.....	25
Battery wires, etc. (3).....	25	Piston packing rings (3).....	25
Blood and the body, the (17).....	25	Plating with German silver.....	25
Britannia dip (3).....	25	Practical mechanism—No. 6.....	25
Business and personal.....	25	Pump details (14).....	25
Car brake, automatic.....	25	Radiometer, Crookes.....	25
Centennial exposition, the.....	25	Recipes, useful.....	25
Civil engineers' convention, the.....	25	Right-handed, why are we.....	25
Chemists, the.....	25	Russell, W. D.....	25
Copper paint.....	25	Saw gages (13).....	25
Croton oil, applying.....	25	Shaft coupling.....	25
Dental inventions, two new.....	25	Shellac varnish, imitation.....	25
Electro-plating difficulty (15).....	25	Signal buoy, automatic.....	25
Engine details (1, 4, 13).....	25	Slavery in England.....	25
Engineers in U. S. revenue service.....	25	Smoke consumer, a new.....	25
Filings, combustion of (5).....	25	Sound apparatus.....	25
Fire place arch bar.....	25	Spectroscope, applications of the.....	25
Fish at the centennial.....	25	Telegraph, military.....	25
Fluorescence.....	25	Telegraphy, fast cable.....	25
Friction and pressure (3).....	25	Telegraphy, multiple (17).....	25
Glycerol, manufacture of.....	25	Tobacco, artificial.....	25
Hog bonnet, the.....	25	Tools, accurate.....	25
Induction coils (30).....	25	Trade, the value of a.....	25
Insufurial earth.....	25	Vacuum tubes (19).....	25
Invention, demand and supply in.....	25	Vanilla from wood tar.....	25
Lamp chimney, improved.....	25	Vicksburg cut-off, the.....	25
Locomotive drive wheels (11).....	25		

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 2.

For the Week ending July 8, 1876.

TABLE OF CONTENTS.

- I. THE INTERNATIONAL EXHIBITION OF 1876.—British Exhibits.—The Jacquard Loom.—Cloth-Cutting Machine, 1 figure.—Jacket-Knitting Machine, 1 figure.—Middlings Purifier, 2 figures.—Jute Spinners.—Centrifugal Pumps.—Iron Ship Building, Exhibits of the Roach Works.—The Main Building.
- II. ENGINEERING AND MECHANICS.—The Mississippi River Jetty, with 2 engravings.—Head of the Jetty.—The South Pass.—American Society of Civil Engineers.—The Metric System.—Resistance of Railway Trains.—Fast Railway Time.—To Calculate Gear Wheels for Screw-Cutting Lathes, by JOSHUA ROSE.—Ships of War, by N. BARNABY.—Song of the Screw.—Compound Engines, 9 figures.—A 100 Ton Gun.—Steam Street Cars.—Turn Stairs and Elevator, 2 figures.—Improved Governor, 1 figure.—Soft Wood for Timber and Fuel.
- III. ELECTRICITY, LIGHT, HEAT, ETC.—Electro-Magnetism, Brief History.—Electro-Magnet with Flat Spirals.—Vibrations upon Liquids, 4 figures.—Telegraphy without Wires.—Demonstrating the Transformation of Force.—Warning Indicator for Explosive Gases in Mines, etc.—Distribution of the Asteroids.—Reaction Time of the Taste.—New Drawing Apparatus for Microscopes.—Economy of Electricity.—Electro-Motive Changes Produced by Light.—Magnetism-Electricity for Telegraphy.—Constitution of the sun.—Fading of Colors in Zoological Specimens.
- IV. TECHNOLOGY.—Suggestions in Floral Design, 7 figures.—Imitation of Chinese and Japanese Bronzes.—Transferring, Reversing and Transporting Negatives.—Brewing Preparation of Malt Sugar.—Machine for Destroying Potato Beetles.—A Clock without Hands, 1 figure.—New Tool Grinder, 1 figure.—An American Arboretum.
- V. CHEMISTRY AND METALLURGY.—Chemical Examination of the Function of Leaves, 1 engraving.—Separating Arsenic and Antimony.—Glycerol-Phosphoric Acid.—Reactions of Bismuth.—Coloring Power of Aromatic Substances.—New Method of Preparing Hydro-Carbons.—Benzene in Rosin Oils.—Saline Solutions of Copper.
- VI. NATURAL HISTORY, ETC.—The Sulphur Beds of Nevada.—The Gas Wells of Pennsylvania.—Lunar Geology.—The Sleep of Plants.—Perforation of Stone Blocks by Tree Roots, 1 figure.—Arable Earth, 3 figures.
- VII. MEDICINE, HYGIENE, ETC.—Action of Biliary Acids.—Iron in the Spleen.—Photographs of the Blood.—Solubility of Salicylic Acid.—A Grotto of Health.
- VIII. LESSONS IN MECHANICAL DRAWING, by PROFESSOR MACCORD, 55 figures.

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PRACTICAL APPLICATIONS OF THE SPECTROSCOPE.

The uses of the spectroscope may at present be divided into eight classes. The first use is the observation of the luminous colored lines in the spectra of flames, which lines, as it is well known, appear in sets or systems, each substance producing a set of lines, peculiar to itself and not appertaining to any other substance: so that by this means many of the component elements of a substance may be determined by direct observation, without the necessity of going through the laborious process of chemical analysis. Another advantage is that the minutest quantity of material is sufficient for this method: a quantity so small that it would not suffice for a chemical test made in the ordinary way, even if assisted by the microscope.

The second process is effected by enclosing the substance to be examined in a gaseous or vaporous condition in a glass tube, rarefying the gas or vapor, and illuminating it by the passage of an electric spark. Then special lines will appear, which differ, in some instances, from the lines produced by the same substance in a flame, and this by reason of the higher temperature: the local temperature of the atom when exposed to the electric current being the highest we can produce. The current does not heat up the tube, because its quantity of heat is too small, notwithstanding that it is of great intensity. It is evident that any substances easily volatilized, or gases, are adapted to this method of investigation.

The third class of spectroscope observations is especially adapted to solids, and consists in observing the spectrum of the electric spark passing between electrodes of the material to be investigated. Thus the spark passing between two copper electrodes will show the copper line, between iron electrodes the iron lines, etc. The spectrum seen in this way will also be affected by the spectrum of the atmosphere, gas, or vapor between the electrodes, through which the electric spark forces a passage.

A fourth class of observations may be made with the above method, using not the spectroscope, but a microscope with a spectroscopic eyepiece. The easiest way to submit the material under investigation to this test is to reduce the metal to the state of thin foil or plate, cut out a few pointed strips, and attach them to an ordinary glass slide, with the points a distance of $\frac{1}{4}$ of an inch or less apart; then connect them with the poles of a small induction coil, and bring the space between the metallic points into the field and focus of the instrument. Then apply the spectroscopic eyepiece, let the current pass, and the peculiar spectrum of the metal will be seen.

A fifth use of the spectroscope is by attaching the spectroscopic eyepiece to the telescope in place of the microscope: this constitutes one of the most important uses of the spectroscope, and has given rise to a new branch of science, astronomical chemistry; and by its means we have been able to determine the chemical constitution of the sun, stars, and comets, and also of the atmosphere of most of the planets.

A sixth use of the spectroscope consists in the observation of the absorption spectra, when the light forming a complete spectrum is made to pass through a colored transparent medium. A colored glass or a colored liquid is in fact a kind of filter, which lets rays only of a certain color pass, and obstructs all the others. White light consisting of all rays of light, as is proved by its analysis by the spectroscope, we can change it into red by removing all the orange, yellow, green, blue, and violet rays, and this is what a purely red glass or a red liquid accomplishes; we can change it also into blue by removing all the red, orange, yellow, green, and violet rays, and this is what a purely blue glass effects. If, however, we test different colored media in this way with the spectroscope, we find that there are very few pure colors, as most of them will not extinguish all the colors different from their own: thus, for instance, indigo, which is blue, will not extinguish all the red, and its color therefore contains red in its composition. Red blood will not extinguish the blue, but only a portion of the green, forming two broad bands in that part of the spectrum, called the blood bands. These bands are so characteristic of blood, belonging to no other substance whatsoever, that they serve as the basis for legal evidence as to whether suspected spots are blood or not. Some substances, like chlorophyllin, the green coloring matter of leaves, produce a series of such absorption bands in different parts of the spectrum, quite self-characteristic and distinguishing them from all other substances of apparently the same color.

As a seventh class of observations, we may consider the absorption bands produced by colored gases and vapors, such as nitric oxide (especially when heated), chlorine, bromine vapor, iodine vapor, etc., all of which produce peculiar absorption spectra.

Finally we may add an eighth class of observations, that of opaque substances visible by reflected light. Observations of this class are in many instances best made by the microscope armed with a spectroscopic eyepiece; and such observations are best made in direct sunlight. When the sun shines on a piece of white paper placed under the spectroscope, the complete spectrum will be seen; but if on the paper a colored spot be present, and this be brought into the field, at once absorption bands will appear, which will of course differ, not only for substances of every color, but also for substances of the same color, if they be composed of different ingredients. A useful application of this property was recently made by Dr. P. H. Vander Weyde, and was mentioned by us on page 293 of our volume XXXIV. Dr. Vander Weyde was a witness in a case before the courts, involving an amount of nearly \$100,000, which depended on the question whether the signature certifying a

check was genuine or not. One of the arguments brought forward to show that the signature was forged was that the blue ink with which it was written was of a kind different from that used at the bank where the check was claimed to have been certified. Fortunately the different kinds of blue used for inks can easily be distinguished, one from the other, by spectroscopic analysis. Indigo will absorb the whole spectrum except the blue and red; blue verdigris will absorb all except the blue and green; permanent blue will leave, besides the blue, part of the violet visible; Prussian blue will absorb all except the blue. The spectra are of course modified and even disturbed by the enlargement of the coarse fibers of the paper on which the writing is done; and the spectral colors are, in some spots, darker or more intense, in others paler and almost colorless; but after careful comparison with the spectra of various inks, the peculiar absorption of the Prussian blue is seen to be so characteristic that no doubt was left but that the ink used for the check in question was of the same kind as that used for other checks acknowledged to be genuine. The researches described of course cannot settle a matter of the kind in dispute, and are not claimed to do so. All that was intended was to disprove the allegation of the defense that the inks were different; and this it did most effectually, notwithstanding that the spectroscope could not show that the ink of the different signatures proceeded from the same inkstand.

WHY ARE WE RIGHT-HANDED?

There is, in Sir Charles Bell's Bridgewater treatise, a quaintly-worded passage in which the author endeavors to deal with the reason why we normally use the right hand in preference to the left. After a surfeit of Haeckel and Darwin: after, as must be the case when one attempts to keep *en rapport* with modern scientific thought, becoming fairly imbued with the notion that distinct creative acts never took place, and that the fire mist and the primal germ are our legitimate ancestors in unbroken line: there is something positively refreshing to turn back to earlier writings, and there to find a material theory contemptuously dismissed in order that the author may anchor his faith to the idea that man was created right-handed by Divine intention. He says that "the preference of the right hand is not the effect of habit, but is a natural provision, and is bestowed for a very obvious purpose"; but what that purpose is he fails to make clear, except inferentially in the statement that "there ought to be no hesitation which hand is to be used or which foot is to be put forward; nor is there, in fact, any such indecision." Any one who has ever witnessed the amusing spectacle of a squad of raw recruits learning the goose step will be disposed to combat this last assertion. It requires longer teaching than would be imagined to impress upon the embryo soldier that the left foot is first to be moved. Experience goes clearly to show, besides, that the average individual steps off indiscriminately with either foot; and hence the selection of the left foot, merely to secure uniformity in the military files, has been made, though the very fact again is curiously at variance with the above author's intimation that a heaven-implanted instinct teaches us to put the right foot forward.

We have mentioned Bell's treatise, not, however, for the sake of the theory which he maintains, but for the one which he rejects in a few brief lines. "It is affirmed," he says, "that the trunk of the artery going to the right arm passes off from the heart so as to admit the blood directly and more forcibly into the small vessels of the arm. This is assigning a cause which is unequal to the effect," he adds; and probably supposing that no other causes would ever be combined therewith to bring it up to equality, he curtly pronounces it a "participation in the common error of seeking in the mechanism the cause of phenomena which have a deeper source," said source being supernatural. For the man who discovered the functions of motion and sensation pertaining to the brain and spinal marrow: who located the sensory nerves, and those which form the wonderful telegraph commanded by the will, and who showed that the nerves of the different senses are connected with distinct portions of the brain, so implicit a belief in the active interference of an Unknown Power with human mechanics is indeed strange. It is to this faith, however, that must be ascribed this neglect to prosecute the investigations which, very recently carried through by a French physician, Dr. Fleury, of Bordeaux, have adduced facts showing that our natural impulse to use the members on the right side of the body is clearly traceable to probably physiological causes.

Dr. Fleury, after examining an immense number of human encephala, asserts that the left anterior lobe is a little larger than the right one. Again he shows that, by examining a large number of people, there is an unequal supply of blood to the two sides of the body. The brachio-cephalic trunk, which only exists on the right of the arch of the aorta, produces, by a difference in termination, an inequality in the waves of red blood which travel from right to left. Moreover, the diameters of the subclavian arteries on each side are different, that on the right being noticeably larger.

The left lobe of the brain, therefore, being more richly hemated than the right, becomes stronger; and as, by the intersection of the nervous fiber, it commands the right side of the body, it is obvious that that side will be more readily controlled. This furnishes one reason for the natural preference for the right hand, and another is found in the increased supply of blood from the subclavian artery. The augmentation of blood we have already seen suggested above; but the reason for it is here ascribed to the relative size of the artery, and not to any directness of path from the heart. Dr. Fleury has carried his investigations through

the whole series of mammals; and he finds that the right-handed peculiarity exists in all that have arteries arranged similar to those of man. At the same time, such animals, notably the chimpanzee, the seals, and the beavers, are notably the most adroit and intelligent.

THE PATENT DRIVE WELL.

The long pending litigation in connection with the patent drive well has reached its first stage of settlement by the decision of Judge Benedict, U. S. Circuit Court, this city, an abstract of which we publish in another column.

Judge Benedict gives many interesting particulars concerning this invention, sustains the patent of Nelson W. Green therefor, and awards to him the honors of priority. This decision, unless hereafter reversed by the Supreme Court of the United States, brings all drive wells heretofore put down without the consent of Green, his assigns or agents, within the category of infringements. The number of wells now in use, not authorized by the original patentee, is very large; consequently the aggregate amount of royalties to be collected by the owners must be great. We have heard it said that the total sum was over two millions of dollars.

The Green patent has heretofore been resisted on the ground that the invention was insufficient to support a patent, as it only consisted in running a tube down into a pool of water and applying a pump, which was an old idea, in common use long prior to the grant of the patent. Another reason for resistance was the alleged prior invention of Byron Mudge, who was one of Green's assistants in the early trials of the improvement. Judge Benedict holds that these and all the other alleged grounds of opposition to Green's patent are untenable.

The early history of the drive well is interesting and instructive. It appears from Judge Benedict's decision that Nelson W. Green, the inventor, was the Colonel of the Seventy-Sixth Regiment, which he had formed, then—1861-62—stationed at Cortland, N. Y. Rumors were current that the rebels intended to carry out a general system for killing off the Union troops by poisoning all the wells as fast as the men advanced. It was to defeat this nefarious project that Colonel Green invented the drive well, which he immediately tried in his own camp grounds, with complete success. From this beginning the invention has spread not only over this country, but throughout the world; and the war departments of nearly all governments now attach to their military branches special corps and wagons to convey and operate the American drive wells wherever their armies move. One of the witnesses stated that one hundred and fifty thousand of these wells were in operation in New York State alone. Over a hundred and fifty patents have been granted for improvements. The drive well ranks almost next to the sewing machine in point of utility as a domestic apparatus. In thousands of localities it is only necessary to drive, with a mallet, a tube down through the kitchen floor into the ground, in order to command an abundant supply of pure water; thus the dwelling, the barn, and other parts of one's premises may be quickly and cheaply supplied. We have seen one of these wells inserted and finished, and animals drinking from the water it supplied, all within half an hour from the time the operator began his work.

Modern improvements, as all must admit, are highly useful and convenient to society in general; but it cannot be denied that they are sadly destructive of the romance and poetry that twine about the good old-fashioned ways of doing things. Take the drive well, for example. The lad of the rising generation clacks a squeaky pump handle, bends himself double, and sticks his face under a rusty spout, in order to get a drink of water. He knows nothing about the delights of the bucket, and the original method of water lifting, so charmingly described half a century ago by Woodworth:

"The old oaken bucket, the iron-bound bucket,
The moss-covered bucket which hung in the well.
How ardent I seized it with hands that were glowing,
How quick to the white pebbled bottom it fell,
Then soon with the emblem of truth overflowing,
And dripping with coolness, it rose from the well.
How sweet from the green mossy brim to receive it,
As, poised on the curb, it inclined to my lips;
Not a full blushing goblet could tempt me to leave it,
Though filled with the nectar that Jupiter sips.
The old oaken bucket, the iron-bound bucket,
The moss-covered bucket arose from the well."

DANGEROUS ARCHITECTURE.

The Chicago Chapter of the American Institute of Architects has lately found occasion to discipline a well known member for a violation of professional ethics, involved in supplying a couple of contractors with working drawings of a building now in progress, and receiving pay therefor, when no fees should be received, it appears according to their decision, other than from the client. We have no desire to criticize the architectural code of ethics, the refinement of which the above serves well to indicate; but the question suggests itself as to whether in that code there is any provision whereby the architect who builds houses which, in point of sanitary precautions, are death traps can be called to an accounting. If not, we submit that it is time that some check of the kind were devised. Quite recently in this city, we have seen the heirs of an eminent architect suing the people for \$800,000 fees for plans and superintending the building of an edifice, only partially completed, which is little more than a nest of airtight boxes, and which is so badly constructed that sanitary experts now insist that improvements involving heavy expense, pointing almost to a radical change in plan, must be made before it can be

pronounced healthy. Several of our most eminent judges have been rendered dangerously unwell through holding court in the rooms, to the great detriment of public business.

Architects and plumbers deserve to be gaged by different rules from other professions and trades, for the reason that the largest part of their work is out of sight; and many a bad defect may be rendered invisible until it asserts itself through the fair exterior. We know when a physician does his work well, and we have a remedy against him for malpractice. So also the law protects us against ignorant or conscienceless lawyers; but there are few cases where the owner of property has refused to pay his architect on the ground that the design is radically bad. The defense that the proprietor accepted the plan, which the professional gentleman would urge, seems to us a specious one, for it presupposes an expert knowledge in the layman, whose only object in consulting the architect is to obtain expert assistance. A precisely parallel case would be that of an engineer who should defend himself against a charge of waste or bad fitting or bad material, in the engine entrusted to him to build, by saying that his client had selected that type of engine in preference to others submitted.

We are quite aware that there are a great many painstaking architects who know the faults of their brethren and lament them; but that does no help matters. What we want is a class of architects who can do something more than put the confused notions of their clients into tasteful shapes. It is their business to be sanitary engineers as well as architects; and it is time that the fact were generally understood that it is a worse fault to put abominably designed drains and ventilating arrangements in a building than to make the exterior a combination of all known styles, and the interior richer in hallways than in apartments. Here are two cases of flagrant malpractice which we take from the recent report of the Massachusetts Board of Health. A conspicuous public building, costing nearly \$200,000, became pervaded with a nauseous odor, which grew apace until the occupation of the edifice was rendered dangerous. Under the cellar floor were found some square cesspools, into which various drain pipes entered, and from which a brick drain, covered with flat stones, led. One of these reservoirs of filth overflowed and saturated the concrete pavement, so that the stench remained permanent for a long time after the cesspool was abolished. What good service the cesspool served is past comprehension; and the brick drain, in these days of smooth pipes, evinced the ignorance or cupidity of the planner. Another architect put a huge brick drain under a building for the length of 200 feet. It was too large for self-cleaning, and consequently became a prolonged cesspool. In addition to this, another reservoir was arranged outside the building, where the sewage of five hundred persons was allowed to accumulate. And all this in the immediate presence of a good and sufficient sewer.

Now these defects might well have resulted in epidemics and deaths. Who is answerable? The landlord, we have heard it recently stated; and even in public journals, tenants have been urged to sue the proprietors for damages when illness or death occurs in their family through faulty construction in the house. Legally, the landlord may be responsible; but we cannot consider him morally so, certainly, in such cases as are above cited. Would not then, the American Institute of Architects do the community a service by bringing members who evince ignorance in the matters we have pointed out to a rigid account? Certainly there is no code of ethics which will not warrant the stern censure of men who, by careless or incompetence, not only bring discredit upon their profession, but imperil the lives of their fellow beings. It is needless to say that such censure should be so marked as to result in a withdrawal of public confidence from the person disciplined.

THE CENTENNIAL EXPOSITION.

The judges in group 21, on metal, wood, and steel working machinery, have nearly completed their work. Out of 600 exhibits in their group, more than 300, it is reported, will receive bronze medals with written certificates of excellence. Attendance at the Exposition now averages from 20,000 to 30,000 people a day; but a decrease is expected during the harvesting season, which will be followed by larger crowds than have yet appeared, during the cool fall months. It seems reasonably certain that, financially, the Exposition will make some profit rather than show a deficit. The hotel and boarding housekeepers of Philadelphia are not reaping the rich returns so confidently expected. When the immense throng, attracted by the opening day ceremonies, visited the city, speculators thought their opportunity had come, and prices were exacted in accordance with their elevated notions. When the people dispersed after the ceremonies, they advertised the condition of affairs; and as a result, those houses which charged exorbitantly are now avoided. Thousands of visitors who intended residing in the city during their short stay now strain a point to find accommodations in the suburbs, or even in New York. It is reported that the permanent increase in Philadelphia does not now exceed 10,000 people, and that dozens of lodging houses, fitted up near the Centennial grounds, have been closed from lack of business.

Don Pedro has again visited the Exposition, and has made a minute survey of its contents. The marvelous work of the Walter press, on which an edition of the New York Times is daily printed, is said to have astonished him more than all else. The Tunis café, that of the strange musicians and dancing woman, was recently shut up by the authorities, because visitors were compelled to purchase a little cup of coffee for twenty-five cents, in order to gain ad-

mittance. This was considered virtually requiring an admission fee, which is contrary to the regulations.

It is said that the judges on machine tools are seriously puzzled to know how to award proper distinctions. The competition is so remarkably close, and most of the tools are so good, that the judges assert that nothing but the most severe tests will enable them to arrive at impartial conclusions. Some time ago, in an editorial, we deprecated the habit workmen have got into of nickel-plating their productions, and suggested that, for objects exhibited at the Centennial, it would be much more satisfactory to finish with the file and scraper. These tools are difficult to handle; but when skillfully managed the results they give speak very plainly for the ability of the workmen. The Putnam Machine Company, of Fitchburg, Mass., seem to have adopted this advice, and a number of excellent machine tools are thus finished. Plain surfaces, handles, wheels, and gearing are all brilliantly finished; and many an expert mechanic has been heard to inveigh somewhat contemptuously against "this shiftless habit of nickel plating" before bringing his eyes close to the metal and discovering the virgin surface.

ACCURATE TOOLS.

A prominent feature of the display of the Pratt & Whitney Company, of Hartford, Conn., is the gages, the accuracy and fit of which are remarkable. A specimen of the work of the finely made tools manufactured by the above concern is exhibited in a pistol, which is shown in the condition in which it left the machines, without having undergone any subsequent finishing operation. Both the finish and the fit of the parts are excellent.

We have already stated that the general arrangement of the Exposition is such as to render it not easy for the visitor to obtain readily a comprehensive view of any one class of objects. For this reason it is difficult to realize, until one has become familiar with the general aspects of the display, how complete the collection are. Take, for example,

FISH.

To acquire all the available information of an ichthyological nature, it is necessary to visit almost every department and section. Scores of fish of various species may be studied alive in the aquaria of Agricultural Hall, or may be seen frozen in the refrigerators. Or, if the visitor desires to study fish more comprehensively, he may, by stepping over to the Government Building, examine a large series of finely colored plaster casts of ocean edible, and other fish. Superb collections of fish, prepared in alcohol, as scientific specimens, are to be found in the Norwegian and Swedish sections, and besides these are stuffed fish in endless variety.

If fish as food be the object of an investigation, the visitor may examine every preparation of it that can be conceived. France has a remarkable collection of fish preparations, and, in fact, almost every nation which catches fish has a representation at the Centennial. Japan forwards smoked salmon, done up in bags, like hams. China sends powdered fish, and Norway a similar exhibit of fish meal. From Oregon comes salmon packed in cans of various sizes and sorts.

If it be desired to know about the many articles, useful in arts and industries, derived from fish, the visitor may see oils obtained from various fishes, isinglass, with sizes and glues, fish skins tanned to excellent leather, besides scores of other utilizations, down to delicate fancy work ornaments made of fish bones and scales.

Fishermen will find tackle, from the heavy surface and trawl lines used in the cod fisheries down to the delicate gossamer threads and flies for trout. Then there are the more important implements used by whalers and others, such as the common harpoons, gun harpoons, lances, and walrus spears, besides the rakes and tongs used by oystermen. Nets of all kinds, some made of bamboo, some of whalebone, some even of human hair, may be seen; and with them all the various traps and pots, rods and reels, artificial bait, fishing baskets, boats of every conceivable shape, from kayaks up to whaling vessels; all the inventions for curing fish, refrigerators, apparatus for drying fish in the sun, models of smoke houses, all the machinery for producing fish oil, and for preparing fish guano; may be found in the collection.

Should the visitor prefer devoting himself wholly to the scientific consideration of fish, he can look at the Agassiz collecting tank, and the preserving mixtures, by the aid of which fine specimens can be brought from far-off lands. He can see how Professor Baird models his casts of fish out of papier maché and plaster, and also examine the methods for drying the skins of fish for scientific use, and even the photographic instruments employed to take pictures of fish. Then there is the subject of fish culture, including the pans, pails, spawning vats; and later in the season, the actual habits of the fish during the spawning may be watched. Allied closely to the subject of fishes are those of sponges and seaweed, of pearls and pearl oysters, and of corals. We have only indicated the extent of the collection as a whole. To describe the various specimens or the different appliances would fill a volume; the above, however, will suffice to afford a general idea of the time and labor which a careful examination of all the fish of the world, as gathered in the Centennial buildings, will require, and give the reader an idea of the task before him if he visits the Exhibition with the intention of studying the industries of this one class of exhibits.

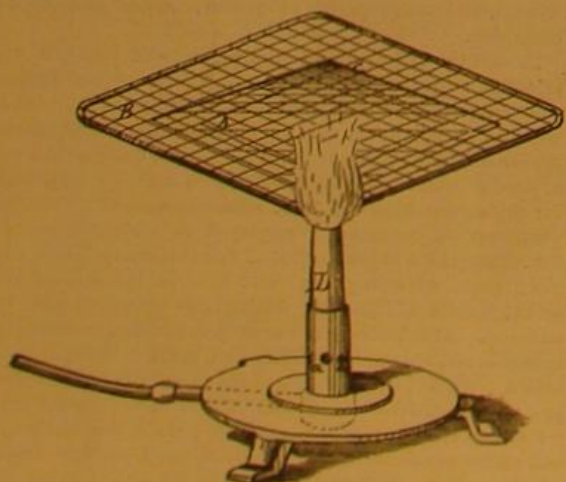
To make aqua regia, distill together 16 ozs. spirit of nitre and 4 ozs. common salt. Another way is to mix equal parts nitric acid and muriatic acid, or nitric acid 2 parts and muriatic acid 1 part.

TWO NEW DENTAL INVENTIONS.

A very ingenious electric plugger, in which the circuit can be established or interrupted at will, has been patented (March 21, 1876) by Dr. Allen Spencer, of Columbus, Ohio. The mallet hand piece, composed of an inner tube, is mounted in a casing. The wire of the helix is confined in the handle, and passes through the butt cap, and connects with the battery. Armatures, formed of two cylindrical cores of soft iron, are mounted in the inner tube. The core, D, is fixed, and the core, E', movable endwise. A metallic rod plays through the fixed core; and, by the spring, d, pressing on a shoulder, is forced slightly beyond the inner end of the core, D, so that it may be acted upon by the movable core, E'. A tool holder is attached to the outer end of the rod, F, for the insertion of different plugger points. The movable core is pressed against a collar, a', by a spiral spring, f'. This spring surrounds a neck, F', and bears at one end upon the collar, a', and at the other against a non-conducting ring. Two posts, H H', are screwed into the butt cap, and connected by a crosshead, H². A set screw, I', projects against a disk, j, of soft iron, around which, and between the posts, H H', is coiled a thin band spring, J', of copper. One end of the spring is connected to the disk beneath the plate, and the other end to the post, H. A collar, K, on the neck of the movable core carries an insulated break, consisting of a rod, K', of wood, which acts on a plate spring, k', secured at one end in the butt cap, b, by a screw communicating with one end of the helix wire, the other end of the helix wire being connected with the insulated post, H'. The outer end of the spring, k', abuts against the guide, k, which forms a contact stop. A simple circuit break or key, which may be operated by the mouth, or preferably by the foot, is connected with one of the battery wires, sufficient length of wire being employed, as shown, when the key is used, to admit of its ready manipulation by the operator. It is composed of two rubber sides, L L', connected by a spring, l, at the rear, so as to admit of the sides of the key being pressed toward each other at their outer ends.

In operation the armatures, D E', being magnetized, the sliding one, E', carries down the disk, j, until the endwise-moving break rod, K', strikes the spring, k', breaking the circuit and interrupting the current at the same time that the hammer-like stroke of the moving core upon the shaft, F, operates the plugger point. The cores being demagnetized by the breaking of the circuit, the moving one is quickly returned by its spring, f', to its normal position, closing the circuit; and the shaft also, at the same time, is protruded beyond the end of the fixed core, D, retracting the plugger point with it. The above operation is repeated and continues as long as the break key closes the circuit. In this way the operator has complete control over the instrument. The battery is, by preference, provided with a vibrator to cause the current to pulsate. The vibrator is shown as mounted in a cylinder, N, supported upon the battery cover or box, N'.

When the connections are all made and the vibrator is started by hand, the motion becomes self-sustaining because of the impulse given the spool magnet by its attraction toward the disk, R, at every pulsation of the current; and as the pulsations pass by the wires through the cores, D E', of the mallet, they become magnetized, and the plugger point strikes its blow. The speed of the pulsations is controlled by the thumbscrew, P'; when the screw is set toward the spring, P, the vibrations are more rapid, and when set further off they become slower. The set screw of the vibrator serves also to regulate the force of the blow by determining the instant at which, with reference to the stroke of the mallet, the circuit shall be broken; whereas the set screw, I', of the automatic break, serves merely to regulate the frequency of the blows.

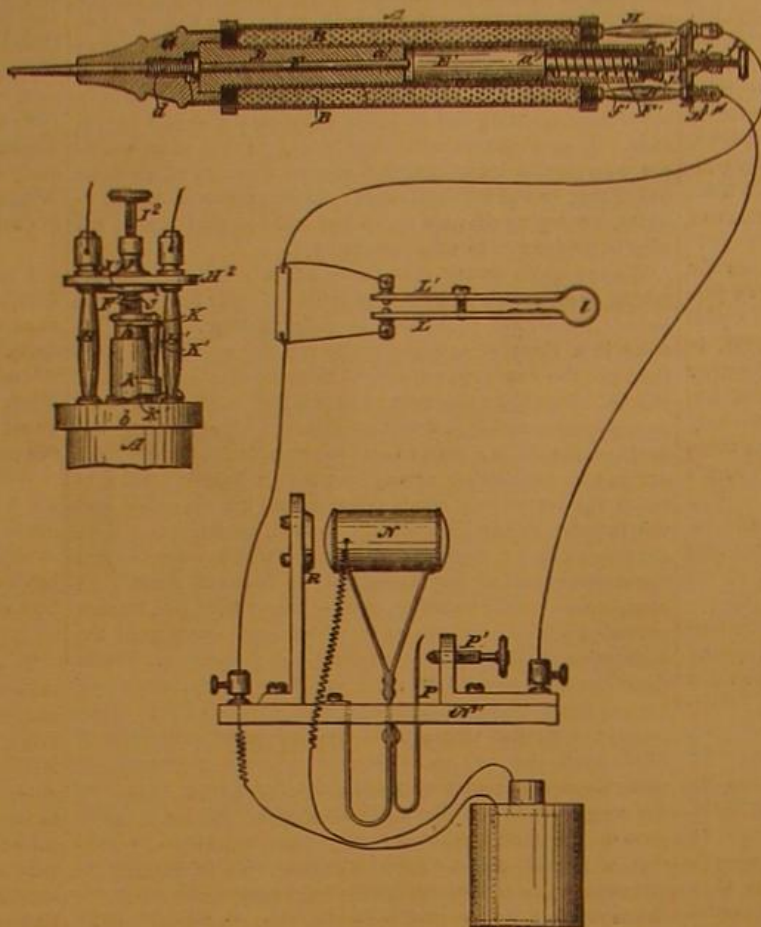


WILLIAMS' METHOD OF MANUFACTURING DENTAL FOIL.

Another new invention relating to dental manipulation is a means of covering foil with a coating of carbon to render it more easily worked without becoming adhesive.

Heretofore, non-cohesive or soft foil has generally been made by imperfectly refining, and by leaving traces of silver, copper, and iron, which cause it to be somewhat stiff and liable to discoloration in the mouth. In order to produce a

foil for dentists that can be absolutely pure, and which, even when freshly annealed, does not stick at all or only slightly, when rolled up or manipulated. Dr. Richard S. Williams, of New York city, takes the sheet of foil, A, places it upon a wire gauze, B, and, with the aid of any suitable flame, causes a slight deposit of fine carbon upon the surface of the foil. To prevent the ascending current of heat from the flame from displacing the foil when laid on the gauze, a sheet of mica, C, is placed upon it. With a Bunsen gas burner, as shown at D, the amount of carbon to be deposited may be readily regulated by stopping up one or more of the air passages, a, of the burner. The less air admitted, the greater will be the depo-



SPENCER'S ELECTRO-MAGNETIC DENTAL MALLET.

sit of carbon, and vice versa. This invention was patented January 25, 1876.

Artificial Vanilla made from Wood Tar.

It appears that the series of dyestuffs which may be obtained from tar is by no means exhausted; while another large and equally important class of substances, also obtained from tar, is daily increasing: substances not intended to please the eye, but for the nose and mouth, namely perfumes and flavors. The manufacture of salicylic acid from carbolic or phenic alcohol opened the prospect of a cheap manufacture of great numbers of various flavoring principles, which had been commenced by the nitro-benzole or so-called oil of mirbane, which perfumers use in place of oil of bitter almonds. Soon benzoic acid and oil of wintergreen or *gaultheria* were produced, and then many closely related flavoring principles; and now it has been proved that vanilla flavor can be made artificially from one of the tar products.

According to the German *Industrie Blätter*, Reimer reported to the German Chemical Association that he had made from beechwood tar, first oil of guaiacum, and from this vanillin, the flavoring principle of the expensive vanilla bean. He obtained this by searching for a common reaction of the various phenols or carbolates (the creosote-like constituents of all tars) by which different aromatic aldehydes are formed from each.

When phenol or carbolic acid is mixed with chloroform and an excess of a caustic soda solution, and proper time for reaction is allowed, the unchanged remainder of the chloroform must be removed, and replaced by an acid; then an oily aldehyde of salicylic acid will be separated, which may be purified by combination with bisulphite of soda, and decomposed by some diluted acid. Oil of guaiacum, treated in this way, produces (as mentioned) vanillin, which is the aldehyde of vanillic acid.

Marasse, who several years ago found the oil of guaiacum in the creosote of beechwood tar, observed then that this body smells agreeably like vanilla, a smell which is also peculiar to guaiacum wood (*lignum tita*, iron wood) and its resin, out of which the oil of guaiacum was first made in 1826 by Unverdorben.

It is to be expected that, out of the numerous carbolates at present known, by applying the reaction discovered by Reimer it will become possible to produce artificially many other natural flavors, hitherto only obtained in an expensive way.

A NEW copper paint is made in Paris from porous copper deposited by the galvanic battery mixed with a varnish. The solvent of the varnish is benzine. The copper is very pure and is easily pulverized, and, when mixed with the benzine varnish, may be applied to iron, brass, plaster, or wood. When mixed with oils, the copper acquires an antique green hue.

A New Smoke Consumer.

The Pittsburgh *Chronicle* says: There has recently been introduced in Zug's Sable Iron Mills a smoke-consuming apparatus, which certainly accomplishes all that can be desired. It would be hard to conceive anything more simple in its construction and operation. A one half inch steam pipe runs along the forward wall of the furnace, some 20 inches above the grate bars. From this transverse pipe project inwardly a number of short pipes, terminating in a small orifice. Each of these pipes is surrounded by a sleeve of larger pipe, 1 1/4 inches in diameter. The annular space between the interior of the larger and the exterior of the smaller pipes communicates with a flue, opening into the outer air at the side of the furnace. When a pressure of 20 lbs. per square inch has been attained, steam is turned into the smaller pipe. Its escape from the orifices acts upon the air-filled annular space, much as the steam in the Giffard injector does upon the feed water, and, drawing it rapidly through the pipe, projects air and steam into the furnace. The heat of the fire decomposes the steam, and at the same time the carbon-laden smoke is utterly consumed and converted into a bright, clear flame that lights up the interior of the furnace. This operation is observable through a mica door in the rear of the furnace. Fixing the eye on the top of the smoke stack, and noting the moment when steam is turned into the consumer, the inky torrent of smoke is first seen rolling skyward. With the hiss of the escaping steam these clouds are dissipated, like fog before the sun, and in a few seconds only a faintly depicted vapor is wreathing upward from the stack. The engineer states that the decrease in consumption of fuel amounts to 20 per cent since the introduction of the consumer. The boilers are of the Wiegand pattern.

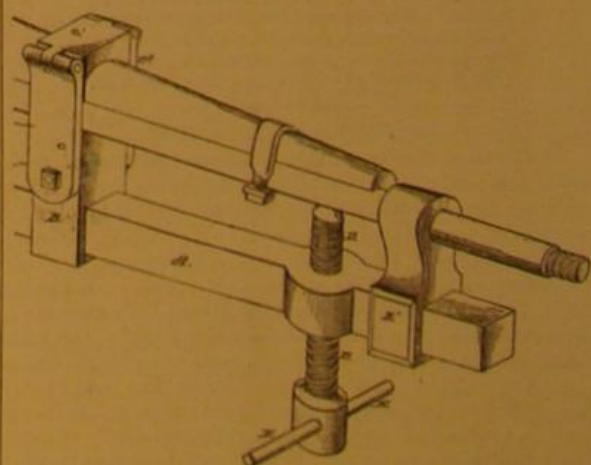
Setting Milk.

Mr. L. S. Hardin, of Louisville, Ky., has recently made a series of experiments regarding the setting of milk. He states that deep setting accompanied with refrigeration is the best plan. The milk is placed in cans from 12 to 20 inches deep and 8 in diameter. These are put in a refrigerator box, with a shelf in the top, upon which ice is placed, and the temperature is reduced below 50°. The milk is skimmed after 36 hours. The cream is churned at 58° in warm, and at 65° in cold weather. The butter is said to be of superior flavor and aroma, uniform in quality, and to keep well; and a greater weight is obtained from a given quantity of milk with less labor and less cost than by other methods.

APPARATUS FOR SETTING METAL AXLES.

We illustrate herewith a new apparatus by means of which the axles of wagons, carriages, and other similar vehicles can be straightened or set, should they happen to become bent out of shape, without removing them from the body of the vehicle.

The bar, A, supports two heads, B and B'. The head, B, is adapted to slide upon the bar, A, and has attached to it a hinged yoke, C, consisting of three parts, c, c', c''. The part, c, is secured at its lower end to the head, B. To the upper end of said part, c, is hinged one end of the part, c', the upper side of which may be curved to conform to the shape of the upper side of the axle, if desired. To the other end of the said part, c', is hinged the part, c''. The head, B', is adapted to slide upon the bar, A, and is provided with an aperture or eye by which it can be fitted over the end of the axle of the vehicle. Between the two heads the bar is enlarged and provided with a screw thread aperture, which is fitted with a powerful screw, D, provided with a lever, E, at one end, by which it may be turned, and having its other end rounded off to form a proper bearing surface against the axle while in operation. The operation is as follows: The wheel is removed from the axle to be straightened, and the bar placed longitudinally beside said axle in proper position to



bring the end of the screw to bear in the required place. The heads are then adjusted and secured, the head, B, being passed under the body of the vehicle, the hinged yoke passed over the axle and fastened to the head, and the head, B', being simply passed up on to the end of the axle. The screw is then put into operation and made to bear upon the axle until it assumes its proper shape. Patented December 21, 1875, by Mr. Frederick Bex, of Washington, D. C.

IMPROVED SHAFT COUPLING.

The annexed engravings represent a new shaft coupling, in which two shaft ends and the sleeve are connected by longitudinal wedge keys alone, these being driven in on opposite sides of the ends and between the bushings and the sleeve. Through the center of the hub passes the shaft aperture, which is enlarged at each end, as shown. At A, Fig. 1, are bushes fitted in and keyed down to the shaft by the keys, B, which firmly press the shaft against the opposite side of the hole, where it is secured against revolving in the coupling by the key, C, Fig. 2. The bushes are preferably located on opposite sides of the hub, though they may be, if desired, on the same side.

If the device is to be placed in a position where much jarring occurs, the wedge keys, B, may be prolonged through the coupling, and be set up on the nuts on the ends. The coupling as thus arranged is especially intended to obviate the use of bolts, screws, and flat tapered keys or wedges, so as to be readily removed by driving out the keys by means of a drift. For coupling fly and other wheels to shafts (see Fig. 3) a tight fit is obtained by boring the hole about one hundredth of an inch smaller than the shaft, the segment or bushing being bored in its place in the wheel. The inventor claims that this attachment of wheel and shaft is easily effected, and the wheel may be removed without requiring sledging, forcing with power screws, etc. Similarly, steam engine cranks can be attached to shafts as firmly as by a shrinking fit, while the injurious strain on the metal produced by the latter is avoided.

Patented through the Scientific American Patent Agency April 4, 1876. For further particulars relative to rights to manufacture, etc., address the inventor, Mr. S. M. Guss, Reading, Pa.

IMPROVED AUTOMATIC SIGNAL BUOY.

The means in general use for warning vessels approaching coasts, reefs, or shoals are of two kinds, those which are seen and those which are heard. To the first class belong lighthouses and buoys; to the second, fog whistles,

bells, horns, sirens, guns, and similar sound producers. Although of late years, mainly through the development of electric illumination, it has been possible to construct lighthouses of extraordinary powers, no beacon ever has been or probably ever will be devised which a heavy fog cannot render practically inefficient. True, it may be similarly asserted that the varying conditions of the atmosphere exercise a potent influence on the transmission of sound, and thus tend to decrease the value of the sound signal; but the fact remains nevertheless that the latter stands superior to the light, for, as Tyndall has proved, "even against a moderate gale and unfavorable conditions for sound transmission, signals may be relied on for sending sound to a distance of two

a heavy fog is likewise present, the mariner, aided neither by sight nor by hearing, perforce must feel his way, as best he can, by the lead. It is safe to believe that, had we been possessed of some efficient system of sounding buoys, the Atlantic, the Schiller, the Deutschland, and other ill-fated vessels, warned from the reefs and shoals, would not have terminated their voyages in wreck and disaster. There can, therefore, be no question as to the importance and necessity of inventions looking to the perfection of such a system; and for this reason, for the device which we here illustrate, and which belongs to that class, the careful consideration of lighthouse boards and similar bodies is bespoken.

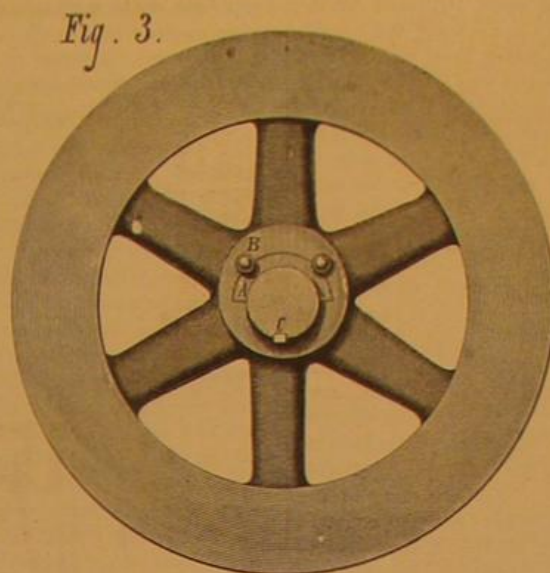
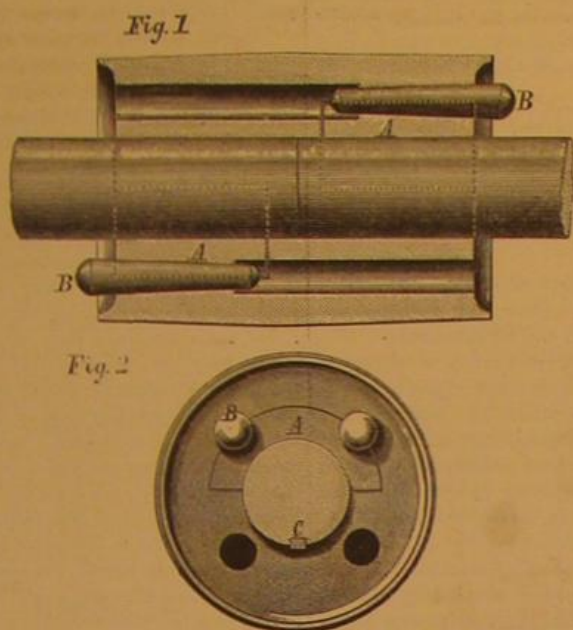
Before proceeding to examine the mechanical construction,

a few results of scientific investigation into the phenomena of sea waves may be recalled. Waves are of two classes: those of translation, and those of oscillation. Ordinary sea waves are oscillatory, but become waves of translation as they enter shallow water. They are, in character, cycloidal. The motion of the water is that of alternately flowing to and from a point. Toward the top of the wave the movement of particles is in the direction of the wave; but in the trough, the movement is in the opposite direction. Motion is greatest at the crest and at the lower portion of the trough. At half the height of the wave there is no motion.

It has further been proved that the depth to which water is agitated by waves is not much greater than the

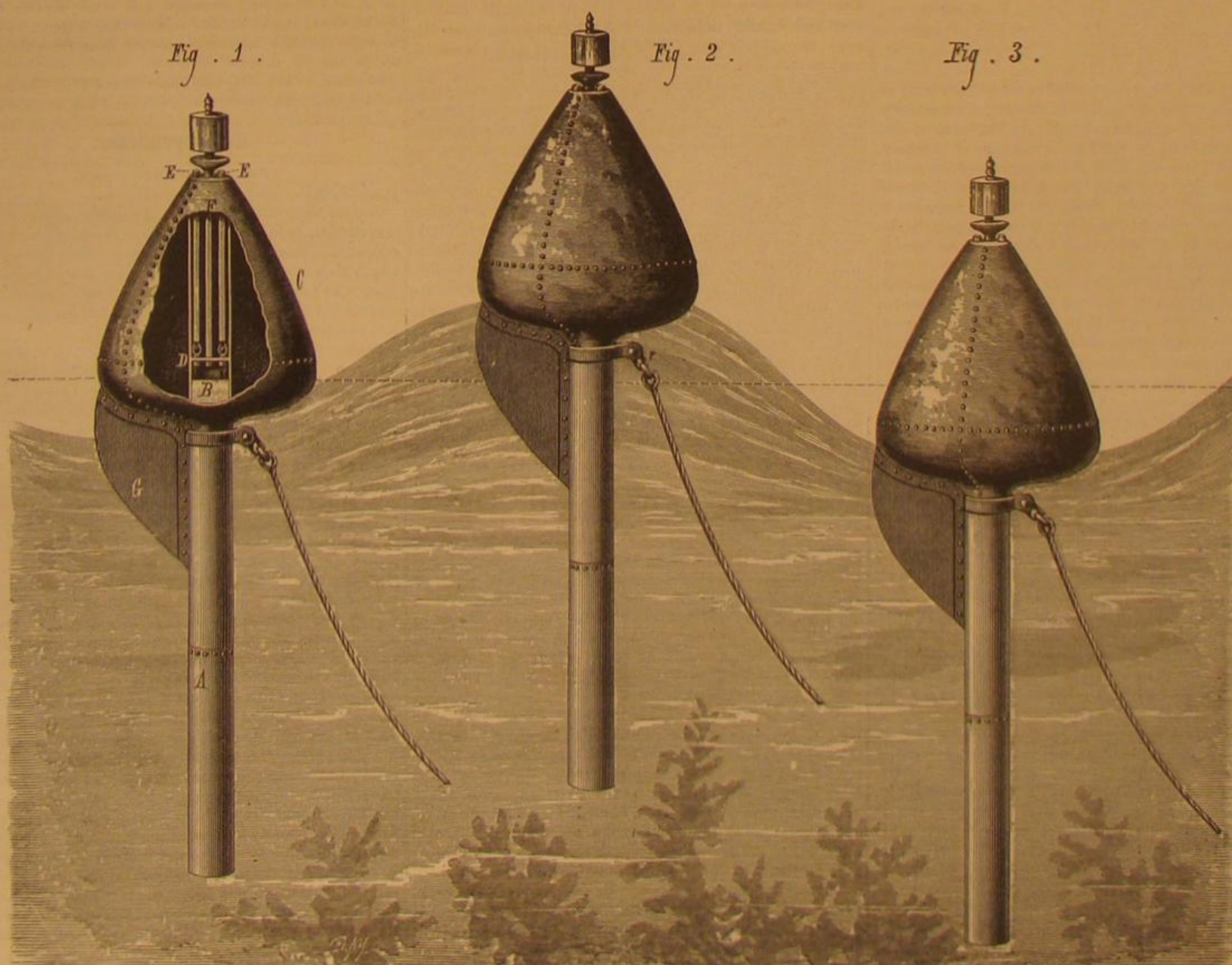
height of the wave measured from trough to crest. Accurately, a wave 10 feet high and 32 feet long would only agitate the water 6 inches at 10 feet below the surface; at a depth equal to the length of the wave, the motion is diminished to $\frac{1}{11}$ that of the surface. Hence, for practical purposes, we may consider the depth of motion below the surface to be commensurate with the height of the wave above.

The highest waves ever measured occur off the Cape of Good Hope, and reach a total height, from trough to crest, of 45 feet: that is, 22.5 feet above and the same beneath the average level, indicated by the dotted line in our engraving. Ocean waves at a distance from land rarely seem higher than 20 feet; and it is only where circumstances, in the



GUSS' SHAFT COUPLING.

or three miles, and, under ordinary conditions of fog, considerably further." What the lighthouse is to the coast, the buoy is to the hidden reef or shoal; but, unlike the former, it is useless save by day. Moreover, while we have supplemented the lighthouse by the stationary sound signal, we have devised no parallel invention to supplement the buoy. The object has been a sounding apparatus and buoy combined, the former of which will sound under all circumstances; the best we have hitherto done is to fasten a bell to the buoy or apply a whistle, and have relied on waves to rock the support and so toll the bell or blow the whistle, the latter by air forced out by the moving water inside. These devices all become inoperative during a calm; and when



COURTENAY'S AUTOMATIC SIGNAL BUOY.

shape of prevalent opposing winds and currents, combine on shallow water that rollers of the exceptional height, first noted, are generated.

Sufficient has now been explained to make it clear that, if a hollow cylinder be immersed in water agitated by waves to a depth greater than the height of the waves, the water entering that cylinder will seek not the level of the waves, but the mean average level located at half the height of the waves. Consequently, while the heaviest billows may roll past the cylinder, the surface of the liquid therein will be unmoved, and will not rise and fall with the varying depression or elevation of the sea surface immediately adjoining; that is to say, referring to the engraving, let A, Fig. 1, be the long hollow cylinder which extends in the water to a depth exceeding the height of the wave indicated by the sinuous line. Disregard the rest of the drawing, and consider that cylinder as fixed; then the water level will remain constant at the point, B, and the lower end of the cylinder will be in still water. Waves will produce no effect on the enclosed column of water. But now consider the cylinder attached, as it is, to the bottom of a float, C, which rests on the surface of the water and which must rise and fall with every undulation. Then we have the conditions of a fixed immovable column, encompassed by a rising and falling envelope; in other words, we have a moving cylinder and a fixed piston, by which we can compress air by wave power.

The tube, A, it will be observed, extends up to the top of the buoy. There a powerful whistle is placed. D is a diaphragm, in A, between which and the plate on top of the buoy extend two tubes, E, open above, and having at their lower extremities ball valves, as shown. A central open tube, F, leads from diaphragm to whistle. Suppose the apparatus to be carried from the position where the diaphragm, D, comes just above mean water level, Fig. 1, to the summit of the wave as in Fig. 2. Then the space between the constant water level, B, and said diaphragm will have been greatly enlarged, and air must have been drawn in through the tubes, E, to fill it. Now as the instrument descends to the trough of the wave, the diaphragm must descend upon the water piston; and the air compressed, being prevented by the ball valves from escaping through the tubes, E, is driven out through the central tube, F, and so sounds the whistle.

It is obvious that any disturbance of the surface of the water must produce this effect. Long low ground swells must do it as well as short chopping waves; but, of course, the higher the waves the longer is each sound given. Thus, where waves are 8 feet high and average, as they do, 8 in a minute, the sounds afforded would be similar in number. Where they are 20 feet high they run at but 4 per minute, and there would be but 4 sounds in this period. There will clearly be a difference in the intervals; but in all cases the force of the blast is the same, since that depends first on the weight of the buoy and length of the tube. We thus have a means of determining, mathematically, exactly the size and proportions of the instrument required to produce a given effect. On one hand, the resistance offered by the water piston equals the pressure of a column of water of similar depth. Knowing the pressure, per square inch, required to blow the whistle, the tube is lengthened in accordance, about 32 feet giving resistance equal to a pressure of one atmosphere. Now to compress the air, we have the whole weight of the apparatus applied to the area of the diaphragm. The water in the tube is the gage of pressure; for should the expansive force of the air exceed the resistance of the column, the water would, of course, be forced out at the bottom. Having fixed the desired pressure, a simple calculation, based on the laws of specific gravity, determines the weight and proportions of the apparatus, as well as the pressure which may be obtained.

The buoy is fastened by a suitable anchor and chain off the reef or shoal, and is kept from the whirling motion which might interfere with the proper effect of the waves by the rudder, G. Its design is such that it stands vertical in any sea. By proper anchoring, it may be placed in mid ocean to mark a latitude and longitude point, as well as in a roadway to warn vessels off bars and sands. It may be located from 10 to 15 miles from the reef or other danger to be avoided, so as to warn a ship of her position, and enable her to continue her course in safety. It may be used whenever an undulation of 12 inches in height exists; so that practically it is as efficient in rivers, where waves are comparatively little more than ripples, as at sea, where the highest billows may occur. The sound of the whistle of a buoy, located near a harbor of this city, has been heard 9 miles to leeward, 3 miles to windward, and 6 miles across the wind, or everywhere over a radius of 3½ miles. In a dangerous locality, reefs or sands may be provided with buoys having whistles tuned to different notes, so that, merely by the locality of the various sounds, the masters of vessels can recognize their positions, or pilots direct the helm.

The invention seems to us of unusual importance and value. It is scientifically correct in principle, mechanically simple, and in action, automatic. It remains for the test of actual and continued experiment to demonstrate practically its complete efficiency.

Patented in foreign countries and in the United States, through the Scientific American Patent Agency. For further information, address the inventor, Mr. J. M. Courtenay, of Idlewild, Cornwall-on-Hudson, N. Y., or Mr. James Bigler, Newburgh, N. Y.

Plating Articles with German Silver.

Many unsuccessful attempts have been made to nickel small articles by boiling, just as pins, hooks and eyes, etc., are silvered or tinned. A Nuremberg chemist, named Dr. Kayser, has succeeded in coating metals with an alloy resembling German silver, thus giving them a handsome finish,

and making the surface more durable and permanent than that of tin or silver. He first melts together 1 part copper and 5 parts pure tin—preferably the Australian, which has recently come into commerce, almost absolutely pure, yet cheaper than Banca tin. The alloy is granulated as usual, but too not fine, and then mixed with water and tartar as free from lime as possible, into a paste. To each 200 parts of the granulated alloy is added 1 part ignited oxide of nickel, and the articles are laid in it. After boiling a short time, they become beautifully silvered. Some fresh oxide of nickel must, of course, be added from time to time. Brass and copper articles can easily be silvered in this manner without previous preparation; those of iron must first be copper-plated. By adding some carbonate of nickel to the above bath, or to a common white bath, and boiling, a coating richer in nickel is obtained, and darker, varying in color from that of platinum to a blue black, according to the amount of nickel salt added.

Infusorial Earth.

The numerous uses which the silicious remains of the microscopic animals, known as diatoms or infusoria, have found is illustrated by the following list given by Gruene and Hagemann, the proprietors of the large German mines at Oberhe and Hutzel:

1. As pure silica in the finest state of division, it is employed in the manufacture of water glass, water glass soap, artificial stone, cements, fatty lute, and ultramarine.

2. Because it is a poor conductor of heat, it is employed for packing steam and hot air apparatus and pipes, where it excels every other material in lightness, for isolating fire boxes and catching radiant heat by protecting shields filled with the earth, etc., for filling the space around money safes and ice chests, for lining and encasing the conduits for melted metals in foundries, and in laboratories as a support for heating vessels that break easily.

3. Because of its property of absorbing liquids, in which it surpasses that of any other material previously known, it is employed for rapid filtration, making precipitates solid, making dynamite and other explosives, and making cheap colors, because the infusoria take colors like cotton. In surgery it is used for absorptive bandages and supports.

The ability of infusorial earth to take up five times its own weight of liquid, and to suck it up rapidly without becoming fluid, enables it to replace the filter press. It is simply necessary to surround the filter with a layer of dry infusoria, in order to obtain in a very short space of time the same result that is attained by ordinary filtration in days or even weeks. Simple drying restores to the infusorial earth its absorptive power.

4. Owing to its great volume and slight weight, it is employed for packing very fragile objects and glass apparatus, etc., and mixing with plaster of Paris for making light casts.

5. Owing to its fineness, it is used as a cheap polish for glass and metal, and is an excellent material for cleaning greasy vessels and pieces of machinery.

The Civil Engineers' Convention.

The papers read before this body during its recent session in Philadelphia, besides those noted last week, included one by Mr. Charles McDonald on the general arrangement and intermediate spans on the Portage viaduct of the Erie railway, and another by Mr. L. L. Buck, on the erection of Virragus bridge in Peru, of which brief abstracts cannot be satisfactorily made. Mr. T. G. Ellis, from the committee appointed to report upon a uniform method of gaging streams in connection with the observation of the rainfall, stated that no uniform method would be applicable to streams of all sizes and characters. The committee recommended a permanent and continuous record of the heights and discharges of such streams as come under observation, and suggested that members be requested to exert themselves to procure the establishment of permanent gages; also that engineers of cities be requested to keep a record of the height of water daily, so that by suitable means the approximate discharge could be obtained. In this way a vast amount of valuable material might be gained, which could be worked up when occasion demanded.

Mr. J. J. Croes criticised the Croton waterworks, and asserted that the masonry in the aqueducts had not been built strong enough to withstand the pressure of water without being upheld by earth embankments.

Mr. Corthill, chief assistant engineer of the Mississippi Jetty Works, stated that the shallowest point on the bar is now 17½ feet. Formerly there was but 9 feet of water at average flood tide, for a distance of nearly 3,000 feet. At this day there is only 200 feet distance between the 20 feet of water inside the bar and the same depth outside it, and at many points there is now 30 feet. There has been excavated by the river current thus confined more than 3,000,000 cubic yards of material.

General W. Sooy Smith, chairman of the committee on tests of American iron and steel, made a brief report, urging the importance and necessity of securing the necessary appropriation by the government for carrying to completion the work already accomplished by the board appointed by the government to test iron, steel, and other metals. As an instance of value of the board to the government itself, as a consumer of the metals to be tested, the fact was stated that, in the columns of one government building now in course of construction, and in the beams of another recently built, more money has been wasted than would be required to defray the expenses in making tests for a year to come; and this waste, in a greater or less degree, is believed to run throughout the iron architecture of the country, both public and private. The metal parts of the buildings, public and private,

are alarmingly waste. The report was accepted, with a request to the board to prepare an appeal to Congress.

Mr. Clemens Herschel, of Boston, submitted a paper commendatory of the introduction into the United States of a metric system of weights and measures, which he supported. Mr. Coleman Sellers, of Philadelphia, suggested various objections to the introduction of the system—among others the very large cost entailed by the change, an estimate of this in the workshops of Sellers & Co. amounting to \$150,000. He remarked that we have already the advantages of the decimal system, which the German people did not have, and other advantages, to secure which the introduction of the metric system was mainly predicated. The subject was finally disposed of by its reference to a committee of five, to report upon it at the next annual meeting, in November.

A paper, by Mr. William P. Shinn, of Pittsburgh, on railroad accounts and returns, was next read and discussed. Sundry reports from special committees were then read, after which the convention adjourned *sine die*.

The Value of a Trade.

The old story of the uncertainty of riches and the importance of learning a trade is brought to mind by the following, which appeared in a recent number of the New York *Ledger*: Karl Frostern, the old nailmaker of Luben, in Silesia, was a jolly, story-telling man, who sang at his work, and whose busy hammer made merry music.

Not far away lived Herr von Koben, a wealthy land owner, whose only son, when not at school, was wont to come to the nailer's, where he would sit by the hour and watch the bright sparks as they flew in showers from the ringing anvil.

"Come, Master Conrad," said the nailer, one day in a jolly mood; "why not set the world an example? Show them that the son of a rich man can learn a trade. Who knows but that it may profit you one of these days?"

The youth fell in with the humor of the thing; and pulling off his fine jacket, he donned a leathern apron, and went to the anvil. He was a bright quick lad, and, when he had once attempted to make a nail, he had a pride to make it well; and so it came to pass that ere long he could make shoe nails as deftly and as well as could old Karl.

Time passed on, and Herr von Koben died, leaving his great wealth to his son Conrad. A few years thereafter the armies of Frederick came sweeping through Silesia, and Conrad's inheritance was lost. In poverty he wandered away towards the mountains of Bohemia, until he came to a town where a host of shoemakers were at a stand for want of nails. Shoes were in great demand for the soldiers, and a great price was offered for nails. "Here," thought Conrad, "is my opportunity. Let us see how my trade will serve me."

And he told the shoemakers if they would help him to a shop and a forge, he would make nails for them. They furnished him what was required, and he went at the work in earnest. He made better nails than had ever before been seen in that section. He took apprentices, and enlarged his shop, and in time Von Koben's nails were demanded on both sides of the mountains. By slow but sure degrees he arose to opulence as a manufacturer, honored and respected as the founder of his own fortune. And it all came, as he was proud to tell his children in the after years, from his having learned a trade in his youth.

Correspondence.

The Vicksburg Cut-off.

To the Editor of the Scientific American:

In your issue of June 17, I find an article over the signature of C. G. Dahlgren, evidently intended for a correction of errors in a former number, by some other party; but in which Major D. has himself fallen into grave errors, which those who have read his article will readily perceive from reading the following correct statement of the situations before and since the cut-off.

Before the cut-off from Young's Point, the Mississippi river ran a little east of south about four miles, thence nearly northeast six miles, to the United States Cemetery, thence about southwest, half south, to Vicksburg and the landing two miles; in all, from Young's Point, twelve miles. The river continues in this last direction about six miles below Vicksburg, to Brown and Johnson's plantation, thence a little south of east to Warrenton, about three miles. The upper edge of the cut-off and foot of the island made thereby is immediately opposite the foot of Crawford street, a street running east and west from the river, and about the center of our city, the wharf, boat, and general steamboat landing being immediately above, and the Mississippi River Elevator Company's magnificent elevator, and the landing for the St. Louis, Memphis, and Vicksburg Anchor line of packets, below it. The island itself, made by the cut-off, is about one and one half miles long. The present distance to Young's Point by the cut-off is about seven miles; hence you will see that the distance cut off is about five miles, nearly all of which is north of the center of our city, measuring from the head of the cut-off around the island to Vicksburg. From the above you will readily see that Vicksburg has not as yet suffered anything from the cut-off. I am not aware of any steamboat having passed our city, going up or down, since the cut-off, without landing, except coal tow boats with heavy tows; nor do I believe that one has so passed. The damage resulting from the cut-off, if any, will exhibit its effects years hence. Indeed many affect to believe that no injury will result to our city from it, while others fear its final effects upon Vicksburg, its commerce, etc. By giving the above a place in your columns, you will do a simple act of justice to our city, and oblige a thirty-eight years' Vicksburger.

G. L. RECORD.

Vicksburg, Miss.

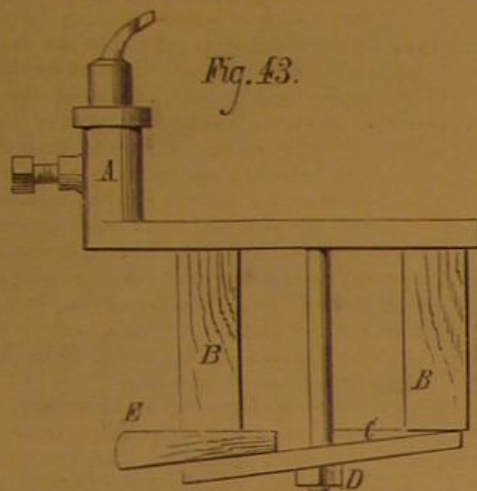
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

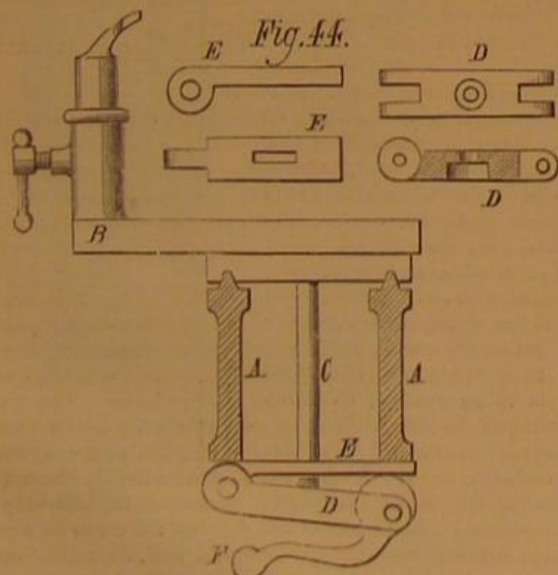
SECOND SERIES—Number VI.

PATTERN MAKING.

To give the required form to various patterns, recourse must frequently be had to that useful machine, the lathe. The lathe adapted for pattern work is strong and steady in the framework, to avoid the tremor resulting from the high speed at which it is driven. It should be of good and durable workmanship and should also be handy, that is to say, the parts requiring frequent adjustment should be provided with the readiest means for accomplishing that end; and especially is this the case with the hand rest and the manner of holding it to the lathe bed, as it is, in the progress of a piece of work, almost constantly changed in position. Fig. 43 shows the method, still followed by many wood turners, of holding the hand rest; it is a primitive arrangement, but the tightening and loosening of the wedge, E, is found to take less time than screwing up the nut. In Fig. 43, A



is the hand rest, B B the lathe shears, C the clamp, and D the nut upon the bolt, E, the head of which slides in a groove running along the foot of the hand rest. It will be observed that the nut, being beneath the lathe shears, is somewhat unhandy to get at, and the wrench may not perhaps at the moment be at hand; while, in any event, screwing up a nut with a wrench is a slow process. In some cases there is substituted, for the nut, a wheel with a tapped hole in its center; but it is still not perfect, because the workman, in slacking it off, gives the wheel a twist; and while his attention is absorbed in the intricacy of his work, the momentum of the rim of the wheel has kept it turning, so that it either unscrews itself altogether and falls off, or runs so far back that it requires handling twice to bring it home when refastening it. A much better method is now in many cases adopted; it is shown in Fig. 44, in which A A represents the lathe shears, B the hand rest, C the fastening bolt, D a piece hinged at each end and having through its center a hole to receive the fastening bolt, and a counter-sink or recess to receive the nut and prevent it unscrewing. E represents a hinged plate, and F a lever, having a cam at



its pivoted end. A slot for the fastening bolt to pass through is provided in the plate, E. In this arrangement, a very moderate amount of force applied to bring up the cam lever will cause the plate, D, to be pressed down, carrying with it the nut. This arrangement is simple, cheap, durable, and very handy, and may be applied on any existing lathe to the hand rest, slide rest, or tail stock. There are other simple and useful contrivances devised for the same purpose; but generally speaking, the lathe requires to be designed to accommodate them, and they are not superior in action to the system above described.

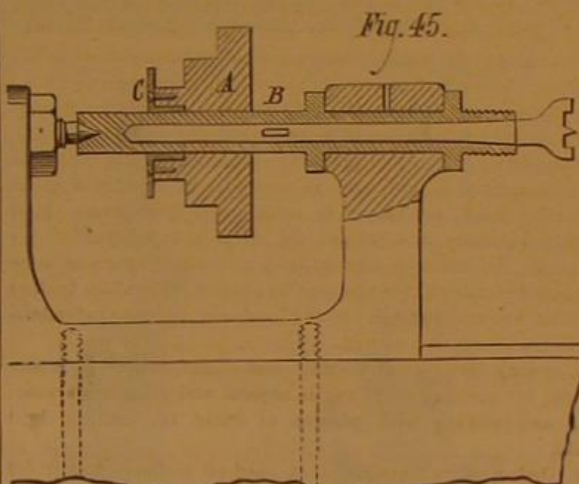
The running head of the lathe requires particular mention. The mandrel should always be of steel, turned true, hardened, and trued by an emery wheel after the hardening process. It should be well fitted to its bearing; for if it is not, an unpleasant jarring noise will be produced when the latter is set in motion.

Hard steel coned bearings are very desirable, and will work perfectly when properly made, lasting practically unimpaired for years. They are, however, expensive to make;

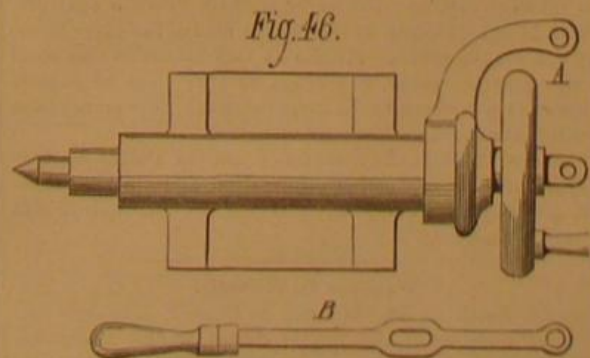
and in view of the present active competition in producing cheaply, most mechanics, knowing the difficulty attending the proper fitting of this style of mandrel, feel more or less dubious as to the perfection of such lathes until they have been well tried. Next to a hard steel coned bearing, we should prefer a cylindrical one of hard brass: that is to say, a mixture of five parts copper, one part tin, and one quarter part zinc. The length of the journal should be three times its diameter; the brasses should be made in halves, and adjusted so that the faces of the brasses are butted when the cap screws are tightened home, and the journal is at a neat working fit in the bearings. It will then be a long time before the brasses will require letting together for adjustment. If, however, the joint faces of the brasses are left open, the cap screws are apt to slack back, there being no pressure on them to retain them in their places. It is an advantage to have the mandrel bored nearly through its length, say within one inch of the tail pin or screw, whose coned end forms the bearing for that end of the mandrel. The size of the hole referred to should be as large as is consistent with the strength of the mandrel. This arrangement is shown in Fig. 45. The usefulness of this bore or hole is that, when a number of small pieces require to be turned, a nipping chuck can be screwed on the mandrel, and a long piece of stuff can be pushed up the hole, and the projecting end to be operated upon nipped in the chuck; then, when a piece is finished, all we have to do is to advance our long piece of stuff and proceed again.

The method ordinarily employed is to drive a plug into the mandrel, and form the projecting end to the shape required. By this plan more stuff is lost than is used; and if the plug is not well fitted and driven, it loosens while being operated upon, to say nothing of the trouble of extracting the stub from the mandrel when the work is cut off. Another purpose served by the long bore is that it will form a guide for a boring bar.

The cone pulleys should be as light as possible for a pow-

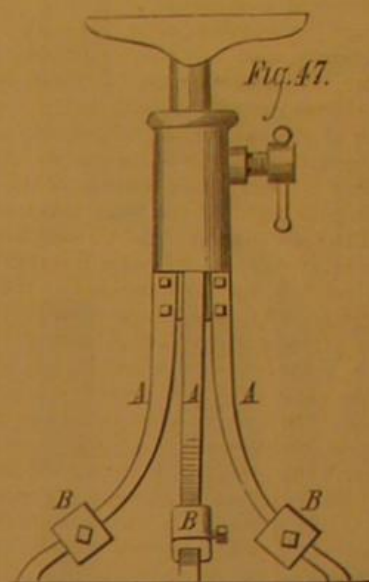


er lathe. Hard wood is very suitable for them, the manner of fastening to the mandrel being shown in Fig. 45. The cone pulley, A, is bored to fit the mandrel, B, tightly, and secured at the end to receive the light brass bush, C, which is keyed to the mandrel and screwed to the pulley. The reason for making the cone pulley of wood is that, if it were of iron, and consequently heavy, it would, from its weight, require time to get up to its full speed; and from its momentum, it would take some little time to stop in both cases, especially if the work were heavy. The tail stock should, in addition to the hand wheel, be provided with an arm; and a lever, to give rapid motion to the spindle when used for boring purposes, should be added, the arrangement being as illustrated in Fig. 46, in which A represents the arm or fulcrum, and B the lever, which is applied after the hand wheel is removed. The end of the screw must be cut like a double eye. The long hole or slot in the middle of the line is to allow for the difference in the direction of the motion, since the lever moves from its end as a center, while the tail stock spindle moves in a straight line. The supporting frames of the lathe need not be very heavy, but should be well braced to the shears or bed, and screwed fast



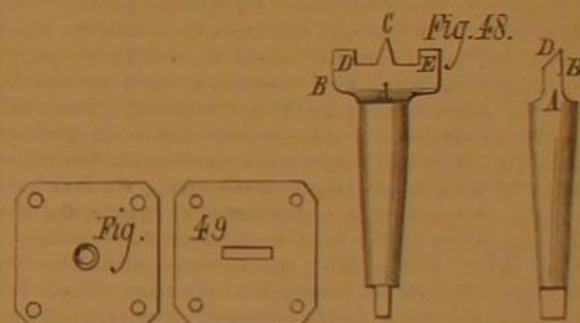
to the floor. It is not an uncommon thing, when an unusually large job is being done in the lathe, to brace or shore the lathe by means of braces placed between the lathe shears and the floor, wall, and ceiling. Of this arrangement it is sufficient to say that it is merely a makeshift, and is only resorted to when the floor is springy. In cases where it is necessary to use one lathe for both large and small work, the countershaft overhead should be so placed that the belt will run quarter-cross when the lathe head is placed across the ewo, in which position there will be full swing for large work from floor to ceiling.

It remains now to provide, for large work, a means of supporting the hand rest. The handiest is the portable tripod rest shown in Fig. 47. The legs, A A A, are curved so as to get the rest close up to a large chuck. Heavy weights, in the form of a U, as shown at B B B, may be clamped, by means of the set screw, to the legs, to give additional steadiness if required; but if good spread be given to the legs, so that they may form an angle of about 60° to the floor (taken

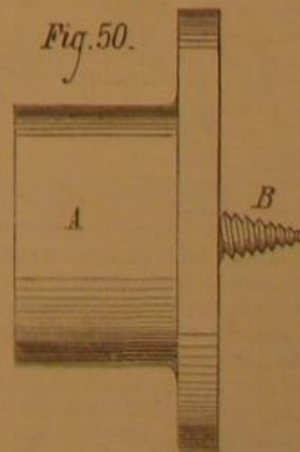


from the point of the foot to where the leg joins the hub), the weights may be dispensed with; and at the same time more space will be occupied, so that it may not be possible at all times, on account of surrounding objects, to get such a broadly spread rest into the position required; hence a narrower spread, in conjunction with the weights, is, under such condition, the most desirable.

We come now to the various chucking contrivances employed by the pattern maker. In Fig. 48, A represents a fork center, the taper part of which fits into the lathe mandrel in place of a center, the extreme end, B, being a flat projection, providing that there is a recess in the mandrel to receive it, as there should be. But if the lathe mandrel is bored up a great distance, then the extra length which may be given to the conical part of the fork will cause adhesion sufficient



to drive the work. The broad part is wedge-shaped on the edge view, the center point, C, being turned conical, similar to a common center. The center, C, acts to keep the work true, and as a guide in taking the work in and out of the lathe, while the prongs, D and E, drive it. This tool, however, is only to be depended upon for small work; for larger work, center plates are used. They are made of metal and screwed firmly to the work. Of these center plates, one has a slot in it, so that it may be used in conjunction with the fork; while another has a conical hole in the center, which hole is made to fit the back center of the lathe. They may be made of hard wood, screwed to a small iron face plate; such plates are made useful for a variety of purposes. A pair of such center plates are shown in Fig. 49, A being that to receive the back center, and B that for the fork center. Another driving chuck for small work is shown in Fig. 50.

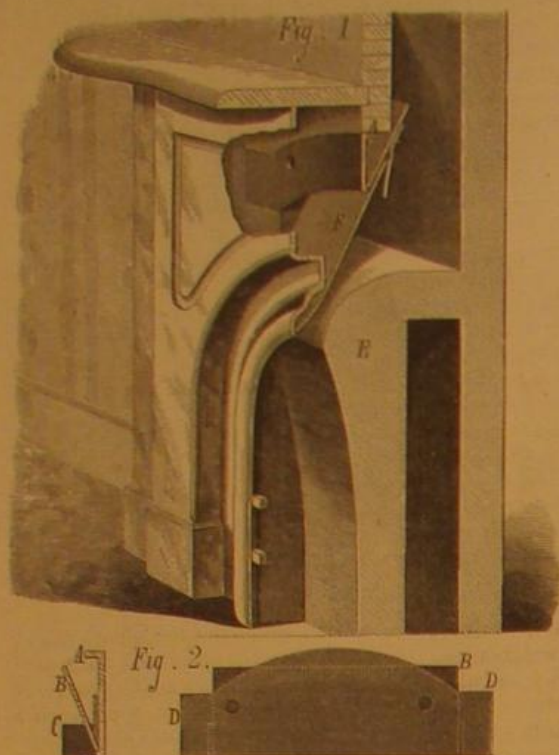


the part, A, having an internal screw to fit the driving screw on the lathe spindle, and the point, B, being a coarse screw intended to screw into the work; which latter should have a small hole bored up it to prevent (especially in the case of hard woods) the pressure of the screw from splitting the work.

The following imitation shellac varnish is used by many furniture manufacturers: Gum sandarac 1½ lbs.; pale rosin 1½ lbs.; benzene 2 gallons. Dissolve by a gentle heat.

WICKERSHAM'S FIRE PLACE ARCH BAR.

The usual support for the brick arch of chimney fireplaces is a flat iron bar, made either straight or slightly curved. To this, the principal objection is the liability of obstruction to the passage of the smoke by reason of the thickness of the superincumbent brick arch or wall. In order to obviate this, the inventor of the device herewith illustrated employs an



arch bar of improved construction, and combines therewith a plate for directing the smoke. The front part of the bar has a horizontal flange, A, on its upper edge, which is turned inward and made sufficiently wide to support the brickwork above. To the lower edge of the plate, A, is united the back plate, B, which extends upward and inward at an angle of about 25°. An inwardly projecting foot, C, Fig. 2, on plate, A, centers recesses in the fireplace jambs, and thus firmly secures the arch bar. The ends of the latter, D, also project laterally and enter recesses in front of the jambs.

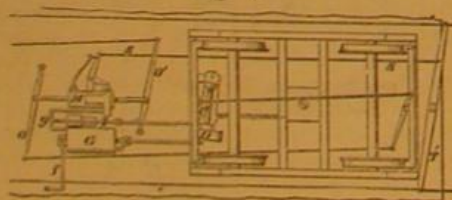
It will be perceived that, by reason of the thin lower edge of the arch bar, and also the inclination of the back plate and the smooth surface of the same, no obstruction is offered to the passage of the products of combustion into the flue. The back plate has also the additional function of turning any downward-setting current of cold air, and thus creating a whirl, which is claimed to aid the draft instead of impeding it. Another result of the employment of this arch bar is that the back wall, E, of the fireplace may be extended three or four inches higher and at least two inches forward, thus increasing the heating and reflecting surface. In practice a supplemental flange or plate, F, Fig. 1 (which has the same form and inclination as the back plate, B), is supported by a tongue pivoted on the latter, while its lower edge is attached to the framework of the grate. Holes are formed in the front plate, A, to allow of the escape of heated air into the flue. The arch bar may be cast in a single piece if desired. It appears well calculated to improve the draft of chimneys and the heating capacity of grate fireplaces, besides affording some incidental protection to mantels from the action of smoke and heat.

Patented through the Scientific American Patent Agency, May 9, 1876. For further information address the inventor, Mr. Isaac McCown Wickersham, Harrodsburg, Mercer county, Ky.

A NEW AUTOMATIC CAR BRAKE.

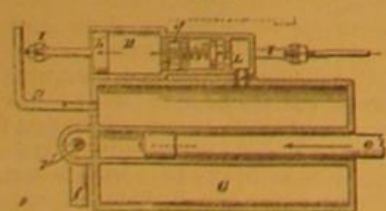
Mr. Alfred James, of Seymour, Jackson county, Ind., has patented (July 6, 1875) an automatic brake for cars, operated

Fig. 1.



by compressed air and embodying some novel and interesting mechanical features. Larger drawings than we are here able to present are necessary to convey a complete idea of its construction, but the annexed diagrams will suffice to give a general notion of the new points.

Fig. 2.



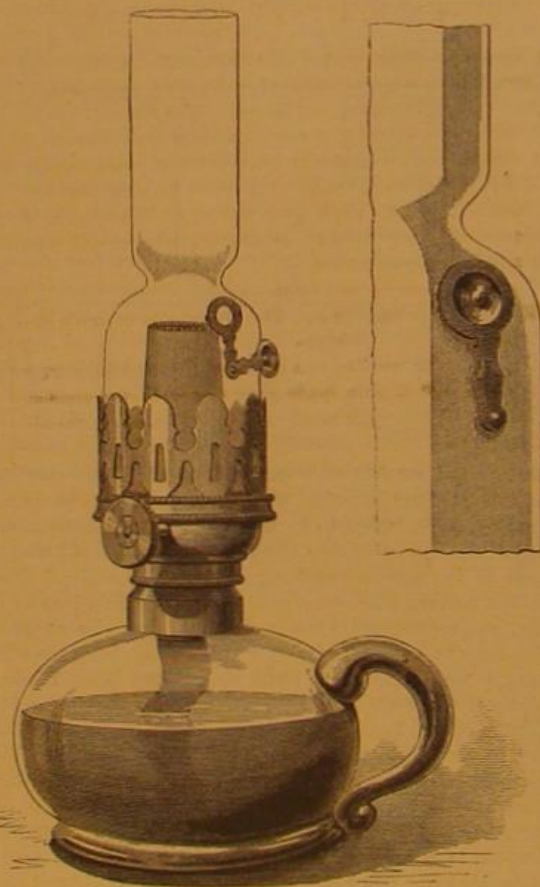
Under the car is arranged an auxiliary shaft, C, Fig. 1, carrying a friction wheel, D, which, by the action of a coiled spring, is drawn against and rotated by the car axle when the vehicle is in motion. A pitman on the wheel, D, con-

nects with the rod, E, Fig. 2, which draws in air through the opening, F, whence a pipe leads to the roof of the car. This air is compressed in the annular chamber, G, beside which is a cylinder, H, in the larger bore of which is a plunger, A, which acts on a yoke, I, which last connects with the swinging frame in which the shaft, C, is mounted. The small bore of the cylinder, H, has an adjustable nut, J, and a valve actuated upon by a spring, which valve, when opened, allows access of air from cylinder, G, behind the plunger, A. At M, Fig. 1, is the brake cylinder, in which are two pistons, moving in relatively opposite directions so as to act on the brake levers, O O'.

The air pressure at which it is required to operate the brakes is regulated by adjusting the valve in H. As soon as pressure is generated in G, the air passes to the brake cylinder, M, and shuts the inlet valve there located. As soon, however, as the desired point is exceeded, the valve in H opens, the air enters behind the plunger, A, acts on the yoke, I, and so pulls the friction wheel out of contact with the axle, thus stopping further storage of compressed air. Now when the brakes are to be applied, the engineer pulls a cord so as to swing the lever, T, as shown in Fig. 1. A rod connected to this moves a bell crank on the brake cylinder to close a discharge valve thereon. By suitable mechanism, the inlet valve is then opened, the compressed air forces the pistons outward, the brake levers are acted upon, and the brakes applied. The brakes can be thus thrown into action on any single car or any number of cars. No special engine is required to compress the air, as the power is obtained by the advance of the train. The accidental uncoupling of the cars is sufficient to throw the brakes into action, and injury to the brake system under one car has no effect on the rest of the train. The inventor may be addressed as above.

TOLMAN'S IMPROVED LAMP CHIMNEY.

We illustrate herewith another simple patented household convenience, from which no doubt a considerable sum will be realized. It consists of the ordinary lamp chimney with a hole through it, by which the necessity of removing the



same in order to light the wick is avoided. The device is shown in full size in Fig. 2, and the chimney attached to the lamp in Fig. 1. The hole has an eyelet fitted in it, from which extends a shank downward, to form a support for the cover, the stem of which is pivoted. The shank and stem are set so as to spring the cover slightly into the aperture, which is tightly closed by the convex side of the cover pressing against the eyelet. Simple as this invention may seem to the general reader, it belongs to that class of patents which often produce to the inventor much more money than greater inventions on less used machines.

Patented through the Scientific American Patent Agency, May 30, 1876. For further information address the inventor, Mr. Elijah Tolman, Jr., P. O. box 48, Taunton, Bristol county, Mass.

William D. Russell.

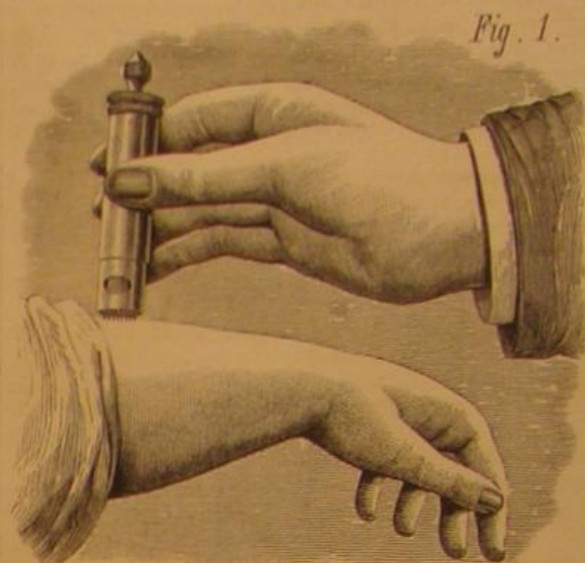
By the death of Mr. William D. Russell, president and business manager of the Baxter Steam Engine Company, Newark, N. J., loses one of her most energetic and prominent citizens. On Friday evening, June 16, Mr. Russell returned to his home from Philadelphia, and at about ten o'clock was taken ill. A physician was at once summoned, and pronounced his attack one of paralysis. Shortly after midnight he fell into a stupor, and died in the morning from affection of the brain. His disease is supposed to have been caused by mental strain, in view of pressing business engagements, and possibly from being overheated while at Philadelphia. Mr. Russell was for many years engaged in the rubber business in New York city, but some years since became a large stockholder in and president of the Baxter

Steam Engine Company. He was also interested in the Baxter Steam Canal Company.

We have known Mr. Russell for many years, and can attest his many good qualities. He was genial and pleasant in his intercourse with men, and will be missed by a large number of personal and business acquaintances.

ELLIOTT'S APPARATUS FOR APPLYING CROTON OIL.

Croton oil and other substances possessing similar qualities are used by physicians as counter irritants to subdue and destroy internal or deeply seated diseases and to induce or substitute therefor a superficial inflammation. The external application of this medicament is attended with very



beneficial effects; and in order to admit of said application in an easy and expeditious manner, to avoid unnecessary suffering to patients, and to insure a proper deposition of the irritant, the present device has been contrived. Fig. 1 shows the method of its manipulation, and Fig. 2 its internal construction.

The apparatus consists of a case or tube containing at one end a reservoir for the reception of the irritant. At the bottom of the case a roller is pivoted, the whole periphery of which is studded with needle points projecting a short distance from the surface. The position of the roller within the case is such that a portion only of its diameter projects beyond the lower open end. The irritant is conveyed to the roller by means of a peculiarly constructed tapering stopper, the lower portion of which is contained within a circular brush, the feather ends of which rub against the needle points.

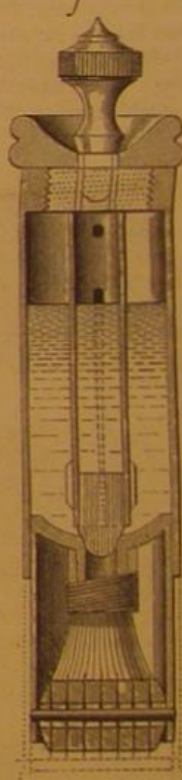
The operation of the instrument is as follows: The croton oil is conveyed to the roller by slightly loosening the taper stopper in its seat, an application which is greatly facilitated by the double milling on its flanged head. The oil runs down the brush, and is evenly spread upon the needle points as they pass through the brush, each point being entirely and freshly coated with oil at every revolution of the wheel; thus, as the roller is passed up or down on the surface upon which the counter irritant is to be applied, no needle point enters the skin without leaving a deposit; and a peculiar advantage that this mode of applying the oil has over the ordinary method is that the needle point enters and leaves the skin at different angles, thus enlarging the hole at the bottom of the puncture and causing the oil to be deposited therein. Another advantage is that, on tender or particularly painful spots, the roller can be applied with the utmost delicacy of touch, in a striking contrast to the application of the pounding instrument now in use. And lastly, a large amount of surface can be perfectly, as well as expeditiously, covered or acted upon.

The invention was patented in Canada, February 1, 1876. For further information address the inventor, Dr. J. W. Elliott, Box 76, Toronto, Ontario, Canada.

Or-Moulu.

The or-moulu of the brass founder, popularly known as an imitation of red gold, is extensively used by the French workmen in metals. It is generally found in combination with grate and stove work. It is composed of a greater portion of copper and less zinc than ordinary brass, is cleaned readily by means of acid, and is burnished with facility. To give this material the rich appearance, it is not unfrequently brightened up after dipping by means of a scratch brush, the action of which helps to produce a very brilliant gold-like surface. It is protected from tarnish by the application of lacquer.

Fig. 2.



IMPROVED MILITARY TELEGRAPH.

We extract from *La Nature* the annexed engravings relating to M. Trouve's new military telegraph, an apparatus of very ingenious construction. It is composed of a cable containing two wires, which is extended between the stations; and at each of the latter is a battery and instrument. The stations are simply the individuals who work the line, and instruments and batteries are secured to their persons. The officer on the right, in Fig. 1, is supposed to be establishing a line. Attached to his belt is a box containing the battery; and to this is connected the telegraph instrument, which is about as big as a watch, and which can easily be carried in the pocket or hooked to an epaulette. The soldier shown starting off with the line carries on his back, knapsack-fashion, an apparatus which is represented in detail in Fig. 2. On the upper part is a large coil of wire, and below is the battery in a box. The instrument during transportation is hooked, as shown in Fig. 1, to the frame of the apparatus.

As the soldier advances the cable unwinds. If, for example, he is a skirmisher sent out to reconnoitre, he can now transmit intelligence of his discovery of the enemy, since he has only to unhook his instrument and signal. Each coil carries about six tenths of a mile of wire. Signals can, however, be sent from any point within this distance. The cable is insulated, each conducting wire being covered with rubber, and both united being enveloped in the same substance. With this safeguard, the cable can be laid over moist earth or even through streams, without its electrical qualities becoming impaired. In laying the line, however, the soldier is required to select a course as much away from roads and open country as possible, and to extend his wire on trees, so that it will be out of the reach of injury. Two men may, of course, be sent out; so that, when the coil carried by one is exhausted, the other may attach his cable, and thus extend the line for several miles.

Fig. 3 represents the telegraph instrument at one half its natural size. It is simply a case of metal containing an electro-magnet which, when the current passes, attracts its

paid laborers, must be what Darwin would call an inversion—in this case an hereditary remnant of the original savage—or else a survival of slavery in the state. The facts which the author gives in support of the last view will surprise many, for it is not generally known, we believe, that actual slavery existed in Great Britain up to the beginning of the present century. In ancient times the Saxons were notorious slave dealers, and the Irish were their best customers. After the Norman conquest the Saxons became slaves themselves; and it was not until the commencement of the 15th century, in Henry IV.'s time, that Saxon mechanics were allowed to put their children to school.



TROUVE'S MILITARY TELEGRAPH.

Queen Elizabeth emancipated the last serfs in England, but the Scottish serfs were not freed until 1799. Before then, colliers and salters belonged to the soil. They were bought and sold with it, and their masters simply provided them with the sustenance necessary to keep them in working condition. They never were required to save for any purpose, for they had no right to their own savings. The habit of improvidence was then formed among the colliers and iron workers, and it still continues.

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

A new cement for uniting metallic to non-metallic substances is composed of thin-made glue mixed to the consistency of thick varnish with wood ashes. The ashes should be added gradually to the glue during ebullition, with constant stirring, and the cement should be used hot.

A strong mucilage capable of fastening wood or porcelain and glass together is made of 8½ ozs. strong gum arabic solution, to which a solution of 30 grains sulphate of aluminum dissolved in ½ oz. water is added.

Carbolic acid paper, now largely used for packing fresh meats, in order to preserve them, is prepared by melting 5 parts stearin at a gentle heat and then stirring in 2 parts carbolic acid, and afterwards 5 parts melted paraffin. The mass is well stirred until cool, and is then applied with a brush to the paper.

Care should be exercised in handling carbolic acid, as in certain cases it is an active poison. A saturated solution of carbolic acid in alcohol, with an equal quantity of water, rubbed into a scratch on a cat's nose, has killed the animal almost as promptly as prussic acid would have done.

A method recommended for removing moths from carpets is to pour strong alum water on the floor to a distance of half a yard around the edges before tacking down. Then occasionally spread dry salt over the carpet before sweeping.

The best method of producing crystalline surfaces on tinned iron and other metals is to immerse the plates for not longer than 10 seconds in a mixture of 3 parts hydrochloric and 1 part nitric acid diluted with an equal bulk of water. Wash the plates in water after their immersion.

Artificial Tobacco.

Tobacco leaves for the manufacture of Havana cigars are now being produced in New York, thanks to the industry of some of her citizens, aided by the progress of chemical science. The material used is a kind of brown wrapping paper, made of straw especially for this purpose. The paper, after coming from the mill, is saturated with the juice pressed from tobacco stems and other offal; then the sheets are rolled through a machine, which gives them the perfect appearance of the tobacco leaf, and the peculiar spots are printed on them as on calico. The paper thus prepared is especially adapted for wrappers around the cigars, and is such an improvement on the natural tobacco leaf (being much stronger, more economical, and easier of manipulation) that the Havana cigar makers desire no other wrapping for cigars, and import it largely from New York; and no Havana steamer leaves here at present without taking out quantities of it. These figure up, according to some authorities, to 5,000 reams in one cargo, and occasionally as much as 30,000 reams of this artificial tobacco leaf has been exported.

It is stated that this tobacco-flavored straw paper makes also a filling superior to the genuine leaf; and it is impossible to detect the delicate film of paper interlapped with

some broken leaves of real tobacco in the finished cigar, which the paper so very neatly holds in form. Besides this, the paper leaves no residuum other than a pure light gray or nearly white ash, just like that of the best quality of tobacco.

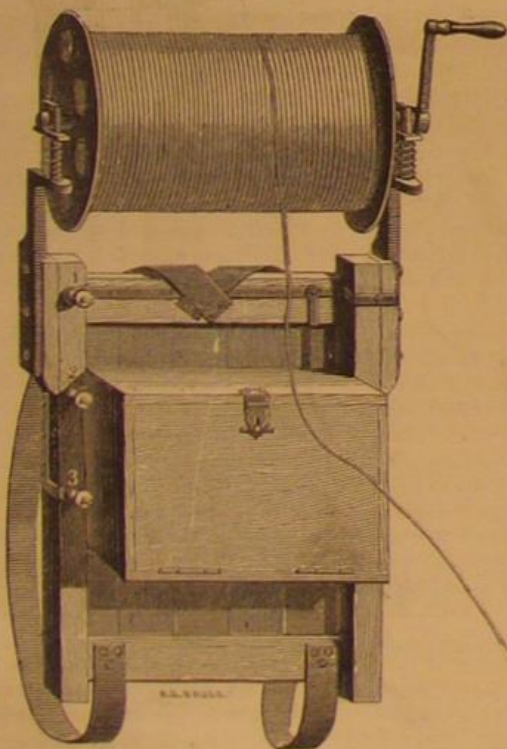
The Manufacture of Glucose.

As there is just now much inquiry as to the process of making glucose or grape sugar directly from starch or other vegetable matter, the following will be of interest:

Dilute sulphuric acid and the fecula of the potato are the active agents in the production of grape sugar from starch.

The principal processes are the following: The boiling of starch meal with dilute sulphuric acid is effected on a small scale in leaden pans; but in an extensive preparation, iron pans are employed. The requisite quantity of water is first heated to the boiling point, and to this is added the sulphuric acid diluted with 3 parts by weight of water. The starch is also brought, by the addition of water, to a milky consistency. The liquids so prepared are mixed, and the boiling continued until all the starch is converted into sugar. An intermediate stage, not usually noticed by the manufacturer, is the conversion of the starch into dextrin, which, in its turn, suffers conversion into sugar. The entire conversion of the dextrin into grape sugar cannot be with certainty ascertained by the iodine test, as sometimes a purple-red tint is produced, while in others there is no change. The most reliable test is that with al-

cohol, founded on the well known insolubility of dextrin in an alcoholic menstruum. If no precipitate is thrown down there is no dextrin remaining, and the conversion has been entire. The proportions of materials are, generally, to 200 lbs. of starch, 4 lbs. of ordinary sulphuric acid of 66° Baumé, and from 80 to 100 gallons of water. The conversion of the starch and grape sugar is hastened by the addition of a small quantity of nitric acid. The separation of the sulphuric acid from the sugar solution is a most important operation, for the color, purity, and flavor all depend upon success in this stage of the process. The acid is neutralized with baryta or lime, with either of which it forms an insoluble salt, deposited at the bottom of the neutralization vessels, and leaving



TROUVE'S MILITARY TELEGRAPH.—Fig. 2.

mature with an audible click. This amply suffices for sending sound signals. The key for transmitting messages merely closes circuit, and is arranged as shown at the upper part of the case.

The Fastest Cable Telegraphy.

On a recent occasion, when all the Atlantic cables were interrupted except the Direct, the entire business for two days was done on this one wire, and the average speed maintained for 48 successive hours was 104 words per minute. The highest speed attained was 18 words per minute. Length of cable, 2,500 nautical miles. This is the fastest ocean telegraphy ever executed on a cable of equal length.

A Relic of Slavery in England.

Mr. Samuel Smiles, in his recent excellent little work entitled "Thrift," devotes a chapter to the consideration of why it is that English workmen, earning, as many do, better wages than the average class of clerks, are unable to live thereon. After examining various probable causes, he comes to the conclusion that the reckless extravagance and indifference regarding the future, peculiar to many of the highest



TROUVE'S MILITARY TELEGRAPH.—Fig. 3.

a clear supernatant sirup. The baryta can be employed as a carbonate (witherite), and is, without doubt, the better neutralizing agent, sulphate of baryta being very insoluble. Lime, although ordinarily used, forms with the sulphuric acid a sulphate (gypsum) that is not perfectly insoluble in water. It can be employed as marble dust, chalk, or caustic lime. The neutralization is completed in the boiling pan while the sirup is still hot. For every pound of sulphuric acid so much pulverized marble is required as the varying strength of the acid may demand, about pound to pound. After the addition of the marble powder, and when the effervescence has subsided, the liquid must be tested with litmus paper, or, better, with tincture of litmus; if the sugar solution be neutralized when at 26° Baumé density, the following evaporation will concentrate even the smallest quantity of sulphuric acid which may have remained, and render another neutralization necessary. To insure perfect neutralization, it is useful to add an excess of carbonate of baryta in the proportion of 5 to 10 ozs. to every 10 lbs. of sulphuric acid. The evaporation and purification are similar to those employed for other sugars.

NEW YORK ACADEMY OF SCIENCES.

A meeting of the New York Academy of Sciences, formerly the Lyceum of Natural History, was held recently in Professor Mayer's lecture room, at the Stevens Institute of Technology. Two communications were made by Professor A. M. Mayer and one by President Henry Morton. The first paper was by Professor Mayer on

CROOKES' RADIOMETER.

and on some results obtained by the action of sound pulses on an apparatus constructed in a similar manner. Crookes was led to the construction of his delicate instrument in the following manner: He made a torsion balance consisting of a bar of pith suspended by a fine filament. One half the length of this bar was blackened. On exposing this apparatus to rays from different parts of the prismatic spectrum, he found that the torsion balance moved through spaces proportional to the thermometric effect produced by the same area of rays falling on a thermopile. Representing the motion produced by the ultra-red rays by 100, those of the other rays were as follows:

Extreme red.....	85	Blue.....	23
Red.....	73	Indigo.....	8½
Orange.....	66	Violet.....	6
Yellow.....	57	Ultra violet.....	5
Green.....	41		

The difficulty of ascertaining facts in Nature, even by the most careful observers, is well illustrated here by the fact that Crookes overlooked the circumstance that he was here operating with a purely accidental spectrum, the proportion of whose parts depended entirely on the nature of his prism. Had he employed the normal or diffraction spectrum produced by the passage of light through finely ruled gitter plates, his results would have been the same as those obtained many years ago in this country by Dr. Draper.

Crookes found that the bar of the torsion balance was attracted when the apparatus contained air, and repelled when it was placed in a vacuum; also that the radiation from a candle on blackened pith was 5½ times what it was on plain pith. From these observations to the construction of the radiometer was but a short step. Two fine wires, at right angles to each other, were provided with little vanes of mica blackened on one side, and the whole suspended on a pivot and enclosed in a glass vessel, from which the air was exhausted by means of a Sprengel pump. When rays of light fall on this apparatus, the differential action of the blackened and natural surfaces of the vanes gives rise to a continuous rotation. The rate of this rotation, and hence the intensity of the exciting cause, was obtained by means of a small electromagnet placed in the apparatus in such a manner as to register the number of revolutions by making a series of dots on a slip of paper.

Professor Mayer then exhibited this very delicate instrument to the meeting, and showed the increase in the velocity of rotation on bringing it nearer a source of light.

In order to measure the repulsion of a blackened surface in a vacuum, Crookes employed W. Ritchie's torsion balance, described in the "Transactions of the Royal Society" of 1830. This is so arranged that the repulsion of the blackened surface twists a fine glass thread, to which is attached a mirror projecting a beam of light on a screen. By means of a screw, the circumference of which is divided into 360°, the glass thread is turned back again until the beam occupies its original position. The amount of torsion is then read off on the screw. The extreme delicacy of this instrument may be appreciated from the fact that the $\frac{1}{100}$ of a grain produces a torsion through 10,000 degrees or about 28 rotations of the thread. As it is sensitive to 1° of rotation, it is evident that we can thus weigh $\frac{1}{10000}$ of $\frac{1}{100} = \frac{1}{1000000}$ of a grain!

A candle at a distance of 6 inches repels 2 square inches of surface of blackened pith with a force of 0.001772 grain, at 12 inches distance with a force of 0.000444 grain. Starting out with the latter figure, and remembering that the effects are as the reciprocals of the squares of the distances, we should obtain at 6 inches a force of 0.001776; which differs from the result actually obtained by experiment by only the $\frac{1}{1000000}$ of a grain.

After succeeding in constructing so perfect an instrument, it is not surprising that Crookes should be elated; but it is to be regretted that he should express himself as he did in the following extract from his paper: "A candle 12 inches off, acting on 2 square inches of surface, was found equal to 0.000444 grains; the sun, equalling 1,000 candles at 12 inches, gives a pressure of 0.44000 grain; that is equal to about 32 grains per square foot, to 2 cwt. per acre, to 57 tons per square mile, or nearly 3,000,000,000 tons on the exposed surface of the globe—sufficient to knock the earth out of its orbit if it came upon it suddenly." It is true he immediately modifies this statement, but it is liable to be quoted without the following disclaimer: "It must be remembered that our earth is not a lamp-blackened body enclosed in a glass case, nor is its shape such as to give the maximum surface with the minimum of weight."

Still more mischievous, however, is the pretention to "weigh a beam of light." That it is not light which causes the rotation in Crookes' radiometer has been conclusively proved by Schuster ("Proceedings of the Royal Society," April, 1876). He made a radiometer having one arm a magnet. When a strong light fell on this apparatus, it overcame the directive force of the magnet, and caused it to rotate in the usual way. Now on floating the instrument in water, and holding a magnet outside to keep it stationary in spite of the strong light falling upon it, the bulb began to rotate in a direction opposite to that which the light would have imparted to the vanes.

The only plausible explanation hitherto offered of the instrument is the following: The vacuum of the Sprengel pump is not a perfect one; but in the highly rarefied air contained in the bulb, the molecules have a much greater amplitude of swing than in their ordinary condition, there being vastly fewer in the same space. Hence the currents set up by the very feeble heat of the rays of light are sufficient to produce a much more intense action than could take place in dense air. The blackened surfaces become heated more than the natural ones, and consequently repel more particles, the reaction of which causes motion; and the apparatus being free to turn, the motion becomes one of rotation, which continues until the effects on the two surfaces become equalized.

To show that the effect was due to heat, Professor Mayer interposed a glass plate between the apparatus and the diffused light from a window. The effect was to stop the rotation by cutting off the heat rays, while the light rays passed through freely. Rotation was also produced by placing the hand near the radiometer.

AN ANALOGOUS APPARATUS FOR SOUND.

In the next place, Professor Mayer exhibited an apparatus constructed by him to produce motion by means of sound pulses. Four glass resonators on cross arms were suspended by means of a string. On sounding an organ pipe in tune with the resonators, and bringing it opposite the mouth of one of them, the resonator was repelled and the apparatus commenced to rotate. This experiment was the more striking from the fact that, so far from any current of air proceeding out of the mouth of the organ pipe, the air is actually sucked in, as may be rendered visible by means of smoke from a cigar. The smoke is carried up the pipe even when the latter is closed at the top with cotton wool so as to smother the sound. On substituting disks of cardboard for the resonators, they were drawn up to the mouth of the organ pipe with considerable force. When fine silica powder was placed in the resonators, it was thrown into violent motion on sounding the pipe.

OBLITERATION OF SONOROUS SENSATIONS.

Professor Mayer next described some interesting experiments, the effect of which will be to modify our present theories of audition. He took an American clock ticking 4 beats a second and a watch ticking 5. At a distance of several feet from the ear, all the ticks of both could be plainly heard, even those which coincided. On gradually moving the watch away from the ear, a point was reached where the fifth or coincident tick of the watch became inaudible. A watch beating 4 times a second was then substituted and set to gain 30 seconds an hour on the clock. Coincidence then occurred every 2 minutes. Removing the watch 24 inches from the ear, its ticks became extinguished for 9 seconds at a time.

To determine the relative intensities of these ticks, numerous experiments were made on still nights in the country, and it was found that the ticks of the clock became inaudible at a distance of 350 feet, and those of the watch at a distance of 20 feet. The ratio of the squares of these numbers makes the ticks of the clock about 300 times more intense than those of the watch. Standing at different distances from the clock, and holding a slender stick graduated to inches and tenths against his zygomatic process, the experimenter slid a watch along the stick (taking care not to touch it) until its fifth tick disappeared. The relative intensities of clock and watch ticks at the same distance being known, their intensities at the distances in these experiments were obtained by the law of reciprocal squares. The slightest noise or breeze renders the experiment impossible.

In the same way one musical sound may obliterate the sensation of one higher than itself. To obviate the objection that this might be due to a change of timbre, Professor Mayer caused one of the notes to sound periodically by opening and shutting the resonant box of a fork with the hand at regular intervals. Now on sounding another lower note, either from a fork or an organ pipe, continuously, its timbre could only be changed during the sounding intervals of the other note, and would be restored during the intervals of silence, if the objection is just. No such effect, however, is observed. The actual result is that the sound of the fork becomes more and more feeble, and finally its sensation is entirely lost. If at this point the other sound is stopped, it is found that the fork is still vibrating and emitting a sound, which had been completely overpowered by the graver one of the pipe. The same takes place if a closed organ pipe of the same pitch is substituted for the fork and its sound is made intermittent.

Another very remarkable fact is that even a very intense sound cannot obliterate the sensation of one lower in pitch. When the ear ceases to perceive the lower sound, it is generally found, on stopping the higher one, that the lower fork has entirely ceased to vibrate. Numerous experiments have been made, through a range of four octaves and on a score of ears, always with the same result.

If a sentence is read over and over in the same tone of voice and modulation, while an Ut pipe is sounding, it seems as if two persons were reading, one with a very grave voice (consisting of all the vocal sounds below Ut) and one with a high, squeaky, and nasal voice. The intermediate harmonies are obliterated. The fundamental tone of most notes is perceived as the strongest, because each harmonic is diminished by the sum of all below it, while the lowest is not affected by any of them. On sounding Ut, together with an Ut, free reed pipe, the component Ut, is perceived unaffected in intensity, while all the higher harmonics are obliterated except Mi, and Sol, which are very distinct. The deep residual sound of a New York fire alarm bell is heard

distinctly through all the noises of the street higher than it is until it dies entirely away. It seems in these experiments as though we had a special sense for the lower sounds.

Professor Mayer stated that since these discoveries he has repeatedly witnessed in orchestral music the entire obliteration of all sounds from the violins by the deeper and more intense sounds of the wind instruments, while the bass viols hold their own. From the same cause the clarinets lose their peculiar quality and charm. The leader probably heard them all; but as the ears of the audience hold different relation of distance to the several instruments, they are actually paying for his enjoyment instead of their own. His position ought therefore to be that of an average hearer. The laws of orchestration can only be arrived at by a quantitative determination of the intensities of all musical instruments. When quantitative analyses of the compound sounds in the different instruments shall have been made, the composer will be better able to command such qualities of sound as he desires to bring out. It is evident that instruments to be used in orchestras must be differently constructed from those designed for solos or quartets, and that they must have their peculiarities of timbre exaggerated.

Professor Mayer concluded by stating that he is at present engaged in determining the intensity of sounds either existing alone or as components of compound notes.

The meeting then adjourned to President Morton's lecture room to listen to a communication on some fluorescent bodies.

FLUORESCENCE.

Professor Morton began by stating that the property of lengthening the wave length of light rays, to which fluorescence was due, was one inherent in a great range of bodies. Fluorescence is produced when light rays of one kind are converted into another having a longer wave; when the rays are lengthened so much as to exceed the limits of the spectrum, they are converted into heat. A number of fluorescing substances were then exhibited, producing effects of indescribable beauty.

Fluoresceine, a substance having little color of its own, fluoresced with a rich bright green when illuminated with the electric light passing through blue or violet glass.

Eocene, the tetrabromide of fluoresceine, which has naturally a delicate pink color in solution, became dark green under the same conditions. In this, as in the other solutions shown, the fluorescence produced a very noticeable opacity.

Purpurine, one of the coloring substances made from madder, became very opaque orange yellow. The tinctorial power of this and some of the other substances shown is perfectly marvelous. As much as will lie on the point of a penknife, dissolved in a gallon of water, had to be diluted again with three or four times as much water to produce a good effect. Fluorescence enables us here to distinguish with perfect certainty between the natural product and artificial purpurine. A piece of a dressing gown dyed with madder, having passed the last stage of its usefulness, had been employed for a long time as a rag to wipe up things in the laboratory. A bit of this was treated to extract the purpurine, and its fluorescence was shown to be perfectly distinct and characteristic. By thus analyzing a garment dyed with artificial preparations, we would be enabled to decide with certainty that it could not have been manufactured before the date of the invention of the artificial dyestuffs.

Chlorophyll, made by steeping exhausted tea leaves in alcohol, is a liquid of a very deep green, so deep indeed as to appear almost black. It fluoresced with a magnificent crimson.

A solution of bisulpho-bichlor-anthracenic acid, which is perfectly colorless, fluoresced with a purplish blue.

A dish of nitrate of uranium crystals fluoresced with a luminous yellow color.

An extremely beautiful effect was produced by illuminating a screen on which a large wreath encircling the monogram of the Stevens Institute of Technology was painted by means of different fluorescing substances.

President Morton concluded by exhibiting some absorption bands, and pointing out how they serve to distinguish the substances by which they are produced.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

Positions of Planets for July, 1876.

Mercury.

On July 1, Mercury rises at 3h. 33m. A. M., and sets at 5h. 56m. P. M. On July 31, Mercury rises at 4h. 29m. A. M., and sets at 7h. 6m. P. M.

Mercury is at its greatest elongation west of the sun on the 8th, and can then be best seen. It should be looked for before sunrise, a little south of the point of sunrise.

Venus.

On July 1 Venus rises at 6h. 13m. A. M., and sets at 8h. 30m. P. M. On the 31st, Venus rises at 3h. 21m. A. M., and sets at 5h. 20m. P. M.

Venus is becoming less and less conspicuous, and will probably not be noticed after the first week of July, being too nearly in range with the sun. After the middle of the month Venus should be looked for in the morning, as it has passed to the west of the sun.

Mars.

Mars is now very small, and will not be noticed by ordinary observers. It will be very near Venus on the 5th, and may possibly be seen just after sunset some 45° farther

north than Venus. Mars rises on the 31st at 5h. 16m. A.M., and sets at 7h. 31m. P. M.; it cannot at that time be seen at all.

Jupiter.

On July 1, Jupiter rises at 3h. 45m. P. M., and sets at 1h. 35m. the next morning. On July 31, Jupiter rises at 1h. 47m. A. M., and sets at 11h. 35m. P. M.

Jupiter is so well situated in the first half of the month that observers who have small telescopes (say with two inch object glasses) can very well observe the many changes in the relative positions of its four moons. As the first satellite, or the one nearest to Jupiter, makes a revolution around the planet in less than ten days, it goes through all the changes, passing from east to west behind the planet, and in front of the planet from west to east (as seen in a telescope), becoming invisible by transit, by occultation, and by eclipse in that space of time. This satellite will show these changes of position between 7h. 30m. P. M., and midnight on July 7, 8, 9, 14, 15, 16, 22, 23, 24, 30, and 31.

On July 10 the third satellite (which is the largest, but third in the order of distance) will not be seen until near 10 P. M. (Washington time), being in front of the planet; on the 28th it will disappear at 10h. 14m. by going into the shadow of the planet. Young observers may learn much of this system of bodies by watching their movements, and may determine periods for themselves.

Saturn.

On July 1, Saturn rises at 10h. 35m. P. M., and sets at 9h. 21m. the next morning. On July 31, Saturn rises at 8h. 34m. P. M., and sets at 7h. 16m. next morning.

Saturn can be recognized on July 10 by its nearness to the moon; and by reference to the *American Nautical Almanac* it will be found that the moon occults (hides by seeming to pass over it) the planet Saturn on August 6, and again on September 2.

Uranus.

Uranus is too nearly in range with the sun to be seen. It sets at 9h. 41m. P. M., on July 1, and at 7h. 48m. P. M. on the 31st.

Sun Spots.

We are evidently passing through a minimum period of sun spots; as from May 26 to the present date, June 19, a period of 23 days, with a telescope whose object glass measures two and a half inches, no spots have been found.

NEW BOOKS AND PUBLICATIONS.

TROW'S NEW YORK CITY DIRECTORY, VOL. XC., for the year ending May 1, 1877. H. Wilson, Compiler. Price \$5. New York city: The Trow City Directory Company, 11 University Place.

WILSON'S BUSINESS DIRECTORY, 1876-7. Price \$2.50. New York city: The Trow City Directory Company, 11 University Place.

The peculiarity which distinguishes directories from other books is that everybody wants to consult them, yet few wish to buy them. In fact, there seems to be a kind of popular idea that directories are only magnified sign posts, to be used as freely as the signs on the street corners. This is one disadvantage with which directory publishers are obliged to contend, and which prevents the care and elaboration with which their onerous tasks are performed from being recompensed as highly as they merit. The two volumes above named are the oldest and best known works of their class, and possess a degree of accuracy which none other in this, or any other city, to our knowledge, possesses. In the city directory, there are 241,167 names, and there are seven items (business, number, etc.) to each name; yet we are told there is but one error to every 8,400 items. The number of names above given shows an increase over last year of 7,196, and also proves that the population of New York is steadily growing, notwithstanding the assertion to the contrary by some despondent croakers. Allowing that each name represents five persons—for generally it is only the name of the head of the family that is given—the increase since last year is 35,980 souls. Not only for the counting room and business man is a directory useful, but in the household such a book of reference is very convenient.

THEORY OF SIMULTANEOUS IGNITIONS. By Brevet Brigadier General H. L. Abbot, Major U. S. Engineers. Printed on the Battalion Press.

This is a treatise on the best method of securing the simultaneous ignition of many fuses distributed throughout the charge of one long mine. The theory is mathematically demonstrated at length, and a portable machine, requiring only about four horse power, is described, which will supply an magneto-electric current ample to meet nearly any demand in submarine blasting on the most extensive scale. The paper has already been referred to in these columns, in our abstract of essays read at the last session of the American Academy of Sciences.

POCKET BOOK OF USEFUL FORMULAE AND MEMORANDA FOR CIVIL AND MECHANICAL ENGINEERS. By Guilford L. Molesworth. New York city: E. & F. N. Spon, 446 Broome street.

This is the eighteenth edition of the most convenient engineer's pocket book extant. It differs from the works of Haswell and Nystrom in containing very much less information; but its contents embody just those useful suggestions and formulae with which every engineer fills up the leaves of his private note book. It is of the right size, and contains just the facts which will be convenient to the engineer when called to examine machinery, and to make rough calculations; and not knowing exactly what the requirements are, he feels safer if he has his rules and tables handy.

A TREATISE ON UNITED STATES PATENTS. Edited by H. & C. Howson. Philadelphia, Pa.: Porter & Coates.

This is a neatly bound book of 160 pages, and contains more information of value to patentees than any work of its size that has come to our knowledge. It not only defines the nature and scope of patents, but it states what constitutes an invention, and tells the reader to whom patents are granted, how an acquired interest may be lost, etc. But the most important feature of the book is its citations in brief from decisions in the United States Supreme Court on important and peculiar cases, which gives the book a considerable value to the owners and workers of patents, as such information cannot be had except by laborious search through elaborate law reports.

HINTS TO YOUNG ENGINEERS UPON ENTERING THE PROFESSION. By Joseph W. Wilson, A. I. C. E. New York city: E. & F. N. Spon, 446 Broome street.

The author, in this little pamphlet of 22 duodecimo pages, has combined a good many sound practical hints, and plenty of just the advice which an engineering student requires at the threshold of his profession. It is written in a pleasant half amusing style, does not abound in moral reflections, and, altogether, is an agreeable and sensible little work. More of the same kind would be welcomed by students in other professions and trades.

OUR ROADWAYS. By "Viator." New York city: E. & F. N. Spon, 446 Broome street.

A story who append anonymous names to their productions can hardly

expect much deference paid to their opinions. The present pamphlet has some useful information on pavements in general, but appears to be strongly devoted to the interests of an English wood-paving concern.

THE CLERK OF WORKS' VADE MECUM. By George Gordon Hoskins, F. R. I. B. A. New York city: E. & F. N. Spon, 446 Broome Street.

A useful volume of practical suggestions for the architect charged with the supervision of a building. It is of course mainly in accordance with English practice and customs, which detract from its practical usefulness to our architects; but it possesses hints which may be found of interest and some benefit.

DECISIONS OF THE COURTS.

United States Circuit Court—Eastern District of New York.

THE PATENT DRIVE WELL.—WILLIAM D. ANDREWS & CO. vs. THEODORE A. CARMAN.

(In Equity.—Before Benedict, J.—Decided April 24, 1876.)

This is a suit in equity brought by the owners of a patent issued to Nelson W. Green, on May 9, 1871, designated as release No. 4,372, against Theodore A. Carman for an injunction and damages, because of an infringement of their patent.

The language of the claim may be first considered. It is as follows: "What I claim as my invention, and desire to secure by letters patent, is: The process of constructing wells by driving or forcing an instrument into the ground until it is projected into the water, without removing the earth upward, as it is in boring, substantially as herein described."

I understand this patent to be a patent for a process, and that the element of novelty in this process consists in the driving of a tube tightly into the earth, without removing the earth upward, to serve as a well pit, and attaching thereto a pump, which process puts to practical use the new principle of forcing the water in the water-bearing strata of the earth into a well pit, by the use of artificial power applied to create a vacuum in the manner described.

A somewhat different reading of the patent may be adopted, and supported by authority high in this court upon such a question.

But the view I have expressed is so firmly impressed upon my mind that I shall rest my decision upon it, and leave the more learned judges before whom the patent must be brought to decide upon my error, and to uphold or instead of excavating.

The interpretation I have thus given to the patent renders it unnecessary to pass upon the evidence in the case, given to show that, prior to the time when Green claims to have made his invention, well pits had been made by puncturing the earth.

Was Green the man entitled to secure the invention which his patent describes? The evidence is convincing that Green first conceived the idea, explained his idea to others, and caused the feasibility of his process to be tested by actual experiment. Comment has been made upon the fact that the particular tools and devices used in constructing the first wells made were not related out by Green. But such comment loses its force when it is considered that the tools and devices employed in sinking the shaft form no part of the invention.

The invention consists in the method of putting to practical use the new idea or principle of increasing the productive capacity of a well by forcing water directly from the earth into the well pit, artificial power being employed to create, by the operation of a pump attached to a tube driven tightly into the earth, a vacuum in the tube and the water-bearing stratum into which it is projected, whence follows an increased pressure upon the water in the earth toward the well pit, and an increased supply of water is afforded to the pump. This concept of such a character that when described there was left nothing to be done but to test its correctness by an experiment so simple, and involving the means in such common use that it could be tested by any one upon the mere statement of the idea. In the present instance the process was at the outset put to the test of an experiment conducted near Green's house, in his presence, and under his directions. His idea, and his process of putting it into practical use, became a reality, and the property of the patent in question.

Subsequent experiments are spoken of in the evidence, which may properly be claimed by Green as his experiments, for they were conducted in pursuance of his directions by those acting at the time under his orders.

Furthermore, it should be remarked in this connection that, when Green first stated his idea and described his process there were two points of doubt, one which might be called into question by the creation of the vacuum sufficient to overcome the resistance of the soil, and afford a supply of water to the pump; the other, whether practically a tube could be driven to a water-bearing stratum of the earth under various conditions of soil, always excluding, of course, rock formations.

The general utility of the invention depended principally upon the result of tests applied to the latter of these points of doubt. A wide range of subsequent experiments might have followed for such an invention, notwithstanding the circumstance that the first experiment proved that the principle was sound, and could be usefully applied in some circumstances.

Upon this branch of the case, the contention has been whether Green was the inventor, or Byron Mudge, the person who, under the direction of Green, conducted the early experiments; and a patent issued to Mudge, October 31, 1865, is set up in the answer. The defendant does not, however, claim under Mudge's patent, or under any patent. In fact, there is no patent to Mudge, as his original patent was surrendered; and upon his application for a release, a case of interference between him and Green was declared, which, after a severe contest upon a large amount of testimony, and after careful argument, was decided in favor of Green. No patent to Mudge is therefore in this case, nor is Mudge called as a witness.

But it is asserted that, before the patent was issued to Mudge, the evidence shows Mudge to be the inventor, and not Green. I cannot find upon the evidence that this defense is sustained; on the contrary, it appears quite clearly that the inventor was Green.

A patent to James Suggitt is also set up. That, however, is not a patent for a process, but a combination which does not involve the use of Green's process, and to which Green makes no claim.

The whole of the case, prior to Green's invention, water had been pumped from a hole in the ground, and from a small hole. Doubtless, it is also true that, in some such case, where a pump had been inserted in a small hole, for the purpose of raising therefrom the water found therein, the principle of Green's invention may at times have been called into operation. No such case is here proved; but if such fact were proved, Green's claim would not be defeated by the charge of prior art, for the principle of a principle unrecognized by any one at the time, and from which no information of its existence, and no knowledge of a method of its employment is derived by any one, if proved to have occurred, will not be sufficient to defeat the claim of him who first discovers the principle, and, by putting it to a practical and intelligent use, first makes it available to man.

As bearing upon the question whether the idea claimed to have been conceived by Green, and to have been applied, it should also be noticed that, while the advantages of the process claimed by Green are many and obvious, and although since the date claimed for his invention numerous patents have been issued—some 150, I think the evidence shows—for instruments to be used in putting down the tubes of such wells, no application for any such patent appears to have been made before that time; moreover, the invention when it was announced by Green was received as a novelty, and since then an extensive business of constructing driven wells has sprung into existence—a business of such importance that the number of driven wells since constructed is computed by hundreds of thousands. In this State alone the number is stated by a witness to be 150,000 and upward. The change in the art of well making which the evidence discloses, of itself, goes far to prove novelty. Indeed, when it is considered that the methods in use for obtaining a supply of water from the earth are matters of common knowledge, and that a well is a thing of everyday use, everywhere, reference may be made to the common knowledge of mankind to show that it has not always been understood that a supply of water may be obtained in almost any place by simply driving down tight in the earth a tight tube and attaching thereto a pump. Even now, it is doubtless a new thing to many, to be told that in an ordinary well from which the water is drawn by a pump be filled up with dirt, and the dirt packed tightly around the pump, the productivity of the well will be thereby increased.

My conclusion upon this branch of the case, therefore, is that the invention of Green has not been shown to have been anticipated, and is properly claimed by Green as a new and useful invention made by him.

I come now to consider the question of dedication and abandonment, which is presented by the evidence here, and is a question as important as any raised in the case.

It is contended that Green, at the time of his invention, dedicated it to the public, and also that he abandoned it as not worthy to be patented.

HISTORY OF THE DRIVE WELL AND ITS INVENTOR.

The law pertinent to this branch of the inquiry is the law in force prior to January, 1880. By the patent act of 1870, as well as by the Revised Statutes, all rights previously acquired were preserved. The law governing here is to be found, therefore, in the acts of 1836 and of 1870, as those statutes have been interpreted and applied by the courts. The facts relied upon as showing a dedication of his invention by Green are that he permitted a well made by him to be used on the farm where he resided in Cortland, where the Seventeenth New York Regiment, of which he was colonel, was then stationed, and that he publicly used, and that he arranged for providing tubes to be taken with his regiment when it should move in order to supply it with water when in hostile localities. That these facts do not amount to a dedication, I think is plain. The occasion which called forth this invention was the rumor that the rebels were intending to poison the wells in places where the Union army might come, and the rumor that some part of the Union army had been compelled to surrender for the want of water. There was supposed to be a necessity for some form of well that would be tight, to prevent the possibility of poison, and that could be constructed quickly, cheaply, and easily, so as to be available for a moving army. Under the pressure of this supposed necessity, Green conceived the idea of his well, and also devised the instrument by which it could be put to practical use.

Once conceived, a very simple experiment would test the soundness of the position he had taken and maintained, in discussions had respecting his plan, that it was possible to force water from the earth into the pit of a well by using a tube driven tightly into the earth for a well pit, and creating a vacuum therein by a pump attached.

This experiment, as the evidence shows, was made under the direction of Green, and in the presence of witnesses he had chosen, at or near his house in Cortland. The first experiment was successful, and it proved that the possibility of obtaining a supply of water by this process; but of course it could not prove that a tube could be driven down to a water-bearing stratum in all localities with the cheapness and dispatch necessary to render the process one of general utility. It was natural, therefore, to suppose that, before the process could be declared to be satisfactory, other experiments in other and different localities should be made. He could, by law, use his invention for this purpose and permit it to be used for two years without forfeiting his right to a patent.

Under such circumstances, it would be going far to say that his act of permitting the use of his process at the camp in Cortland, where his regiment was then in camp, and of providing material where it was to be constructed, such wells for his regiment when it should move into hostile territory, amounted to a dedication of his invention to public use, and worked a forfeiture of his right to it.

But it is said the patent is invalid under the provisions of the act of 1830. The act of 1830, as has repeatedly been held, has no effect to invalidate a patent, unless there be proof of a use of the invention more than two years prior to the application for the patent, and that such use was with the knowledge and allowance of the inventor. Here there is no evidence of any use or sale of the invention by Green, prior to his application for a patent, nor is there any direct proof of knowledge on his part of any such use or sale by others, during that period. There is, however, evidence that within two years prior to Green's application, some wells called driven wells were sunk in Cortland, and, as it is claimed, under such circumstances of publicity and locality, as to compel the inference that Green knew of the use of his process in their construction.

It cannot be denied that knowledge of the putting down of some of these wells on the part of Green seems highly probable. Still there is no direct evidence of such knowledge, and Green denies the knowledge under oath. Furthermore, two witnesses produced by the defense, who also reside in Cortland, and one of whom was a justice of the peace, being asked as to these wells, say that no knowledge of such wells came to them. It seems necessary, therefore, to conclude that the existence of those wells was not so notorious as to compel the inference that they were known to Green. Here it may be noticed, also, that wells put down by James Suggitt were under patent issued to him March 9, 1864, which patent was for a combination of three instruments—an iron perforated tube, a pointed plug to use as a drill, and a pump. (Haselden vs. Ogden, 3 Fish. Pat. Cas., 578.) and which it is a mistake to suppose necessarily involved the use of the process claimed by Green. It does not, therefore, follow that knowledge of that fact that Suggitt had put down wells in Cortland necessarily amounts to notice that the process of Green was being employed by Suggitt. The rule of law being "proof of knowledge and acquiescence must be beyond all reasonable doubt, as every presumption is the other way." (Jones vs. Sewall, 6 Fish. Pat. Cas., 367, Clifford, J.) I am of the opinion that Green is entitled to the benefit of the doubt raised by his own oath, and the testimony of the two Hunters.

Again, it is contended that the acknowledged fact that Green made no application for a patent till January, 1866, between four and five years after the date of his invention, shows an abandonment of the invention. But, says Woodruff, J., "lapse of time does not, per se, constitute abandonment. It may be a circumstance to be considered. The circumstances of the case, other than mere lapse of time, almost always give complexion to delay and either excuse it or give it conclusive effect. The statute has made contemporaneous public use, with the knowledge and allowance of the inventor, a bar when it comes to the question of the validity of the patent, and of any other colorable circumstances show of no mere period of time which ought, per se, to deprive an inventor of his patent." (Russell and Erwin vs. Mallory, 5 Fish. Pat. Cas., 641.)

In the present instance the circumstances attending the delay are unusual; and as I consider them sufficient to excuse a delay which certainly must be deemed extraordinary, a statement of these circumstances seems necessary.

Premise the statement by repeating that upon the evidence there is no room to doubt the fact that Green at the time of his invention claimed to have made a valuable discovery, and to have invented a new process. Furthermore, that he then declared an intention to secure his process by patent, and expressed his belief that large profits would accrue to him therefrom. At that time, Green, who had been partly educated at West Point, was engaged in organizing a regiment at Cortland, his residence, and was expecting soon to take part in the war of the rebellion. Within a few days after his invention, in the discharge of what seemed to him to be his duty, he felt compelled to shoot one of the captains of his regiment named McNett. The shot was not mortal but inflicted serious injury. In the then state of the public mind this occasion gave rise to intense public excitement, out of which sprang a controversy of extraordinary bitterness, involving numerous persons and continuing several years. The effect upon Green was disastrous in the extreme. He was suspended from his command, then tried by a court of inquiry at Albany, and reinstated in command. His regiment, after having, it is said, required the protection of a battery to save it from violence at the hands of evil-disposed people of the county, removed to Washington, where Green was relieved from his command, and then dismissed the service, and subjected to military charges.

He was, in addition, harassed by civil suits brought to charge him with personal liability for articles used by his regiment. He was also arrested, and then indicted for the shooting of McNett, and after repeated postponements of the trial, effected because of the excited state of the public mind, was tried in 1866, and the jury having disagreed, was discharged.

During this period he also became involved in church difficulties arising out of the shooting of McNett, was expelled from the church, and compelled to appeal to the Bishop, and also became involved in litigation with the pastor of his church.

His efforts during this period to secure a reversal of the order dismissing him from the service were constant and absorbing, and were attended with such anxiety of mind as to give rise to the charge that he was insane. This state of things continued up to 1866, during which period he was of necessity often absent from Cortland, at Albany and at Washington; and he devoted his entire time to the cause in which he had become so involved, abandoning all other occupation, and exhausting all his means. The pressure of these circumstances was such that he became discouraged and despondent, and was, in fact, driven near to madness. The extraordinary nature of the circumstances in which the man was placed during these years is fully proved by many witnesses of character.

These circumstances certainly give complexion to his omission to secure his invention by patent, and serve to furnish a proper excuse for such omission.

In regard to a man so circumstanced, it would hardly be safe, in face of his positive oath to the contrary, to infer an intention to abandon an invention which evidently he always considered of great importance. This conclusion is strengthened by the uncontroverted fact that when in November, 1865, Green saw by an advertisement in the paper that driven wells were being put down, although he was advised by counsel defending him on the indictment, not to apply for a patent, as he would thereby increase the number of his enemies, and prejudice him on the trial of the indictment then about to come on, nevertheless he did then, and in opposition to the advice of his counsel, file his application and assert his right to the invention.

I conclude, therefore, that, upon the facts of this case, it must be held that the defendant has not produced that full measure of actual proof which is necessary to sustain the defense of abandonment.

As to the question of infringement, I do not understand that it is disputed; at any rate, it is clearly proved. There must therefore be a decree for the complainant in accordance with the prayer of the bill.

[George Gifford, Milo Goodrich, E. F. Tracy, and J. C. Clayton, for complainants.

W. D. Shipman, S. L. Warner, and S. A. Robinson, for defendant.]

United States Circuit Court—District of Massachusetts.

PATENT SHEEP-SHEARING MACHINE.—WILLIAM EARLE, JR., et al vs. CHARLES F. HARLOW et al.

(In Equity.—Before Shepley, J.—Decided October term, 1875, to wit: April 4, 1876.)

The question presented in this case is mainly one of infringement. The complainants are the owners of a patent issued to them as assignees of Adoniram L. Fullam, December 23, 1873, for a new and useful improvement in devices for shearing sheep.

In a sheep-shearing device where power is employed to operate the cutters, it is immaterial what kind of power is employed when the two separate devices are operated in the same way to produce substantially the same effect.

The patent of Fullam, December 23, 1873, is not limited to an engine operated by the expansive force of steam, by any fair construction of the specification or claims. In this patent, as well as in the Hamilton and Harlow patent of September 1, 1864 (employed by defendants), a power is generated at a source of supply at a desired point, and is transmitted through a flexible tube, so as to be available to actuate an engine in the portable handle, which converts the power at any other point at the will of the operator.

[George E. Belton, for complainants.

James E. Maynard, for defendant.]

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED DOLL HEAD.

Carl Wiegand, New York city.—This consists of a doll head that is molded of sections made of interior layers of paper or paste-board and outer layers of muslin, that are joined by a paste of suitable consistence.

IMPROVED PAINTERS' SCAFFOLD CHAIR.

John R. Crockett, Flatonia, Tex.—The invention consists of a scaffold made in the shape of a chair, with mechanism to raise and lower by a suspension rope that is carried over suitable friction pulleys of the chair frame.

IMPROVED BEAM SCALE.

Jacob J. Hopper, New York city.—This is an improved beam scale for weigh masters, ice wagons, and other purposes, by which the weight is not required to be placed upon and detached from the beam for each weighing. It consists of a beam scale, in which the beam is made of U shape, with the suspension fulcrum at the upper shorter leg, the weight being hung below the fulcrum and sliding along the lower extended leg.

IMPROVED SHOE LAST.

Robert Taylor, New York city.—This consists of an oblique joint in the last at the shank and under the instep piece, so contrived that the heel can be detached from the ball portion and taken out readily. The last can thus be removed from the shoe without stretching the heel of the latter over the heel of the last, by which the heel is often torn, and the shank is frequently broken.

GREASE CONDENSER FOR PURIFYING EXHAUST STEAM.

Samuel N. Hartwell, Wollaston Heights, Mass.—This invention consists of a grease condenser, into which the exhaust steam is conveyed by an entrance pipe, and brought into contact with a condensing fluid, or with a suitable filtering material, to be mechanically purified by the impact of the oil globules with said fluid or material.

IMPROVED PROCESS OF PRESERVING FOOD.

Kennard Knott, Chicago, Ill.—No efficient and economical method of preserving fresh meat, on shipboard, has been heretofore devised and come into use. The patentee has, however, discovered that it may be preserved indefinitely, under the conditions of temperature and moisture to which a ship's cargo is ordinarily subjected. The meat to be preserved is first deprived of its animal heat in a temperature considerably above the freezing point, and then subjected to a temperature below that point, until it is frozen solid. In this condition it is placed in a case which is then closely sealed, both these operations of packing and sealing being performed in the same temperature to which the meat was last subjected. The meat case is placed in the center of the outer case, made sufficiently large to leave a considerable space between them on all sides. This space is filled with densely packed, fine, wheaten flour and the cover of the outer case then applied and secured. The flour is a most excellent non-conductor, and, after serving as such so long as the meat is required to be preserved, is in condition to be utilized in making bread, etc., the same as if it had been packed separately from the meat.

IMPROVED GLOVE FASTENING.

Frank G. Farnham, Hawley, Pa.—This relates to the hamp-staple and spring-key contrivance for fastening gloves on which a patent was granted to same inventor February 8, 1876. It consists in a cam-shaped arrangement whereby the key is maintained in the position for keeping the fastening intact; also of a device to make the pivot of a couple of points of the foundation plate of the staple, and a simple method of fastening the two prongs of the spring key together at the open end. There is also a stretching plate attached to the inside of the glove by the rivets which attach the staples.

IMPROVED METHOD OF MAKING ICE.

Bernard Hoppenyan, Hancock, Mich.—This inventor suggests a novel plan for making ice in solid blocks. During very cold weather he sprinkles water on sheets of paper prepared with resin and tallow, in order to prevent their adherence to the ice. These sheets are used as partitions, and the ice is thus formed and packed in between them.

IMPROVED CARTRUCK BOX.

John M. Brosius, Richmond, Va.—This invention consists in extending out the lower end of the upper section of the axle box and making this extension detachable so as to furnish convenient access to the space within and allow the brass to be replaced. An inclined spout is also applied to one side of the box, and an excision made in the side face of the brass, to allow the lubricant to be poured into the box, so as easily to reach the packing. Shouldered standards are also employed in the corners of the box to support the brass above the bottom and allow ample space for the packing. There are other improvements, all calculated to render the box better adapted to its purpose.

IMPROVED BURIAL CASE.

Joseph B. Morray and Robert J. Morray, New Burnside, Ill., executors of James B. Morray, deceased.—The top portion of this burial case is formed of glass and the lower part of cement, the two being hermetically joined by tongue and groove and cement joints, also flanges and bolts. The case is particularly designed for use within a monumental cement case, and the body of the deceased can be seen through the glass top of the inner case.

IMPROVED POCKETBOOK FASTENINGS.

Louis Prahar, New York city.—Two inventions. The first consists in the combination of a flanged plate, having a notch formed in the flange at its rear end, and a latch provided with a neck at its rear end to fit into the said notch to pivot the said latch in place. The object of the second device is to lessen the cost of manufacture of pocketbook fasteners, and at the same time furnish a fastener not liable to get out of order. The rear part of the base plate has a recess to receive an arm on the upper plate. The flange of the base plate also has an arm which passes through a short slot formed in the first arm, and thus hinges the two plates together.

IMPROVED ADDING PENCIL.

John J. White, Philadelphia, Pa.—In this adding pencil a pointer is made to turn a grooved revolving cylinder, and move an index along a scale on the case containing the cylinder. This records thereon the number to be added by pressing the pointer upward in the case a distance corresponding to the number to be added to the record. The invention includes several novel and ingenious devices.

IMPROVED LIFE BOAT.

James F. Cosgro, Santa Clara, Cal.—This consists of decks contrived in half-circular form, and fitted so that they can be readily closed over the cabins of the boat, to protect the occupants from storms and the boat from filling. There is also a hollow keel, of sheet metal, which fills with water and materially assists in keeping the boat upright.

IMPROVED BRICK KILN.

Jerome Bronkar, Zanesville, O.—This invention consists in the improvement of brick kilns by a peculiar mode of combining furnaces and chimneys with long, short, and cross flues, so that the operation of the kiln can be regulated and controlled better than as commonly arranged.

IMPROVED PORTFOLIO.

John Quenzer, New York city, and Charles Quenzer, Brooklyn, N. Y.—This portfolio is so constructed as to enable school children to carry their books, slates, etc., in a safe and convenient manner, and may be opened out for use as a writing desk without its being necessary to remove the books and other articles.

IMPROVED CAMP LOUNGE.

Anson Tottingham, Pittsfield, Mass.—This is a knock-down frame with a canvas web stretched from head to foot, over bars of different heights, to elevate the head for a pillow. The web is fastened to the cross bars by two straps attached to the canvas.

IMPROVED FOOT MEASURE.

Francis B. Smith, New York city.—This consists of a vertically adjustable heel rest, in combination with a foot plate, in which is a sliding measure and tape measure to take the measures of the foot, the said elevating heel rest being to adjust the foot more nearly in the position it occupies in the shoe. Tapes for taking the transverse measure are connected to turning studs to enable them to be shifted readily to measure over any part of the foot. The studs have a detachable pin, to be employed for fastening a sheet of paper under the sole of the foot, to be used as a record of the measures, and a kind of chart by which to gage the measures to the last.

IMPROVED PEN RACK.

William E. Thomas, Ford's Store, Md.—This device includes a pen rack and pen safe. The pen rack is supported upon a bracket formed of a bent metal rod, and constituting a fixed attachment of the desk; and the pen safe is an open-ended tube, hinged to said rod, in such manner as adapts it to be turned thereon to expose its ends for the insertion or removal of a pen. The rack receives and supports the pen while the owner or occupant of the desk frequently requires it for use; but at other times, as when leaving his desk at the end of the day, it is placed in the tube for safety.

IMPROVED ENVELOPE.

Lewis P. Hays, Donegal, Pa.—This inventor makes a margin on the right hand of the envelope to receive the stamp and enable it to be cancelled by pencilling without injury to the letter, the two thicknesses of paper forming the margin being pasted together so as to prevent the contents of the letter from entering between them. The extended margin is also designed to facilitate the opening of the letter by tearing off the end.

IMPROVED ASPERSORIUM.

Rev. James J. Dunn, Meadville, Pa.—This is an improved aspersorium or sprinkler, for holy water in Catholic churches, which may also be applied to bottles containing holy water. The sprinkler is always ready for use during service, and does not require a separate vessel containing the holy water, and a special attendant for the same. It consists of a reservoir, which is attached to the handle of the aspersorium, and provided with a neck, tube, and perforated head for sprinkling.

IMPROVED BOOT TREE.

James H. Sampson, Paris, Canada.—This consists of a lever and an adjusting screw on the wedge piece, to be used in combination with the front piece and a series of back pieces of different sizes, contrived for freeing the ankle or center and foot piece.

NEW TEXTILE MACHINERY.

IMPROVED HOSE GOODS.

Henry G. Hubbard, Middletown, Conn., assignor to Russell Manufacturing Company, of same place.—This consists in an improved hose goods, of three or more plies, in which one or more of the inner plies are without warp threads. This is claimed to give the warp threads of all the plies to resist the expansion strain upon the hose, producing a fabric lighter than when made in the usual way.

IMPROVED CLOTH-NAPPING MACHINE.

Marlene H. Whitecomb, Holyoke, Mass.—This is a machine for napping cloth, combining on one frame the wire or card napper and the teasel cylinder. The object is to have the strength of the wire or card clothing for breaking or tearing up the fibers of strong, heavy goods, for which the power of the teasel is not sufficient, and to have the teasels for finishing the nap, for which they are superior to the card.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHURN.

Alonzo L. Starkey, Elwood, Ind., assignor to himself and George M. Oversheimer, of same place.—The novel feature consists of two sets of paddles revolving in opposite directions, the faces of one set being inclined so as to gather the liquid toward the center, and those of the other set to throw it back, thus producing conflicting currents.

IMPROVED COMBINED HARROW AND CULTIVATOR.

Harlin Butner, Duncan's Bridge, Mo.—This machine is adapted for cultivating corn or other crops planted in rows or drills. It is so constructed as to loosen and pulverize the soil and destroy the grass and weeds, and at the same time to open a furrow between the rows to drain off the water.

IMPROVED REAPER AND HARVESTER.

William Clawwater, Liberty Pole, Wis.—The object of this invention is to furnish reapers and harvesters so constructed that they may be used either side forward, so that they may be drawn across the field, making a right-hand cut, and drawn back, making a left hand cut, without detaching the horses.

IMPROVED FENCE-BUILDING MACHINE.

Thomas J. Tally, Rockford, Texas.—This is a portable machine comprising a pile-driving apparatus, with an attachment for making the holes and driving in the posts, also a boring attachment for deep holes, and wire drums for carrying and delivering wires for the wire fence or telegraph wires.

IMPROVED CHEESE VAT.

Solomon Howe and Andrew Hill, Wegatchie, N. Y.—This consists in a lever and roller attached to the legs and front end of a cheese vat for raising and lowering the end by turning the lever, so as to bring the rollers down and lift the vat off the legs. The vats have to be raised in this manner for wheying off, and other purposes.

IMPROVED DITCHING MACHINE.

Charles Skinner and William B. McClure, Eau Claire, Wis.—This invention consists of a kind of adjustable scoop at the forward part of the framework of a two-wheeled truck, to be drawn along for cutting the ditch. It has an endless elevator at the rear of the scoop to receive the slice of earth and raise it up to a platform on which there is a kind of moldboard so arranged as to shoot the slice off obliquely upon the bank at one end of the ditch. The machine is worked by a rope and capstan.

IMPROVED GRAIN BAG.

Henry Redden, New York city, assignor to himself and John E. Walsh, of same place.—In order to secure the mouths of grain and other bags in such a way that the mouths cannot gape or leak, and which will avoid the necessity of sewing every time they are filled, this inventor proposes a novel combination of strings with the mouth of the bag and with a funnel-shaped tube.

IMPROVED MOTH TRAP.

John R. Stephens, Lone Star, Miss.—The moths pass through entrance tubes into a vessel with lid or cap. They are then attracted into a lighted box of the cap. They are thus caged and removed with the box for being killed.

IMPROVED COMBINED FORK AND RAKE.

Ernest L. Gebhardt, Milford, Pa.—The mechanical construction of this device is such that it may be readily adjusted for use as a hay fork, a manure fork, and a rake. It is strong and serviceable in either capacity.

IMPROVED FERTILIZER.

Alexander W. Rowland, Wilson, N. C.—This invention consists of an improved chemical fertilizer, designed to be used in the place of guano. It is composed of wood ashes (3 bushels), cotton seed (3 bushels), rich surface earth (20 bushels), stable manure (20 bushels), sulphate of magnesia (5 lbs.), sulphate of ammonia (30 lbs.), nitrate of soda (40 lbs.), ground plaster (75 lbs.), pure dissolved bone (115 lbs.), prepared in the manner set forth in the specification and in or about the proportions indicated, the amount thus prescribed being applicable to about five acres of land.

IMPROVED HARVESTER.

Andrew T. Nord, Fremont, Nebraska.—The object of this invention is to provide a new and improved construction of harvester, designed to adapt the implement to a more general and extended use. It consists in the peculiar construction of the framework and adjustments of the operating mechanism whereby the machine is adapted to be used either as a header for cutting off the heads of the grain, or as a harvester for cutting off both heads and stalks and for these different uses is readily convertible at will.

IMPROVED CORN AND COTTON CUTTER AND SCRAPER.

Isaac F. Harrison, Rodney, Miss.—This invention is an improvement in implements designed for scraping or cutting away the sides of corn and cotton rows or ridges, and consists in a curved or bent blade adapted to be applied to an ordinary plow and to be adjusted in position to cut away more or less of the ridge, and to be detached when required, in order to allow the plow to be used for other purposes.

IMPROVED HULLER AND CLEANER.

Jacob F. Gibson, Bryansville, Pa.—This invention consists in rotating a shaft provided with rows of tritulators, shaped like saw blades, within a perforated or slotted cylinder that is inclined and has a reciprocating or movable bottom as well as a sliding grate; also in providing the huller spout with a fan that throws a cross blast to complete the cleaning of the grain as it is discharged and passes into a receptacle prepared for it.

IMPROVED PLOW.

William I. Gossett and James P. Stark, Liberty, Tenn.—A bull-tongue plow is here adapted for use as a turn plow in gravelly land and upon hill sides. By moving the lever, either moldboard may be projected, and, by suitable devices, may be held in any position into which they may be adjusted.

IMPROVED BUSH-CUTTING IMPLEMENT.

Oliver Pickering, Needham, Mass.—This is an implement for cutting bushes, which is so constructed that it will not slip over the bushes without cutting them. It may be used as a hoe or as a scythe, and will allow the knives to be readily removed and sharpened, when required.

IMPROVED DEVICE FOR FEEDING SALT TO CATTLE.

Mathias Winterscheid and Bernard Schultes, Mendota, Ill.—This invention consists of a table with stationary top receptacle for the salt, and a conical revolving salt distributor that is adjustable to greater or less distance from the bottom rim of the receptacle, and provided with radial feed channels.

IMPROVED FARM GATE.

Andrew J. Grady, Pecatonica, Ill.—The bars are pivoted to end posts, to allow them to swing up and down. A latch is pivoted at one end to the lowest rail of the gate, while the other end works in notches on the post. This latch is provided with a side stud on which works a lever, thus enabling the gate to be raised in front and unlatched simultaneously by lifting the free end of the lever. In order that the gate may be held at varying height, the top strap is pivoted to the upper end of the posts, and to a stud working in slots of the second rail. The bottom strap is attached to an eye that slides on a pintle, the two straps being connected by the pivoted bar.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED MILLSTONE DRESSER.

Augustine Defor, Etna, Minn.—This is a contrivance for working the pick by a crank mechanism, and feeding it along at the same time in the line of the crack being made by the pick. There is also a device for shifting the pick along from crack to crack, and one for adjusting the pick handle to regulate the force of the blows.

IMPROVED WATCHMEN'S TIME RECORDER.

Augustus A. Cone, Staunton, Va.—This invention consists of the connection of one or more spurs of the main pinion of a clock train, of a forked spring and rod that govern a sliding cylinder, which communicates by a side aperture with the mouths of an entrance and exit tube. Through this a ball, thrown in by the watchman at the proper time, is conveyed to a receptacle in the clock case. The device may be attached to any clock at small cost.

IMPROVED DUMPING BOX.

Joel W. Hiatt, Iowa Falls, Iowa.—The box is rocked from its horizontal to a dumping position, for discharging the coal by a hand lever that is rigidly attached to a cog wheel which gears with a rack. Suitable stop springs lock on pins of the box to retain the same in horizontal position for filling.

IMPROVED PADDLE WHEEL.

Edward Brast and John Boger, Powhatan, Ohio.—This invention proposes to connect the buckets and arms of a water wheel centrally by a yoke, angle plate, and double angle block. This affords a strong construction.

IMPROVED FLUE CAP.

Henry McMillen and William L. Rydman, Lima, Ohio.—This invention consists of a plaster of Paris flue cap, provided with loop-shaped wire springs to retain it in the flue thimble. The ends of the wire composing each spring are fixed in a block of wood embedded in the plaster of Paris, while the point of the loop bends outward and rests against the inner surface of the thimble, where it is held firmly in place by the wire being coiled on each side of the bend. A flange around the cap rests against the outer surface of the wall.

IMPROVED GRINDING MILL.

Lewis B. McDonald, Wytheville, Va.—This invention is an improvement in the class of mills whose burrs or grinding stones are placed vertical upon horizontal shafts. The mill is adapted for grinding shelled corn or corn in the ear, for cracking or grinding wheat and other grains, and also for crushing and grinding plaster and canes. The improvements relate particularly to the construction of the breaking or crushing devices, in connection with vertical burrs; to the manner of securing the conical crusher to the runner; to the means of adjusting the bed stone, and at the same time preventing its rotation; also to the form and manner of vibrating the shoe.

IMPROVED MILL FEEDER.

John D. Mines, Moffatt's Creek, Va.—The funnel, by which the grain is discharged immediately into the eye of the runner, passes through a leather holder, so that it is protected from injury by contact with the balance iron of the stone. The holder is made adjustable on the balance iron, to enable the funnel to be set at a greater or less inclination to the axis of the runner. The improvement also relates to connecting the funnel to the mechanism for rotating it by means of a knuckle joint.

IMPROVED PRINTING PRESS.

Edward T. Dockum, New York city, assignor to himself and Thomas Dockum, of same place.—This invention consists in a lever bent at right angles, pivoted to the frame by a single bolt, and having four arms, projecting in the form of the letter X, formed upon its upper end to receive the set screws for adjusting the plates.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

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Wanted—A new or second hand Brown & Sharp No. 1 Screw Machine. Lidgerwood M'f'g Co., New York.

New patent everlasting Stove pipe Elbow and Joint. Now on exhibition at the Centennial. Hights for Sale. D. H. Klotz, 612 North 2nd St., Philadelphia.

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Snyder's Little Giant One Horse Power Steam Engine, complete with Tubular Boiler, only \$150. Ward B. Snyder, Manufacturer, 84 Fulton St., New York.

For 2d Hand Portable and Stationary Boilers and Engines, address Junius Harris, Titusville, Pa.

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For Sale—Letters Patent for "Cake Pan," issued Oct. 26, 1875. Address F. G. High, Kansas City, Mo.

Amateur Photographic Apparatus, complete to operate \$5; extra accessories, \$1.50. E. Sackmann, 204 Hudson St., New York.

Deafness Relieved—No Medicine. Book free. G. J. Wood, Madison, Ind.

For Sale—25 H.P. Hor'l Tub. Boiler, \$150; 2x4 Engine, \$30; 3 H.P. Portable Engine, \$20; No. 10 Steam Pump, \$100; 1 in. Giffard Injector, new, \$30. Shearman, 45 Cortlandt Street, New York.

Automatic or Mechanical Cow Milkers—Patentees or Manufacturers will please address, with particulars, J. B. Miller, Box 130, Jeffersonville, Ind.

Johnson's Universal Lathe Chuck—Awarded the Highest Premium by the Franklin Institute of Phila., for "Durability, Firmness, and adaptation to variety of work." Lambertville Iron Works, Lambertville, N. J.

Hill's Patent Direct-Acting Steam Drop Hammer will be illustrated shortly in the Scientific American. Address Hill & Williams, Quincy, Ill., for circular.

"Double-Entry Book-Keeping Simplified"—The simplest and most practical book on the subject. Cloth, \$1. Boards, 75 cts. Sent post paid. Catalogue free. D. B. Waggoner & Co., 420 Walnut St., Philadelphia.

Patentees—desiring light articles manufactured in Steel, Gray or Malleable Iron, and Brass, address Welles Specialty Works, Chicago, Ill.

Best Belt-Pulleys—A. B. Cook & Co., Erie, Pa.

Centennial Exhibition, Philadelphia, 1876.—Examine the Allen Governors, Machinery Hall, D. 9, Par. 71.

Machine-cut brass gear wheels, for models, &c. List free. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Rubber Hydrant Hose, Hose Pipes and Couplings, best quality. Send for Prices to Bailey, Farrell & Co., Pittsburgh, Pa.

Safety and Economy—Eclipse Sectional Steam Boiler. First Class references. Lambertville Iron Works, Lambertville, N. J.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Army, 48 North Third St., Philadelphia, Pa.

Power & Foot Presses & All Fruit-can Tools. Ferracute Wks., Bridgeton, N. J., & C. 27, Mch. Hall, Cent'l.

Leather and Rubber Belting, Packing and Hose. Greene, Tweed & Co., 15 Park Place, New York.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Ramsey & Co., Seneca Falls, N. Y., U. S. A.

See Boulton's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 8-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Walrus Leather and Walrus Leather Wheels for polishing. Greene, Tweed & Co., 15 Park Place, N. Y.

For Sale—24 in. x24 ft. Lathe, with Chuck; two 13 in. Lathes; one 7 ft. x24 in. Planer; two 8 in. Shapers. E. P. Ballard, 48 Beckman St., New York.

The French Files of Limet & Co. have the endorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, French Department, Centennial Exposition. Homer Foot & Co., Sole Agents, 22 Platt St., New York.

Trade Marks in England.—By a recent amendment of the English laws respecting Trade Marks, citizens of the United States may obtain protection in Great Britain as readily as in this country, and at about the same cost. All the necessary papers prepared at this Office. For further information address Munn & Co., 37 Park Row, New York city.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

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

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

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

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

Temples and Oilcans. Draper, Hopdale, Mass.

Notes & Queries.

J. P. H. will find full particulars of the malleable glass on p. 402, vol. 32, and p. 29, vol. 33.—H. L. C. will find a good recipe for paste blacking on p. 139, vol. 31.—L. H. W. will find directions for bleaching beeswax chemically on p. 299, vol. 31.—D. M. K. can mend his rubber foot ball by the method described on p. 293, vol. 30.—R. A. B. can preserve natural flowers by the process described on p. 294, vol. 28.—T. J. should waterproof his horse covers by the process described on p. 347, vol. 31.—D. C. will find a recipe for a waterproof varnish for pictures on p. 11, vol. 31.—J. D. T. and many others, who ask how to obtain engineers' certificates in New York city, should apply at police headquarters.—M. will find a description of the glacier theory on p. 90, vol. 31.—I. S. can nickel plate his show case trimmings. See p. 235, vol. 33.—J. R. McN. can make purple and red ink by using the recipes given on p. 315, vol. 33.—P. O. X. will find directions for kalsomining outdoor work on p. 133, vol. 34. For crystallizing with alum, see p. 127, vol. 20.—R. A. I. will find directions for mounting chromos on p. 91, vol. 31.—L. will find recipes for colored fires on p. 165, vol. 21.—L. W. S. will find directions for case-hardening set screws on p. 202, vol. 31.—J. H. D. will find directions for skeletonizing leaves on p. 155, vol. 31.—C. W. should use aquarium cement in the joints of his tanks. See p. 89, vol. 31.—T. O. B. will find a recipe for hair dye on p. 138, vol. 27.—R. S. P. will find a recipe for a silver-plating fluid on p. 259, vol. 31.—C. H. P. should know that a circle contains a larger area than can be enclosed by a line, of similar length to its circumference, in any other form.—W. W. B. will find an account of the inventions of the past century on pp. 330, 336, 352, vol. 34.—F. W. F. can remove grease spots from clothing by using rectified spirits of naphtha.—S. R. S. will find a description of the Solvay soda process on p. 494, vol. 34.—B. X. will find directions for making transfer paper for manifold writing on p. 363, vol. 31.—T. & B. will find directions for lining casks with a waterproof, tasteless compound on p. 11, vol. 31. This also answers H. C. B.—W. A. W. will find an answer to his query as to friction of water in pipes on p. 259, vol. 34.—R. V. L. D. will find directions for building a shell boat in the SCIENTIFIC AMERICAN SUPPLEMENT, vol. 1.—J. B. O. C. and others will find a recipe for mullage on p. 292, vol. 31.—W. B. will find a recipe for aquarium cement on p. 89, vol. 31.—C. E. W. will find a recipe for Babbitt metal on p. 122, vol. 28.—L. R. can clean his dirty oil by the method described on p. 409, vol. 34.—F. R. W. can mold rubber in his iron joint by the process described on p. 283, vol. 29.—R. G. B. will find full directions for making a telescope on p. 11, vol. 1, SCIENTIFIC AMERICAN SUPPLEMENT.—F. & S. will find directions for bleaching hair on p. 389, vol. 24.—E. G. E., W. J. M., R. J. W., J. K. B., R. S., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) T. L. F. says: 1. Please give me a plain mode of calculating port openings, exhaust, etc., of small steam cylinders. A. The ports should be so proportioned that the velocity of the steam will not exceed 100 feet per second. Hence, if you multiply the area of the piston in square inches by the piston speed in feet per minute, and divide by 6,000, the quotient will be the minimum port area. 2. Is Mr. David Shive's way of calculating the horse power of an engine one which can be relied on? A. The rule is a close approximation. You have not, in your instance, applied it properly. 3. I am using a small engine for driving 8 or 10 lathes, and occasionally a small circular saw, for about 2 or 3 hours. I have to drive a large fan. My boiler is 8 feet high and of 30 inches grate surface; cylinder is 15 inches long and of 5½ inches bore; engine runs at 130 revolutions per minute, which gives no power to spare under 75 or 80 lbs. steam. After throwing the fan off, we have far more power than is required, running full speed with 25 or 30 lbs. steam. Would it not pay to build a small cylinder, say 5 by 6 inches, running at 200 revolutions, to use when not using the fan? A. Your engine seems to be performing very well, and we scarcely think the proposed change is essential.

(2) A. B. C. asks: What are the proper proportionate sizes of condenser and air pump to obtain a vacuum of 24 inches under the following conditions? Small engine, say from 8 inches diameter by 10 inches stroke; slide valve cutting off at ⅔ of the stroke. Steam pressure in boiler 75 to 80 lbs., and piston speed 300 feet per minute. Heat of injection water 60°. Air pump to be double acting. Plunger with rubber valves, worked with crank on forward end of shaft. What should be the size of injection pipe? A. You should proportion the apparatus so that the amount of injection water will be from 22 to 28 times the volume of the condensed steam.

(3) C. U. E. says: From the following you will see that friction decreases with the diameter of shaft. See p. 283, vol. 34. R=pressure on journal, and c=coefficient of friction. Then friction = F=cR; the space described is the circumference of shaft=2πr; and the mechanical effect lost by friction is A=cR2πr; now if the shaft makes n revolutions per minute, the mechanical effect expended per second is equal to $L=2\pi c R r \frac{n}{60} = \pi n c R r$ —0.105 n c R r. Therefore the friction

increases with pressure, number of revolutions, and diameter. A. According to the query, the velocity was to remain constant, so that, as the diameter of the journal was increased, the number of revolutions was to be diminished in proper proportion; and the mechanical effect lost by friction would be unchanged.

(4) A. L. B. says: 1. I am building a small upright steam engine, the cylinder being 1¼ x ¾ inches. How large a fly wheel should I have? A. From 2½ to 3 inches in diameter. 2. Which is the simplest way of constructing a feed pump for the boiler? A. A plunger pump would probably be the simplest. 3. The boiler is 3 inches in diameter and 7 inches high, having 13 tubes in it. Is it large enough to keep the engine on a steady run? A. No. It is rather too small.

(5) W. F. W. asks: Why is it that saw filings obtained by sharpening a saw, thrown into a fire in small quantities, will flash like powder? A. Because they are suddenly heated and consumed.

Why is it that, if you multiply all of the numerals except 8 and 0 by a multiplier produced by multiplying the figure 9 by 2, all the figures in the answer will be 2s, and likewise, if you multiply by 9 x 3, the answer will be all 3s, and so on? Thus:

1234567	1234567	1234567
18	27	81
98765432	86419753	1234567
1234567	24691358	98765432
99999999	99999999	99999999

A. It is determined by experiment. Thus, it having been found that $111,111,111 \times 9 = 999,999,999$, the rest follows.

Please give me a good composition for imitation marble, that can be shaped into molds before getting hard? A. See p. 165, vol. 27.

(6) W. C. F. says: I am manufacturing a class of work that may be cast in a chill, and would thus be uniform in size, and save lathe work; but when thus cast the pieces cannot be drilled. By what process can I anneal the castings so they may be drilled? A. Make them red hot, and cover them with quicklime.

(7) A. A. A. says: I am about to construct a magneto-electrical machine like that represented on p. 100, vol. 34, of the SCIENTIFIC AMERICAN. I have a permanent magnet which measures from the two ends to the bend 13 inches, and between the two ends 1½ inches, and from the outside across the two ends 3½ inches, and it will lift more than its own weight. I want to know what length and thickness the ends of the soft iron magnet should have, so as to correspond with the permanent magnet, and also the kind, length, and number of wire. A. Make the iron cores for the electro-magnet about ¼ inch long and ¼ or ⅝ in diameter. Use 150 or 200 feet of No. 23 copper wire in each coil. Cover the iron with paper, and wind on that.

(8) L. K. Y. asks: Will you please tell me how I can make a Britannia dip? Silver platers use a dip by the above name. Before putting a piece of Britannia metal in the silver solution they dip the piece in the Britannia dip. A. Britannia metal should be rinsed in a fresh solution of caustic soda or potash, and then transferred at once to the silvering solution.

(9) M. R. says: I have so changed the solution in a five cup Callaud battery that the offspring seems to have some of the characteristics of frictional and induced electricity, direct from the battery. By placing a piece of graphite from a lead pencil in contact with a piece of carbon, and putting them in circuit (the pencil connected with the positive pole) heat is produced in the lead sufficient to inflame an ordinary friction match. Is this an unusual degree of heat to be produced direct from a battery of this number of cups or of the density form? A. No.

(10) B. S. S. says: Please give me a recipe for coating wooden troughs for batteries, that will withstand the alkali. A. The following is much used in batteries: In 12 parts benzole dissolve 1 part India rubber, and to the solution add 20 parts powdered shellac, heating the mixture cautiously over fire. Apply with a brush.

(11) P. F. W. asks: 1. Can an engine with a 4 foot drive wheel make 60 miles an hour? A. It is possible. 2. Can an engine with a 5 foot wheel make 75 miles an hour? A. Yes, so far as the size of the wheel is concerned. 3. What is the ascertained or supposed maximum of speed attainable by 4, 5, and 6 foot drive wheel engines, respectively? A. The ascertained maximum is about 60 miles an hour. The supposed is an unknown quantity.

(12) G. S. N. asks: I have a 2 x 6 inches cylinder engine, with fly wheel 15 inches in diameter and 2½ inches face, making 150 to 200 revolutions per minute, with steam at 50 lbs. The cone on my lathe has four changes of speed, being 6, 5½, 4½, and 3½ inches in diameter. What size of wheel should I use on a shaft to drive my lathe at the proper number of revolutions? A. Let the countershaft of the lathe make 180 revolutions per minute.

(13) G. W. F. asks: 1. What is the measure of a gage as applied to saws? A. A gage, according to Stubbs' standard, is no particular part of an inch. Gages from No. 1 to No. 20 vary from ⅓ to the ⅓ part of an inch. No. 1 is about ⅓, No. 3, ¼, No. 10, ⅙, No. 16, ⅛, 2. What should be the gage of a 22 inch shingle saw? A. About No. 11 at center and 14 to 16 at the rim. 3. What should it cut per revolution, running at 1,500 revolutions per minute? A. About ¼ of an inch or more, according to the hardness of timber. 4. What width of belt will be required to run it? A. About 6 inches. 5. What size of saw pulley should be used? A. About 7 inches. 6. Could it be safely run at 2,000 revolutions per minute if thick at center? A. Yes.—J. E. E., of Pa.

(14) A. B. says: I have a pump on a tugboat worked with crank and fly wheel. Bore of steam cylinder is 4 inches, stroke 6 inches; bore of pump barrel is 2 inches. Pressure of steam is 85 lbs. to the square inch. What would be best for a plunger? I have been using rubber, but it will not last more than two weeks. A. Use a

mixture of 3 parts copper, 1 part tin, and 1 part zinc.

(15) L. W. R. says: 1. I am trying to electroplate with silver and gold some small articles of Britannia metal, composed of tin and antimony, with two 2 quart Smee batteries; but the solution soon gets out of order and will not work. Deposition takes place very slowly, and sometimes will only go on a part of the work, and the metal will then scale off the work. A. Rinse the objects in a fresh solution of caustic soda or potash, and transfer at once to the plating solution. The latter seems to contain too much cyanide. The free cyanide should be equal to about half the weight of silver in solution. When it is more, it is apt to dissolve silver off from both anode and objects. 2. What ought the strength of gold and silver solutions to be, according to the hydrometer, for plating Britannia metal as above described? A. The proportion of about 2 or 3 ozs. of silver to the gallon is a good working strength. 3. Will gold and silver coin do to make the solutions, and also for anodes? A. Coin is sometimes used, but it is better to use pure metals.

(16) W. H. S. asks: How will brass packing rings do in an engine? A. Do not use them. Cast iron piston rings are the best.

(17) E. H. S. asks: 1. Is it possible to send four or more messages over the same wire without confounding the signals? A. Yes. 2. How are the receiving and transmitting instruments constructed? A. Several ways have been devised, but we believe the details of the system now used by the Western Union company have not been published. A description of Gray's harmonic telegraph will be found on p. 92, No. 6, SCIENTIFIC AMERICAN SUPPLEMENT, vol. 1.

1. Can you explain why the blood gives off only such of its constituents to the various organs or parts of the body as are needed by them, as for instance, lime to the bones, phosphorus to the brain, etc.? A. It is generally believed that each organic substance in the body has the power of assimilation of its own kind of matter only. 2. Would an excessive drain upon any organ of the body in a healthy person cause an appetite for food which would contain a large percentage of the material which is being destroyed? A. Most likely.

(18) I. A. asks: 1. How are the positive and negative wires fastened in a Leclanché battery? A. The wire leading from the zinc may be fastened by soldering; the other is sometimes baked in with the carbon, or it may be secured to the carbon with a clamp. 2. Why does the bichromate of potassa solution in a battery turn dark green after a short time's use? A. Because the chemical reaction exhausts the solution. 3. I have a battery trough made of wood, with 8 cells in it. The cells are 5 inches high and 4 inches long, by 2 inches wide. I propose to make 16 porous plates of yellow ochre, powdered charcoal, and fine sand; they are to be 5 inches high, 2 inches wide, and ¼ inch thick. I shall place them two in each cell, so that there will be a space of 1 inch on each side to receive coke and manganese, and I shall have the zinc in between the plates, and have the plates cemented fast to the partitions. The zinc plates are to be 5 inches high, 2 inches wide, and ¼ inch thick. Will it work? A. The arrangement will probably not work satisfactorily. You had better get the regular porous cells from some dealer in electrical apparatus. You can have them made of any desired shape.

(19) F. A. asks: 1. Through how long a carbonic acid vacuum tube would a ¼ inch spark from an induction coil pass? A. Try the experiment if you have the opportunity. 2. How far from the tube could the time of night be seen by a watch? A. Try it for yourself. 3. What length of platinum wire, No. 36 or 40, would three bichromate of potassa cells heat red hot? A. Probably about a foot.

(20) J. D. O. says: Enclosed find specimen of wire of which I have some 1,600 feet. I intend using it in making an induction coil, for medical purposes. What size and what length of wire would be the best for making the primary or inner coil? A. About 100 feet of No. 20 will do. 2. What should be the length of the induction coil? A. Five or six inches. 3. Is the wire to be wound like thread upon a spool, and are both coils to be wound in the same manner? A. Yes, but it does not matter whether the direction of winding is the same in both coils. 4. What do you think of the way of coiling the wire shown in your paper, p. 344, vol. 33? Would it be practically advantageous in my case for such a comparatively small coil? A. No. 5. Is there any necessity for insulating material to separate the inner and outer coils? A. Yes. 6. What is the difference in quantity, intensity, etc., between an electro-magnet of given length (say 3 inches) composed of 4 layers of insulated wire, with another magnet twice as long composed of the same length of wire, the number of layers being of course nearly one half? The size of the wire and the battery power of course is the same in both instances. Would not No. 1 exceed in intensity, and No. 2 exceed in quantity? A. The terms are hardly applicable to magnets. No. 1 would be the strongest, provided the current were not sufficiently powerful to magnetize it to saturation.

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

J. H. P.—Nos. 1, 2, and 3 are different varieties of mica schist. No. 4 is a chlorite schist. Not valuable.—G. P. H.—The black is hornblende rock. The red is granite containing a potassa felspar. Both contain a small percentage of iron, but not sufficient for extraction.—G. B. L.—It does not contain fertilizers, and is valuable for building purposes.—R. W. C.—It is sulphuret of iron.—I. H. M.'s and G. C. R.'s specimens have not been received.

W. G. asks: Will some one oblige by giving me correct directions for netting a hammock? I have just finished one, but it will not hang properly.—A. H. H. asks: How can I make red, blue, purple, and black ink for printing with rubber stamps? How can I make indelible ink for the same purpose?—W. F. asks: What is the composition of the flesh-colored enamel used by artificial leg makers?—E. T. Q. says: Would S. C. be good enough to give a demonstration of his method of inscribing a regular polygon, published in SCIENTIFIC AMERICAN, April 20, p. 283, vol. 34.

COMMUNICATIONS RECEIVED.

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

On Oil of Bitter Almonds. By H. P.
On Raising Tomatoes. By H. M.
On the Cotton Gin. By R. J. McC.
On the Western Tannin Plant. By G. E. R.
On Spontaneous Combustion. By A. H.
On Social Pressure. By J. J.
On a Locomotive Blast Pipe. By I. H. D.

Also inquiries and answers from the following:
H. H.—B. R. H.—G. E. O.—K. T.—G. N.—B. W. M.—C. S. M.—J. H. B.—E. E.—G. L. R.—D. G. D.—G. W. M.—E. D. W.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes malleable glass? Who does flange work, on boiler heads, etc.? Who makes steel dyes from electrolytic molds, etc.? What is the value of magnetite or magnetic iron ore? What is the cost of a yacht of 25 tons, and of one of 100 tons, burden? Who sells acid chromate of lime? Who uses cattle hair, for making cloth? Who sells flower pot making machines? Who sells or lets out lime light apparatus for tableaux?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were
Granted in the Week Ending
June 6, 1876,

AND EACH BEARING THAT DATE.
[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Mann & Co., 37 Park Row, New York city.

Alarm, burglar, J. P. Kinslingbury..... 128,343
Alloys, making manganese, W. P. Ward..... 128,400
Annunciator, Hirschy et al..... 128,297
Auger handle, G. L. Gibson..... 128,288
Bale tie, W. S. Davis..... 128,418
Barrel cresset, Hale & Shaw..... 128,282
Barrel machine, J. Tilley..... 128,488
Bed bottom, spring, J. A. Reeds..... 128,467
Bedstead, sofa, W. Lewis..... 128,314
Bell, door, H. A. Dierkes..... 128,421
Belt, suspender, E. J. Fraser..... 128,282
Blinder, temporary, J. W. Tallmadge..... 128,347
Boiler feed and steam trap, W. H. Jenkins..... 128,444
Boiler circulation device, B. S. Koll..... 128,244
Bolt, door, T. Hooley..... 128,289
Bolt-threading die, L. W. Stockwell..... 128,454
Bolts, making strap, Lewis & Oliver (r)..... 128,156
Bone black, revivifying, J. Gandolfo..... 128,286
Bone black, preparing, O. Lago..... 128,315
Boot counter stiffener, G. W. Simpson..... 128,287
Boot lasting tool, W. H. & D. G. House..... 128,442
Boot soles, etc., making, G. V. Sheffield..... 128,395
Boot-crippling form, H. A. Robinson..... 128,330
Boot soles and uppers, uniting, E. Drake, (r)..... 128,155
Brush, dust, J. W. Howard..... 128,298
Bureau, wardrobe, and washstand, F. G. Sanford..... 128,479
Burner, gas, W. F. Bonnell, Jr..... 128,362
Burner, gas, I. W. Shaler..... 128,339
Cake, making sponge, C. G. Brommer..... 128,494
Calendar, eraser, pencil, etc., J. H. White..... 128,333
Cam slide, Houghtaling & Sliviter..... 128,441
Can, sealing, J. A. Robinson..... 128,331
Can, sheet metal, G. H. Chinnock..... 128,272
Can, sheet metal, A. Perpete..... 128,462
Car brake, C. C. Smith..... 128,474
Car brake, B. F. Stewart..... 128,491
Car coupling, C. O. Babcock..... 128,397
Car coupling, G. W. Johnson..... 128,369
Car coupling, E. Webber..... 128,351
Car wheel annealing pit, G. W. Moores..... 128,219
Car window, railway, J. L. Joyce..... 128,312
Carriage curtain light, G. L. Randall..... 128,312
Carring machine, Deane & Thomas..... 128,417
Cement, tank for asphaltic, C. M. Warren..... 128,491
Chairs, back rack for, Holts et al..... 128,489
Chicken coop, breeding, T. B. Rogers..... 128,332
Churn, F. Seal..... 128,473
Churn, J. A. Steel..... 128,462
Clamp, door, Spink & Mason..... 128,399
Claw bar, M. Butts..... 128,477
Cocks and T joints stop, E. A. Leland..... 128,312
Coffee mill, T. D. Gaddie..... 128,477
Coffee pot, G. W. Hubbard..... 128,398
Colter, rolling, D. W. Hughes..... 128,443
Condenser, ejector, J. F. Guthrie..... 128,434
Cotton opener, beater for, Whitehead et al. (r)..... 128,159

Countersink, W. H. Laughlin..... 128,448
Croze, cooper's, J. P. Siegfried..... 128,473
Cultivator, C. D. Carter..... 128,470
Cylinders, boring metallic, P. B. Trahera..... 128,399
Dash pot, G. H. Corlies..... 128,375
Distilling apparatus, H. Deymann..... 128,420
Ditcher and the layer, J. J. Campbell..... 128,331
Door fastener, C. Kinney..... 128,317
Drawer pull, J. E. Merriman..... 128,317
Drill socket, C. Allison..... 128,298
Elevator, water, E. J. Smith..... 128,475
Elevator, water, R. H. Douglass..... 128,423
Engine, rotary, C. A. Tower..... 128,349
Engine cut-off valve, T. Hooker..... 128,440
Engine valve, direct acting, E. Purvis..... 128,465
Explosive compound, A. Dieckerhoff..... 128,277
Faucet attachment, H. L. Sadler..... 128,393
Fire arm, breech-loading, I. M. Earle..... 128,363
Fire escape, J. H. Nevins..... 128,457
Fire escape, steam, J. Chadderton..... 128,371
Fire kindler, Boote & Hechler..... 128,368
Flour bolt, De Force, Hurd & Simpson..... 128,276
Flower, artificial, E. F. Penley..... 128,379
Fluting iron, W. L. McCausland..... 128,452
Food, preserving, K. Knott..... 128,446
Furnace for sawdust, etc., F. T. Kidder..... 128,477
Furnace, hydrocarbon, A. Smith..... 128,411
Furnace, metallurgical, A. F. Cassel..... 128,254
Furnace dust trap, T. J. Taylor..... 128,426
Furnace straw feeder, F. X. Fischer..... 128,438
Gage, plating, H. W. Atwater..... 128,226
Game tables, Buckley & Sawyer..... 128,367
Gas retort lid fastening, H. G. Morris..... 128,330
Gas stove, hydrocarbon, I. W. Shaler..... 128,338
Gasifier, drop light, J. H. Seaman..... 128,336
Gate, S. Ernst..... 128,247
Gate, farm, H. Watson..... 128,494
Generator, hot air, and steam, J. & G. Firmenich..... 128,425
Generator, sectional steam, D. Boushaw..... 128,251
Glass, bed for polishing plate, R. Brockman..... 128,403
Gloves, clasp for, A. G. Mead..... 128,316
Gold or silver lace, imitation, E. Read..... 128,466
Grain blinder, L. H. Johnson..... 128,301
Grain blinder, J. F. Steward..... 128,342
Grain, moistening, P. Sellers..... 128,337
Hammer, C. W. Dunlop..... 128,279
Hammer exhaust pipe, steam, J. B. Collin..... 128,374
Harrow, J. E. Perkins..... 128,461
Harrow, E. M. Stevens..... 128,343
Harvester, T. & I. W. Ward (r)..... 128,158
Harvester rake attachment, F. W. Muesing..... 128,456
Hat and coat rack, C. F. Linscott..... 128,247
Hatchway, self-closing, S. W. Bell..... 128,356
Heater, feed water, H. A. Philip..... 128,325
Heater, and iron, J. B. Christian..... 128,412
Heating drum, J. R. Wicand..... 128,396
Hide, manufacture of raw, A. C. Krueger..... 128,385
Hoe and potato digger, Morris & Green (r)..... 128,157
Hog trough, J. Hannon..... 128,435
Hook, snap, W. Heath..... 128,437
Horse collar, T. H. Cooksey..... 128,416
Hose coupling, E. A. Leland..... 128,310
Hulling machine, J. F. Gibson..... 128,429
Ice machine, A. Jas..... 128,300
Inhaler, G. L. Crosby..... 128,362
Ironing board, G. L. Miller..... 128,453
Ironing stand, S. E. Crutchfield..... 128,296
Jack, compound engine, Taylor & Vampill..... 128,360
Jack spool, Scott & Davis..... 128,305
Jail bars, making, P. J. Pauly..... 128,460
Key hole guard, M. Schou..... 128,334
Ladder, extension, R. G. Spaulding..... 128,460
Ladder, step, E. A. Stockton..... 128,345
Lamp, H. H. Doty (r)..... 128,165
Lamp fixtures, hanging, T. F. Wood..... 128,498
Lamp, street, J. S. Wood..... 128,396
Lamps, etc., globe for, C. K. Deutsch..... 128,419
Lard, treating, R. Bullymore..... 128,269
Lath, plastering, T. A. Scheller..... 128,384
Lath for turning balls, A. D. Waymoth..... 128,255
Leather, stretching, W. Coupe..... 128,361
Leather, etc., tool for cutting, P. Coburn..... 128,273
Leather, waterproof compound for, P. Kromer..... 128,447
Level, spirit, M. Wilcox..... 128,354
Lock, electromagnet, H. L. Roosevelt..... 128,382
Lock for safe, etc., W. L. Potter..... 128,250
Lock, seal, W. P. Burrow..... 128,406
Loom temple, J. R. Arnold..... 128,259
Loom, selvedge guard for, J. H. Mills..... 128,377
Melting metal and ores, G. W. Stafford..... 128,222
Microscope, G. Wale..... 128,391
Mill, cider, H. L. Whitman..... 128,496
Mirror adjuster, S. M. Clark..... 128,254
Molds and patterns, producing, C. Grasser..... 128,432
Motion, converting, C. E. Willis (r)..... 128,160
Mucilage bottle, J. A. Robbins..... 128,329
Nail lock, J. N. Arvin..... 128,260
Oil cabinet, G. A. Unkrich..... 128,489
Ore concentrator, G. Ginn..... 128,289
Ore pulverizer, W. Bruckner..... 128,396
Organ pedal attachment, B. L. Boomer..... 128,357
Oyster-dredging machine, H. F. Ward..... 128,495
Pail cover, chamber, C. Kolb..... 128,304
Pail, milk, H. M. Tingley..... 128,348
Paint, D. E. Breinig..... 128,264
Pantaloons, R. Gibbons..... 128,287
Paper bag machine, O. W. Stow..... 128,344
Paper box machine, M. Young..... 128,469
Paper cutter, reciprocating, T. B. Dooly..... 128,378
Pavement, concrete, J. M. Snook..... 128,341
Pencils and penholders, dipping, E. Lillenthal..... 128,246
Pensary, G. Otto..... 128,458
Photographic plate, Powell & Lehen..... 128,360
Pier, composite, C. E. Hill..... 128,498
Pins, making wooden, F. T. Baldwin..... 128,227
Pipe coupling, E. A. Leland..... 128,313
Pipe coupling, W. A. Lickiss..... 128,345
Pipe air valve, water, Stacy & Carroll..... 128,323
Pistol, spring air, A. C. Carey..... 128,233
Pistol, spring air, H. M. Quackenbush..... 128,327
Plane, carpenter's, S. Williams..... 128,226
Planing knife scales, machine for, A. H. North..... 128,322
Planter, corn, J. Clarridge..... 128,414
Planter, cotton seed, J. Clarridge..... 128,411
Plow, J. H. Monroe..... 128,404
Pocket for wearing apparel, R. Gibbons..... 128,428
Pocket, safety, I. T. Green..... 128,291
Potato masher, A. Brown..... 128,229
Press, baling, J. Price..... 128,464
Press, fruit and jelly, A. Wemple..... 128,495
Press, wine and cider, J. Nearing..... 128,321
Printing press, Potter & Judson..... 128,326
Printing press, A. E. Redstone..... 128,328
Printing press, color, J. T. & E. C. Broen..... 128,229
Propeller, vibrating, J. Forge et al..... 128,364
Pump, J. S. Adams..... 128,325
Pump, J. Butman..... 128,290
Pump, I. H. Palmer..... 128,324
Railway crossing platform, G. Brown..... 128,405
Reaping machines, tapering bars for, S. Osborn..... 128,328

Rolling angle iron, J. J. Thomas..... 128,496
Roof, metallic, F. C. Conklin..... 128,359
Rubber articles, making, Smith et al..... 128,479
Sad iron baster, J. B. Christian..... 128,412
Sad iron holder, O. Borreson..... 128,401
Sandpapering machine, P. Barker..... 128,398
Sash balance, W. Cooper..... 128,360
Sash fastener, W. G. Cook..... 128,415
Sash fastener, E. J. Hale..... 128,292
Sash fastener, W. H. Kester..... 128,445
Sash fastener, P. Meyer..... 128,376
Sash holder, J. P. Jones..... 128,241
Sash holder, J. R. Payson..... 128,378
Saw tooth, insertible, E. T. Lippert..... 128,450
Sawing machine, scroll, W. Hessman..... 128,295
Scaffold ladder, A. Bauer..... 128,355
Scales, weigh, A. Carpenter..... 128,358
Screen metallic, S. W. Flint..... 128,280
Screw-cutting die, Campbell & Kyre..... 128,409
Screw-cutting die plate, J. M. Carpenter..... 128,270
Screw, wood, K. A. Leland..... 128,309
Separator, grain, Harder & Anthony..... 128,436
Separator, grain, Wisler & Snively..... 128,257
Sewing machine, E. Drake (r)..... 128,154
Sewing machine journal, J. Kline..... 128,303
Sewing machine shuttle, J. J. Graff..... 128,431
Sewing machine, feed, J. Smith..... 128,478
Sharpening machine, Ingersoll et al..... 128,470
Shearing machine, T. Hrabson..... 128,402
Shears, animal, W. F. Waterich..... 128,500
Sheet metal bending tool, J. E. Hunter..... 128,299
Sheet metal molding tool, G. M. Peters..... 128,463
Ship's log, J. & G. H. Bliss..... 128,261
Ships' running gear stop, J. W. Knight..... 128,373
Shoe lacing, A. W. H. Lindemann..... 128,449
Shoe peg, rawhide, G. V. Sheffield..... 128,316
Shutter, G. Campbell..... 128,232
Shutter and blind fastener, J. M. Meschutt..... 128,318
Sifter, ash, J. H. Raymond..... 128,381
Skate, C. Brewster..... 128,265
Skirt supporter and corset, H. A. Schandevyl..... 128,333
Soap frame, D. Whitaker..... 128,394
Soap holder, H. P. Hood..... 128,240
Sowing machine, tobacco, L. R. Forney..... 128,281
Stamp, hand, B. B. Hill..... 128,296
Steam trap, W. M. Fuller..... 128,285
Stench trap, P. Summers..... 128,425
Stone, imitation, Leathers & Chappellet..... 128,308
Stone, making artificial, W. H. Smith..... 128,340
Stone, making artificial, Leathers & Chappellet..... 128,307
Stove, heating, J. J. Gill..... 128,430
Stove, hydrocarbon gas, I. W. Shaler..... 128,338
Stoves, fire pot for, D. L. Stiles..... 128,483
Stump extractor, B. W. Thurman..... 128,487
Syringe, vaginal, A. J. French..... 128,283
Tank, asphaltic cement, C. M. Warren..... 128,491
Tanning hides or skins, C. Richter..... 128,468
Teasing machine, T. Williams..... 128,497
Telegraph key, C. J. Greene..... 128,433
Telegraph receiver, A. G. Bell..... 128,399
Thill coupling, E. D. Frost..... 128,284
Thill coupling, E. Page..... 128,459
Thrashing machines, packing, M. Laufenburg..... 128,306
Tobacco box, automatic, W. E. Harris..... 128,29
Toy hoop, G. Wheeler..... 128,352
Toy, metal, W. A. Harwood..... 128,366
Toys, wheel for, G. W. Gough..... 128,290
Trap, animal, W. Wallace..... 128,392
Trap, fish, J. McRoberts..... 128,375
Trap, fly, Cole & Dickson..... 128,235
Treadle motion, A. L. Dewey (r)..... 128,161
Trunk clamp, W. S. Jessup (r)..... 128,164
Umbrella tip retainer, J. T. Smith..... 128,476
Valve, J. S. Adams..... 128,224
Valve, balanced slide, J. E. Watson..... 128,393
Valve, check, S. Roe..... 128,469
Valve, globe, C. Walter..... 128,492
Vehicle wheel, P. J. Harvey..... 128,238
Wagon brake, H. Felt..... 128,424
Wagon standard, G. W. Mead..... 128,248
Washing machine, J. Grampelsbacher..... 128,363
Wasteway stoppers, Gibson & Powell (r)..... 128,162
Watch chain and pencil combined, J. H. Mable..... 128,451
Watch spring larrel, S. D. Johnson..... 128,371
Watchman's time detector, J. H. Massey..... 128,374
Waterproof compound, H. F. H. Miller..... 128,319
Weaning bit, P. Heak..... 128,367
Weather strip, D. Munson..... 128,455
Well, S. W. Belles..... 128,400
Windmill, J. & W. O. Swinnerton..... 128,346
Wire-working tool, M. C. Smith..... 128,388
Wrench, J. N. Byington..... 128,408

DESIGNS PATENTED.

9,324.—GLASSWARE.—T. B. Atterbury, Pittsburgh, Pa.
9,325.—CARRIAGE STEPS.—E. A. Cooper, Lancaster, N. Y.
9,326.—PAPER WEIGHTS.—F. A. Fouts, Bloomington, Ill.
9,327.—SHAWL FABRIC.—C. H. Landenberger, Philadelphia, Pa.
9,328.—EGG CUTS.—C. L. Mercer, Washington, D. C.
9,329, 9,330.—CARPETS.—G. W. Pigott, New York city.
9,331.—STOVES.—A. Richmond, Brooklyn, Conn.
9,332.—ALBUM COVERS.—A. Liebenroth, College Point, N. Y.
9,333, 9,334.—INKSTAND SUPPORTS.—H. J. Müller, New York city.

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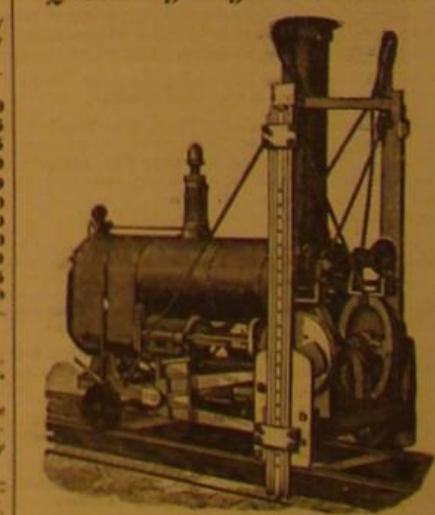
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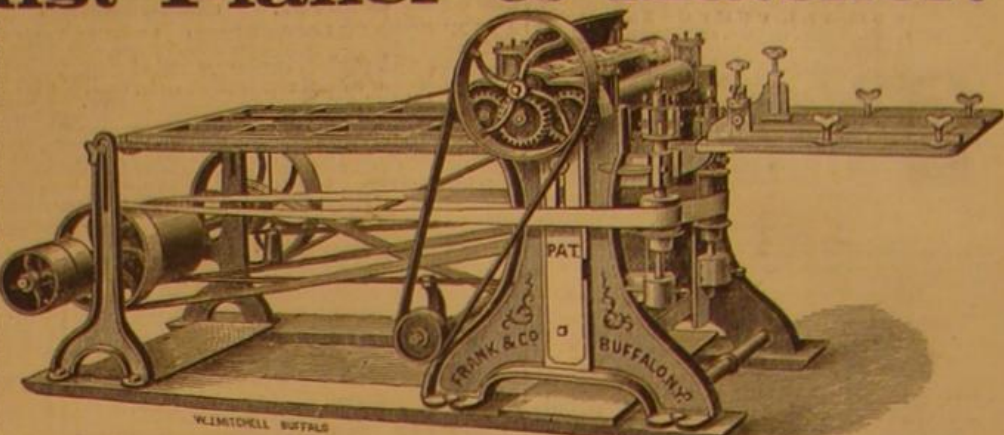
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NEW YORK, JULY 15, 1876.

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BAND RE-SAWING MACHINE.

As a natural consequence of the practice of transporting lumber in planks or thick boards from the sawmill to the manufactory, and there converting it into forms and sizes suited to the wants of manufacturers, which was formerly done at the sawmill itself, a demand has been created for improved methods of such conversion, which should combine a maximum speed of execution with a minimum waste of material.

This work has hitherto been accomplished by circular saws or reciprocating saws. The former, however, owing to the necessary thickness of the blade, produced a waste of material not compensated for by the amount of work performed, while the latter method, although more economical in the waste of material, was found unprofitable on account of its slow operation.

In the matter of re-splitting lumber, the band sawing machine seems best adapted to meet all the requirements; as its great cutting speed, and the very thin gage of saws which can be used, combine at once the saving of time or labor with the saving of lumber.

The accompanying engravings (Figs. 1 and 2) illustrate a machine of this kind recently perfected by J. A. Fay & Co., Cincinnati, Ohio, which combines in its design and construction many improvements and features which careful study and experiment have convinced the inventors are necessary to its successful and economical operation.

The saw is carried upon two wheels five feet in diameter, placed at a short distance from each other, the upper wheel having a vertical adjustment, shown in Fig. 1, to allow for the decrease in the length of saws caused by breakage and rewelding. The wheels run in long bearings and have an outside bearing to secure additional firmness. The tension of the saw is produced by means of a weighted lever, shown in Fig. 2, in connection with the adjusting screw of the upper wheel, which compensates for any variation in the length of the saw by expansion or contraction caused by changes in temperature.

The patent roller guides, which support the back and sides of the saw above and below the lumber, are made of steel and gibbed to a supporting post. This post has a radial adjustment by which the guides will direct the saw to the center of the required cutting line. The guides can be quickly detached for the removal of the saw, and the upper guide has a vertical movement by means of hand wheel and gears to accommodate different widths of lumber.

The saw may be made to run upon any part of the periphery of the upper wheel by means of a device for tipping the

wheel out of true perpendicular, or by a radial movement of the upright column, which throws the upper wheel out of a true parallel line with the lower one; and the saw being thus made to run on any desired part, there is no danger of its running off the wheel.

The feeding mechanism, consisting of four geared rollers of large diameter, is driven by friction, so arranged that, by different movements of the regulating lever in front of the machine, the operator can instantly stop or start the feed or graduate it from fast to slow. The guiding feed rolls are adjusted by hand wheel and screw, and the pressure feed rolls are governed by a weighted lever acting on a ratchet wheel by means of a pawl, and sufficient pressure may be obtained to straighten any warped boards. The feed rolls can be quickly adjusted to saw through the center or from the side of a plank, as may be desired.

The driving belt is tightened by an idler, attached to a lever swung to the lower wheel shaft, and moving concentrically with the driving pulley. The bearings are all provided with oiling devices, so that the wearing parts of the machine can be kept constantly lubricated. The machine is adapted for resawing lumber 30 inches wide and under, and down to the thinnest materials that admit of re-sawing. Its working capacity is stated at from 10,000 to 15,000 feet per day, depending upon the kind and width of lumber. The saw kerf is about $\frac{1}{8}$ thick; the thickness of the blade is number 19 gage. By this machine a large saving in lumber is effected: as, out of a $1\frac{1}{2}$ board, planed on both sides, three $\frac{3}{4}$ panels are obtained. The machine is so arranged as to be at all times under perfect control of the operator.

Several of these machines are in use, giving entire satisfaction. One of them may be seen in daily operation at J. A. Fay & Co.'s space in the Centennial Exhibition, section B. 8, columns 61, 62 and 63, Machinery Hall, where they have on exhibition a large number of their labor-saving machines. For further particulars, address the manufacturers, as above.

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The *Revue Industrielle* describes a new illuminating gas apparatus devised by MM. Kidd & Barff, which is composed of an iron drum into which any kind of carbon is introduced. Carbonized peat gives excellent results; powdered anthracite, coke and wood charcoal may also be employed. In the interior of the cylinder is established a system of circular tubes which are filled with water led from an elevated reservoir. The coal is ignited, and the heat develops steam in the tubes at a pressure corresponding to the height of the

reservoir. A small tube conducts the steam below the fire and allows it to escape into the ash pit. The jet draws in air, and the mixture traverses the burning combustible from below upward. A series of interesting reactions then occur, the watery vapor, air, and carbon acting materially upon each other. The oxygen of the air and steam unites with the carbon to form a certain proportion of carbonic oxide, and a less quantity of carbonic acid. The hydrogen set at liberty and the nitrogen are found in the mixture when it escapes. The nitrogen alone is annoying. The quantity of carbonic acid may be greatly reduced by augmenting the height of the layer of combustible. Carbonic oxide and hydrogen represent about 43 per cent of the mixture. A specimen of the gas obtained from carbonized peat gives on analysis: Carbonic oxide 28.5, hydrogen 14.5, nitrogen 53, carbonic acid 4. The gas contains no sulphur, either free or combined; and in order to use it for illuminating purposes it is only necessary to remove the carbonic acid, an operation of no great difficulty. It is calculated that 1 ton of coal by this process will yield about 98,868 cubic feet of illuminating gas, or, including the nitrogen, about double this volume. The operation is continuous, and there are no retorts to charge and empty. As the coal is consumed, a lever device throws in fresh supplies in closed boxes. The residue is a small quantity of ashes, and all the carbon appears to be mingled in the gas. The gas is remarkably pure, burns without the least odor, and produces only carbonic acid and water; hence it has no deleterious action on paint or gilding.

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Fig. 1

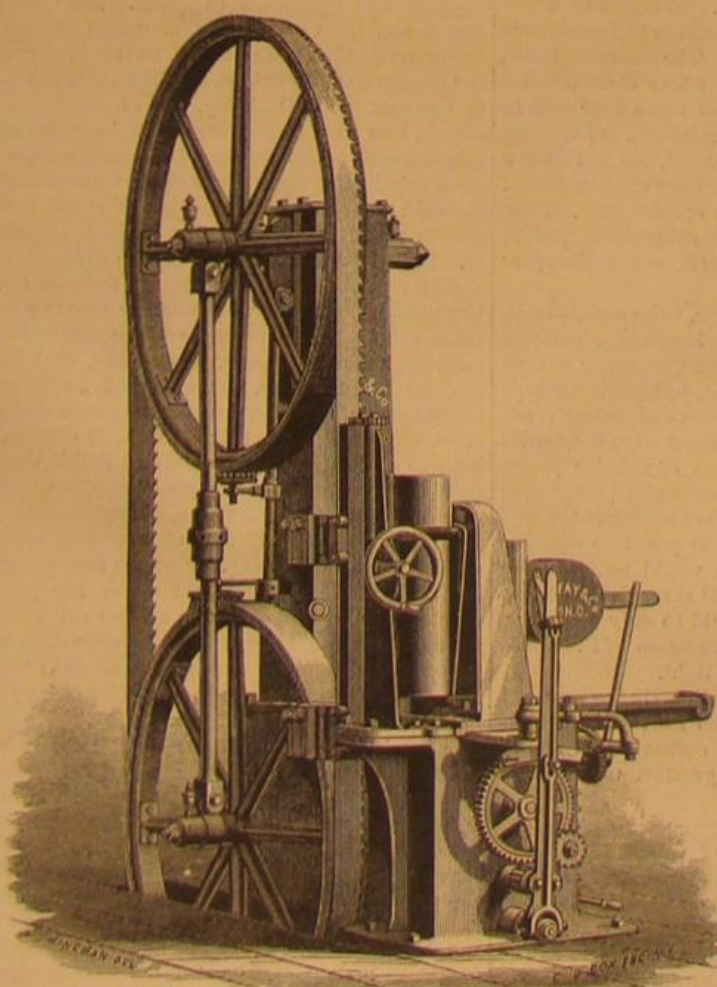
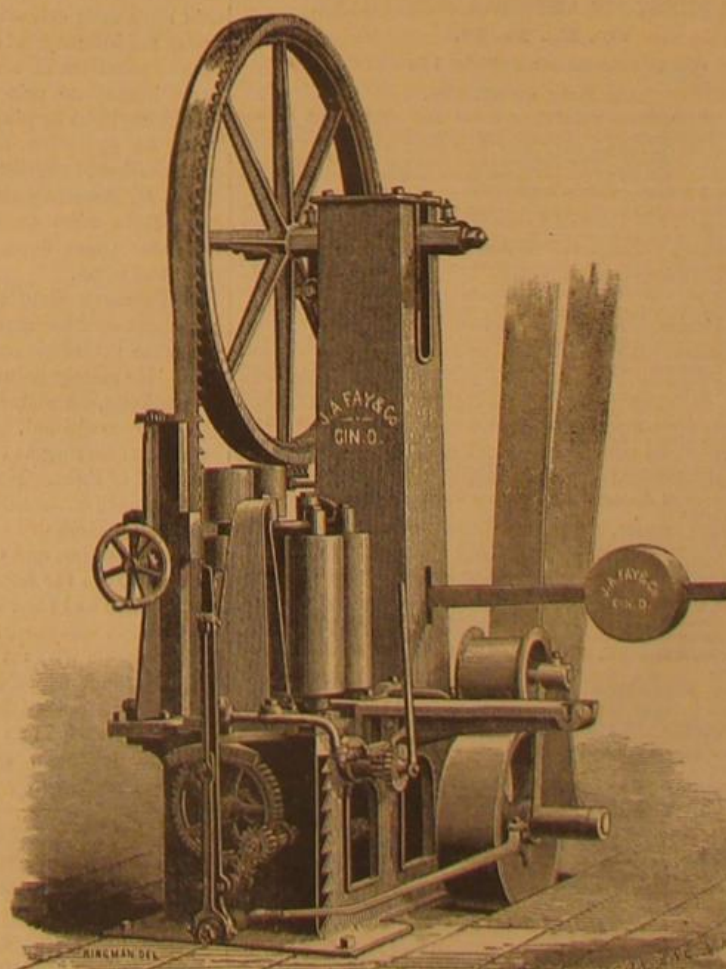


Fig. 2.



J. A. FAY & CO.'S BAND RE-SAWING MACHINE.

Scientific American.

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Contents.

(Illustrated articles are marked with an asterisk.)

American Institute fair, the.....	34
Amphibious black on leather (9).....	41
Animal mechanism.....	42
Answers to correspondents.....	43
Art House.....	43
Ashes and water, mixed (21).....	43
Barometric observations.....	43
Battery, the gravity (31).....	43
Boats, proportions of (19).....	43
Brake, improved wagon.....	43
Brickwork, coating for.....	43
Business and personal.....	43
Cams.....	43
Carbonic acid in rheumatism.....	43
Carbons, setting (28).....	43
Carriages at the centennial.....	43
Cellophane.....	43
Cement for hubs (34).....	43
Centennial exposition, the.....	43
Chloride of sulphur (36).....	43
Coal, combustion of (41).....	43
Coal, soft, as fuel (16).....	43
Colored fires, mixing (7).....	43
Cotton and grain exports.....	43
Dog vehicles.....	43
Drawing on tracing cloth (15).....	43
Drilling chilled iron (24).....	43
Dyeing lawn color (4).....	43
Electrical machine details (38).....	43
Electrical power transmission.....	43
Electric currents, strength of (39).....	43
Engines, inclined (37).....	43
Engines, the Corliss (6, 37).....	43
Flax in Missouri.....	43
Gas, making illuminating.....	43
Gold mining, new phase in.....	43
Harmony and discord, optical.....	43
Hayfork, improved.....	43
Hides, transparent (45).....	43
Ice locomotive.....	43
Ice machinery.....	43
Ice, melting (22).....	43
Ice places.....	43
Injections, power of (42).....	43
Insects, destroying (3).....	43
Interest, calculating (30).....	43
Life without light.....	43
Lops, ships (45).....	43
Minerals, Bergen Hill.....	43
Mirrors, improved silver.....	43
Money box, mechanical.....	43
New books and publications.....	43
Nitrous oxide, preparing (4).....	43
Oracles of ancient Greece, the.....	43
Packing box, a tight (8).....	43
Paint stains, removing (2).....	43
Paraffin oil in agriculture.....	43
Paraffin, separating.....	43
Patents, American and foreign.....	43
Patents, official list of.....	43
Petroleum as a lubricant.....	43
Phosphorus, luminous (32).....	43
Photo-chemicals.....	43
Photograph varnish, dammar.....	43
Photo portraits with borders.....	43
Pittman rod, a (25).....	43
Polishing wheels (27).....	43
Pony planer, improved.....	43
Potato blight, mineral manures for.....	43
Potato bugs (51).....	43
Power, cheap (40).....	43
Protocarbonate of iron (10).....	43
Pulleys, measuring crowned (41).....	43
Pyrolytic iron (12).....	43
Railway cars at the centennial.....	43
Railway collision, a singular.....	43
Railway rail, improved.....	43
Re-sawing machine, hand.....	43
Rhubarb.....	43
Russia at the centennial.....	43
Saltic acid applications.....	43
Slates, trimming and punching.....	43
Smoke in mines (13).....	43
Soap, potash (18).....	43
Solder, granulating (2).....	43
Stoves, finishing (29).....	43
Strychnin in whiskey (35).....	43
Sugar apparatus.....	43
Thistles, Canada (49).....	43
Umbrella supporter.....	43
Vacuum, pressure from a (11).....	43
Vehicles at the centennial.....	43
Ventilating a schoolhouse (47).....	43
Water, decomposition of (17).....	43
Water, power of falling (4).....	43
Water, raising (1).....	43
Wheels, large and small (44).....	43
Welding in charcoal fires (45).....	43
Zinc, amalgamation of (44).....	43

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 29.

For the Week ending July 15, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876.—The Coast Survey Exhibits, 2 engravings.—Government Measuring Instruments.—Foreign Car Wheels.—Novel Type-Setter.—New Engraving Machine.—The Galloway Boiler, 4 figures.—The Pennsylvania Railway Train System.—New Bevel Gear Cutter, 1 figure.—Remarkable Indian Dwellings.—Duplex Auxiliary Engine.—Exhibition Notes.
II. ENGINEERING AND MECHANICS.—Beginning of the Channel Tunnel.—Meetings of the American Mining Engineers.—The Hot Blast.—Mechanical Effects of Blown-out Shots on Mine Ventilation.—Work Stored up in Coal.—New Torpedo Carriage.—Hydraulic Motive Engine.—Hankin's New Propeller, 1 figure.—Steam Digging Machine, 1 engraving.—Centrifugal Filter, 1 figure.—Stockwell's Improved Life-Boat, 10 figures.—The New Portage Bridge.
III. TECHNOLOGY.—Machine for Making Porcelain Plates, 5 figures.—Dry Photo Plates.—Preparation of Glass Photos for Colors.—Where the Photo Co.—To Cement Rubber to Metal.—New Multiplying Camera, 5 figures.—How to Build Cheap Boats.—A Fourteen Dollar Sailing Skiff, complete, 14 figures.—Propagation of Brook Trout.—New Gas Burner for Heating Purposes, 1 figure.—Improved Horse Detacher, 1 figure.—Arsenic in the Arts.—Arsenical Colors.—Poisonous Effects of Arsenical Colors and Preparations.—European Cheeses, 1 figure.—The Perfect Horse Dimensions, and How to Measure Him, 1 figure.—The Peach Tree: How to Treat, 2 figures.
IV. CHEMISTRY AND METALLURGY.—Action of Acids on Tungstate of Soda.—Adulteration of Platinum by Lead.—Antiseptic Properties of Borax.—Bismuth.—Tests for Iron and Steel.—Pyrotartaric Acid.—Mineral Substances of Mushrooms.—Bunge's Chemical Balance.—Formation of Crystals.
V. ELECTRICITY, LIGHT, HEAT, ETC.—New Electric Probe and Extractor, 5 figures.—Improved Battery.—New Telegraph Lighting Projector, 3 figures.—Lighting Gas by Electricity, 1 figure.—Rhe-Electrometer, 3 figures.—Lighting Conductors.—Light Registering Apparatus.
VI. NATURAL HISTORY.—Remarkable Australian Gold Quartz Specimen, 1 engraving.—Section of the Comstock Lode, Nevada, 1 engraving.—Vortex Atoms.—Blue Eyed Cats not Deaf.—Adventures of a Steel Trap.
VII. MEDICINE, HYGIENE, ETC.—Quinia for Sonstroke.—Walnut Leaves in Tubercle.

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LIFE WITHOUT LIGHT.

An interesting discussion has recently taken place in the French Academy of Sciences, on the question of the influence of solar radiation, and of the green matter in the formation of the immediate principles of plant organisms.

M. Boussingault considers this influence to be indispensable, and that, if the solar radiation should disappear, life would be impossible. M. Pasteur on the other hand thinks that life might still continue in certain inferior plants and occasion the most complete organic growths. He cites as an example the life of the *mycoderma aceti*, which may take place in darkness on a liquid composed of alcohol, acetic acid, and mineral phosphates, the latter including phosphate of ammonia.The *mycoderma aceti* to which M. Pasteur alludes is a remarkably curious organism, which serves as a medium between the oxygen of the air and a combustible body or fermentable matter, to produce combustion or oxidation. Fermentation of this kind has thus a special character, and differs from that set up by yeast or in other ways. The *mycoderma aceti* appears as continuous membrane, either wrinkled or smooth, upon the surface of liquids while the same are undergoing acetic fermentation, and is generally formed of very minute elongated cells whose diameter varies from 0.000059 to 0.000118 inch. These cells are united in chains or in the form of curved rods. Multiplication seems to be effected by the transverse division of the fully developed cells, which division is preceded by a median constriction. If we allow this cryptogam to develop itself on the surface of any organic liquid containing phosphates and nitrogenous organic matter, until the whole surface of the liquid is covered; then if we remove the liquid without disturbing the membrane, and substitute an equal volume of water containing 10 per cent alcohol, the plant immediately sets up a reaction between the alcohol and the oxygen of the air. After a certain time the action, impeded by the great acidity of the liquid, becomes slower; but we can restore it to activity by substituting alcoholized water again. So that, as long as the *mycoderma* is supplied with suitable nutrition, it will go on and burn the alcohol; but if on the contrary we deprive it of nourishment, or in any wise diminish its vital activity, then its oxidizing action will not go so far, and the alcohol may change into acetic acid. This is the substance of one of M. Pasteur's most brilliant investigations, among the practical results of which is a new commercial method for the acetification of fermented liquids. The process consists in sowing the *mycoderma aceti* on the surface of liquor containing 2 per cent of alcohol, 1 per cent of vinegar, and traces of alkaline and earthy phosphates. When the surface is covered with membrane, the alcohol begins to acidify. This action being fully set up, some alcohol, wine, or beer mixed with alcohol is added every day to the liquid in small quantities; the acetification is then allowed to terminate, and the vinegar is drawn off. The membrane is collected, washed, and employed for a new operation.M. Boussingault's reply to the suggestion of the *mycoderma* by M. Pasteur is that it is true that some parasites attain a complete development in an artificial medium containing nothing but definite and crystallized chemical compounds. Still there is a great difference between this development and that of chlorophyll in plants. The latter take all their elements from the exterior world, carbon from the atmosphere, hydrogen and oxygen from water. The parasites, even those mentioned by M. Pasteur, take carbon in substances which, although of definite chemical construction, are derived from vegetable organisms. Alcohol and acetic acid have their origin in sugar, which cannot be formed save under the influence of solar radiation. The existence therefore of parasites in an obscure place, where their cellules form immediate principles, similar to those produced in bright daylight by plants of green protoplasm, is far from being an exception, as has been affirmed, but is rather a confirmation of the necessary relation of light and vegetation. Hence M. Boussingault adheres to his opinion that, if the sun's light were quenched, not only chlorophyll plants, but also those deprived of chlorophyll, would disappear from the earth.

M. Pasteur's position appears, however, to be unassailable, as might well be expected from his immense experience and wide investigations touching the subject under discussion. He simply points to the fact that, by known methods of synthesis, chemists starting with carbon and watery vapor can produce alcohol, acetic acid, and many other substances capable of serving as carbonated aliment of inferior plants deprived of light. Moreover it may be conceived that, under the influence of the same, all the carbon existing at the surface of the earth or in the interior might pass into complex organic matters, and that ultimately it would return to the atmosphere in the form of carbonic acid through the actions of oxidation and fermentation. It would be only when this termination was reached that all manifestation of life would be impossible without the aid of solar light.

M. Pasteur's experimental determination that oxygen and light are not essentials of life, and his having caused organisms to exist in an atmosphere of carbonic acid and in absolute darkness, are among the greatest triumphs of modern chemistry.

THE ORACLES OF ANCIENT GREECE.

As the classical authors inform us, there were in ancient Greece, in different localities, so called sibyls, a kind of fortune tellers, clairvoyants, or spiritual mediums, but of a social standing much higher than that of their successors at the present day, as they were not only recognized but maintained by a wealthy and influential priesthood, to whom the presents received from the faithful believers were a source of

enormous revenue. In our present state of society, we can scarcely form an idea of the power and influence of the priests as a separate class of society, monopolizing as they did all the profits derived from the superstitious, who wished to atone for their sins, to obtain knowledge not only of secret events, but also of the future, and to get advice as to their action in cases of difficulty, even to be cured of various diseases; and thus the priests monopolized, for many centuries, the functions of many professions, even that of the physicians, which Hippocrates at last succeeded in rescuing from the power of the priesthood.

These sibyls, of which the two prominent ones were the Cumæan and the Delphian, resided in gorgeous temples erected over caves, from which vapors arose which had an exhilarating and anæsthetic influence, similar to that of nitrous oxide or laughing gas, on those inhaling them. The author of a well known book, entitled "Art Magic," who for some time lived at the locality where the Cumæan sibyl once resided, states that it is one of the wildest, grandest, and most awe-inspiring gorges of the mountains around Lake Avernus, which itself is the inundated crater of an extinct but once mighty volcano; while the whole region around, now fertilized by the waters of the lake, bears the marks of the ravages of fire, presenting a most gloomy appearance. The clefts in the savage rocks abound with caverns, exhaling mephitic vapors and bituminous odors. The scattered inhabitants of the surrounding district once believed that the largest grotto was the entrance to the lower world, and that the hammers of the Titans, working in the mighty laboratories of the Plutonic realms, might be heard reverberating through the sullen air. The dark waters of Lake Avernus were supposed to communicate directly with the silent flow of the river of death, the Lethean stream, made dreadful by the apparitions of condemned spirits, who floated from the shores of the lake to the realms of eternal night. In this grotto resided the famous Cumæan sibyl; and from the exhalations, which were more or less poisonous to birds and other small animals which came near, the weird woman appears to have derived that fierce ecstasy in which she wrote and raved about the destiny of nations, the fate of armies, the downfall of kingdoms, and the decay of dynasties. Even monarchs and statesmen often acted according to her pretended revelations, as it was supposed that the purposes of the pagan gods were made known to her as to a counsellor and a mouthpiece.

She sometimes wrote her soothsayings upon palm leaves, which she laid at the entrance of the cave, suffering the winds to scatter them and bear them whither the gods directed. To the Cumæan sibyls is attributed the authorship of the famous sibylline books, of which many strange stories are told, but of which very little is left that can be regarded as genuine. It is said that she foretold the eruption of Vesuvius, in which Pliny perished and the cities of Herculaneum and Pompeii were destroyed. She declared of herself: "Why must I publish my song to every one? And when my spirit rests after the divine hymn, the gods command me to prophecy again, so that I am entirely on the stretch, and my body is so distressed that I do not know what I say; but the gods command me to speak." If we substitute in the latter expression the word spirits for gods, we have a declaration identical with those of the spirit mediums of the present day.

The abode of the Delphian sibyl or Pythia was in strong contrast with that of the Cumæan oracle. It was situated in the delightful region of Mount Parnassus, sparkling in sunlight and fragrant with bloom. The superb temple of Apollo was built over a similar chasm as that where the Cumæan sibyl held her séances, so that it was secured from the approach of the vulgar. On its former site certain clefts in the rock are still visible, one of which forms a deep cavern, into which travelers, by clinging to its rugged sides, may descend as far as they dare. They then experience effects similar to those produced by nitrous oxide or laughing gas; and one writer, who has explored these caverns, asserts that it is this gas that produces the effects spoken of. This, however, is, according to geological principles, highly improbable; and we rather suppose it to be some bituminous vapor, which (according to our present knowledge concerning petroleum and its derivatives, such as naphtha, ether, rhigolene, chymogene, etc.) has an effect, exhilarating, hypnotic, and anæsthetic, similar to that of nitrous oxide. All the descriptions agree that bituminous odors are exhaled from these volcanic chasms. Plutarch informs us that the most celebrated Pythia who served the Delphian oracle in the temple of Apollo was a beautiful young country girl from Libya, named Sibylla. From this was the name sibyl derived, and it was afterwards given to all clairvoyants of her day. Plutarch further says, concerning the first sibyl: "Brought up by her parents in the country, she brought with her neither art nor experience, nor any talent whatever, when she arrived at Delphi to be the oracle of the gods;" and further, he says: "The verification of her answers has filled the temple with gifts from all parts of Greece and foreign countries." How very much like the innocent young mediums of today, who are often claimed to give the most astonishing revelations from the other world without ever having had the advantages of a scientific education! The sibyls of the ancients had, however, the advantage of the support, assistance, and promptings of a class of men highly interested in their reputation, the priesthood of the period; and this class not only consisted of the most educated individuals, but of men who had the greatest opportunity of obtaining information withheld from the vulgar.

When we compare with this state of things the position of our mediums now, who obtain little support from the in-

telligent, and none among the priesthood of the present day, we cannot help being surprised at their success and the number of their dupes: our surprise is chiefly at the ignorance and credulity of those who patronize such things in the nineteenth century.

CAMS.

There are several devices in mechanics which are important and even indispensable, that are used under protest. In this class we have irregular cams, at once the most useful and the most abused things in the mechanical world.

There is not a loom deftly weaving its delicate designs which is not dependent on cams. Sewing, knitting, and printing machines, a host of ponderous as well as delicate machinery, depend on cams to give one movement here, and another there; yet after all a cam which is in perfect proportion in all its parts is rarely seen. It is no uncommon thing to see a lever provided with an infinitesimal friction roller which is intended to turn on a pivot four fifths its size. This little roller must fit a groove in a cam which revolves at such speed as would drive it at the rate of thousands of revolutions per minute, if it would revolve; but the oil is forgotten, it heats, sticks, cuts itself and the cam; and then comes lost motion, noise, and destruction to the machine. Perhaps a larger wheel or roller is used, for instance, on the periphery of a cam. This wheel is a mere disk, with a hole bored through the center. It is placed on a stud on a lever, and assigned to a duty as heavy as that of the shaft which carries the cam. Is it any wonder that it soon wobbles, cuts the cam, and works unsteadily?

Of course the remedy for this is obvious. The rollers should be made as large as possible, of good material and well hardened. The roller bearings should be of the proper proportion and well fitted, and provided with some means of continuous lubrication.

The cam should be smooth, without the slightest scratch or cut, and should be made as far as possible so that it will not catch dust and dirt. If any part of a machine needs cleaning often, it is a cam; yet it is not an unfrequent thing to see a mass of gum, lint, and grit stowed away in a cam, cutting away its usefulness.

BAROMETRIC OBSERVATIONS.

In a recent issue we briefly described a simple way of keeping a barometric record, by the aid of which farmers and others might soon learn to predict weather probabilities. We believe that it is not generally realized how useful an instrument the barometer is, even in unexperienced hands; for certainly were farmers thoroughly informed as to the meaning of its indications, we should hear much less of gathered crops spoiled by untimely and unforeseen rains. The ordinary mercury barometer can if properly constructed generally be relied upon to indicate approaching weather at least twelve hours ahead; and this because the transmission of pressures to a mass of air is very easy, so that the barometer is sensible to variations therein even over long distances. For good work the simple mercury or the aneroid barometer should be obtained. Little confidence can be placed in those which have a dial and an index which points to words descriptive of the state of the weather. The necessary mechanism causes sufficient friction to prevent slight changes of pressure affecting it, and moreover the words "fair," "variable," "rain," etc., convey a wrong impression of the instrument; for the barometer does not indicate by the absolute height of the mercury, but, by its rising or falling, the kind of weather we are to expect, and this change is not shown on the index. A diminution of barometric pressure is almost always the consequence of the approach of the center of one or sometimes of several rotary storms, which move and travel at a certain distance from the point of observation. These movements are followed by changes of winds which carry rain. A falling barometer is therefore always indicative of changes in weather; but contrary to a general opinion, rain does not fall at the moment when the barometric column attains its lowest point. It is only a certain time after the minimum that this phenomenon is ordinarily pronounced; and by repeated observations, based on this fact, M. Gobin of Lyons, France, has been enabled to prepare a series of concise barometric laws, which he has recently published and of which we give the substance below.

If the barometer, after having been high, descends, a change of wind will probably occur twelve hours afterwards. This change will be without rain or with very little rain. When the barometer stops in its falling without descending lower before rising again, rain will come twelve hours after the stoppage. If the mercury remains low, the rain will persist, and fine weather will not come again until ten or twelve hours after the column commences regularly to rise. Sometimes this interval extends to sixteen or eighteen hours, but this is rare.

If, while low, the mercury oscillates slightly up and down, bad weather will persist, with, however, occasional clearing. These alternations of rain and shine will be more pronounced as the oscillations are greater, and will follow the movements of the barometric column at shorter intervals than those noted in the law above given.

Finally, if, as often happens, the mercury, after reaching its lowest point, immediately ascends in a continuous and regular manner, rain will come inside of twelve hours after the mercury touches the minimum; but it will last but a short time, and will soon give place to fine weather.

A GOOD coating for outside brickwork is made by mixing clean river sand 20 parts, litharge 2 parts, quicklime 1 part, and linseed oil sufficient to form a thin paste. It is also useful as a cement for broken stone, drying exceedingly hard.

THE CENTENNIAL EXPOSITION.

The formal programme of the grand ceremonies, to take place in Philadelphia on July 4, has been made public. After the military parade has concluded, the literary exercises will be held on a large platform in rear of Independence Hall. They will include the reading of the Declaration of Independence from the original document, by Mr. Richard Henry Lee, of Virginia, grandson of the mover of the Declaration in the Continental Congress, the singing of a hymn of welcome by Dr. O. W. Holmes, a national ode by Mr. Bayard Taylor, and a Brazilian hymn of greeting, composed at the request of Dom Pedro. An oration by Hon. W. M. Evarts, which is next in order, will be followed by the Hallelujah chorus and Old Hundred, chanted by the chorus and audience. The proceedings are as simple as those at the Centennial Exhibition opening, and will doubtless be fully as impressive.

Dom Pedro is justifying his reputation as a most indefatigable sight-seer. He is "doing" the Exposition in a way that leaves no doubt but that he makes himself familiar with the appearance and use of every object to which his attention is attracted.

The steady growth thus far in attendance is the best evidence of increasing interest in the fair. During the first week, omitting the opening day, the average of paying visitors was 12,210; at the present time the daily average is over 30,000.

The first of what it is hoped may be a series of industrial excursions recently visited the Exposition. The excursionists numbered 3,631, and were the employees of the Singer Sewing Machine Company. A number of students from the Massachusetts Institute of Technology have been encamped on the Pennsylvania University grounds for some time past, and, with their instructors, are making a careful study of the mechanical part of the show. The display of

RUSSIA

in Machinery Hall is gradually approaching completion. A large partition has been erected, covered with cloth, on which are shown rolls of iron and copper; and a circular stand has been built for the exhibition of different iron and other ores and metals. Around the base of the stand and on the lower shelves are disposed samples of iron and copper. A heavy slab of the latter metal, surmounted by a beautiful mass of malachite, covers the upper portion. There are two other stands in the form of obelisks, against which are arranged in tasteful manner a large number of forms of sheet, bar, and angle iron, boiler iron, and tram and chain work. Numerous stout iron bars are tied into knots without showing the slightest flaw; and specimens of angle iron and long rails are exhibited, twisted into sharp spirals. In the northern half of the section is a fine collection of models of ships, dockyards, and workshops. There is one large model of a shipyard and marine railway, showing the manner in which the largest ships are built and launched. A model of a dry dock is fitted with every timber and requisite piece of machinery, all made on an exactly reduced scale. A fine exhibit is made of heavy work in iron and steel, chains with huge links three or four inches in thickness, steel tires for locomotives, and heavy arched beams of angle iron.

THE SUGAR APPARATUS.

next to the Corliss engine, may be considered as the most prominent exhibit in the Machinery Hall. The gigantic vacuum pan is elevated on great iron columns, three stories high. Inside are four copper serpentine, and into these steam is led. The circulating pump and the centrifugal machines are placed on the first floor. On the second floor is a large receiver which receives the contents of the pan after concentration, in the shape of a dense mass of semi-fluid material, a magma. This goes into the centrifugal machines, which separate the sugar from the molasses. The great vacuum pan is exhibited by Messrs. Colwell and Brother, of New York; it is 8 feet in diameter, and, in a single operation of three hours in duration, can produce fifteen hogsheads of sugar.

THE CARRIAGES

are grouped in an unpretending structure of corrugated iron, immediately in rear of the Main Building. There are 430 American and 20 foreign exhibitors, and the display seems to be one of the most attractive to the general public in the entire fair. Many of the vehicles embody novel appliances, others are remarkable for beauty of finish. Messrs. Brewster & Co., of Broome street, this city, besides a superb display of carriages of all kinds, exhibit two buggies for one and two persons which weigh respectively but 132 and 214 lbs. These have a new side bar attachment, which secures ease of travel. A new feature in one of the sleighs is a small wire sieve on the dash to keep out drift snow. Another novelty is the extension of the runners above the dash for a height of five and a half feet. These are surmounted with red horse plumes. The general effect is striking and handsome. Messrs. Studebaker Brothers, of South Bend, Ind., exhibit a wagon for country roads, with the body and running gear left unstained, in order to show the workmanship, which is excellent. The body is of sugar maple, the axle of hickory, and the hubs of birch. The same firm also display a new wheel, the spokes of which have sloping shoulders, in order to fit them for resisting greater strain. Two Philadelphia firms make a joint exhibit of carriage and harness. The former is plain and handsome. The visitor is attracted to this display by the ingenious idea of attaching to the vehicle four horses, superbly carved in wood and wearing an elegant gold-mounted harness. The animals are painted gray, and so cleverly have both artist and sculptor done their work that at a short distance the figures have been

frequently mistaken for life. Of the large American coaches and carriages, it is hardly necessary to particularize any on the ground of relative superiority. Their characteristic is lightness and elegance of form, combined with the evidences of the highest skill on the part of painters and varnishers.

THE FOREIGN VEHICLES

are exhibited chiefly by English, Canadian, Russian, Australian, and Italian makers. Some of the English carriages, notably the drags, are objects of much curiosity to country visitors. One vehicle of this last-mentioned description is built expressly for picnic parties. It is so put together that the various portions of the carriage and fittings form tables, and the roof is fitted with an ingeniously arranged sun shade. A novel phaeton is one which has recently been introduced into England, and which looks like a Russian droshky. It is hung very low on high wheels. A very elegant brougham, built by a London firm, has an edging of vulcanite on the cloth of the window sashes, which prevents wear. C and under springs are used in all the English carriages, and the tires of wheels and forgings are of Whitworth metal. The Italian makers are represented by two cabs, resembling the English hansom, except that the passenger gets in from behind instead of in front. The driver's seat is in rear and above the door.

A curious feature of the Russian exhibit is a light trotting wagon. The running gear is hung on four small wheels, and above it rests the driver's seat, a long board covered with blue plush. A greater contrast than that afforded by this wagon, as compared with the trotting sulky in use in this country, can hardly be imagined.

Canada exhibits some fine sleighs, among which is one capable of accommodating six people. The seats are placed in tiers, the front one being the highest and the others gradually descending. The body is hung on a double set of runners, in order to facilitate turning the vehicle. There are also some fine cutters, beside coaches, buggies, etc.

The French exhibit, for some inexplicable reason, is located in the Main Building. It includes a drag of admirable build, besides a large number of smaller carriages, all remarkable for elegance of design. The

CARRIAGE METAL WORK

exhibited embraces specimens of axles, bolts, screws, whip sockets, springs, mountings in gold, silver, and nickel, bows, curtain attachments, etc., all arranged in handsome cases. There is one German exhibit in this section, principally of axles and springs. Children's carriages are also displayed in profusion, and some are of exquisite design. There is also a large collection of bicycles, among which is

A DOG VELOCIPED

This is a curious affair, having three wheels, two large ones, between which the rider's seat is located, and one small guiding wheel in advance. Inside the felloes of the large wheels are broad bands of perforated metal, and the spokes are so disposed as to lie on each side of these bands, like the bars of a cage. It is stated that the dogs are placed between the spokes and on the bands; then, by their attempts to run ahead, something like those of the squirrel in its revolving cage, the wheels are rotated and the vehicle impelled. This is the description given, but we are inclined to doubt the practicability of the arrangement.

THE RAILWAY CARS

are all American. The Harlan and Hollingsworth Company, of Wilmington, Del., exhibit one broad and one narrow gage carriage. The broad gage car is superbly decorated with mirrors and gilding, and its interior woodwork is a marvel of artistic workmanship. The narrow gage car is of plainer construction. The Jackson & Sharpe Company display a parlor car built for the state use of the Emperor of Brazil. It is constructed in sections, so that it may be taken apart and stored in the hold of a vessel. In the front portion is a boudoir fitted up with drab morocco seats, relieved by heavy magenta-colored fringes. The carpet is a delicate drab covered with a tasteful flower pattern, and the curtains are green and gold. The furniture consists of elegant cabinets, one for books, another to serve as a sideboard. Light is obtained from small stained glass windows at the top. Adjoining the boudoir are a reading room, furnished in blue, and a writing room in crimson. Next to these is the sitting room, plainly fitted with cane-seated walnut chairs, but having superbly inlaid woodwork.

The Pullman Car Company exhibits one of its magnificent hotel cars, containing all the improvements in the shape of kitchens, china and linen closets, refrigerators, etc. The refrigerator, we notice, is a square box hung under the car. Another new feature is a large flange on the wheels, which, should the vehicle run off the track, will catch on the rail and prevent its going further.

THE STREET RAILWAY CARS

are finished with decorations of the most elaborate description. One built by a Boston firm has a new running gear, said to reduce friction greatly, a patent attachment for putting on a new brake shoe, and a novel arrangement for lowering and raising the pole to suit the varying size of horses. A noticeable feature of a car built by Jones & Co., of Troy, N. Y., is the exterior coloring, which is in imitation of one of the Highland plaids, laid on in a broad band around the body. This is done in deference to the fact of the car being intended for use in the Highland district of Boston. Messrs. Stephenson & Co. also display some street cars, embodying many of their recently patented improvements.

The remaining contents of the carriage building we shall describe in our next issue, in which a full account of the Fourth of July ceremonies will also appear.

A NEW MECHANICAL MONEY BOX.

A variety of curiously ingenious money boxes for children have, of late, appeared in the hardware and toy stores, which, it seems to us, must tend to cause the average youngster to lay up immense stores of pennies, if only for the satisfaction of seeing the toy operate whenever a coin is inserted. There is a metal frog into whose mouth the penny is put, whereupon he gulps down the coin and rolls his eyes in the most astonishing manner. Another device is so constructed that, when the penny is dropped in the slit of the box, two or three tin horses proceed to race around a miniature race track; still another is the figure of a portly individual seated in a chair. The coin is placed in his hand, whereupon he promptly inserts it in the slit which is located in the position of a coat pocket. About the most ingenious invention of the kind we have yet seen is that herewith illustrated. It was patented by Mr. C. C. Johnson, of Windsor, Vt. The penny is placed on the tray held by the miniature cashier outside of the house, and the weight is just sufficient to press down the platform on which the figure stands. The arm, in descending, strikes the pin of a locking device beneath it and frees a spindle which, operated by concealed clockwork causes the cashier to be carried round in a circle against the door on the left, which opens before him so that he can enter the bank, and then closes behind him. He carries his receiver through the slot of a chute, a lip on which removes the coin so that it drops down the chute and into the vault below. Then the cashier moves round against the other door, which opens outward and closes as he passes, and coming again to the front of the bank he is again held by the locking device, waiting for the next contribution.

The Fair of the American Institute.

The 45th annual exhibition of the American Institute will open on the 6th of September next, at the Institute building, corner of 63d street and Third avenue, in this city. The management announce unusual preparations to accommodate exhibitors, and also the fact that a new gold medal will be awarded for articles of great merit and novelty. It is thought that the influx of people to the Centennial will render local fairs in its vicinity exceptionally valuable for advertising purposes to exhibitors. Application for space, etc., is to be made to the General Superintendent, American Institute, New York city.

TRIMMING AND PUNCHING ROOFING SLATES.

Mr. E. R. Davis, of Detroit, Mich., has patented (Dec. 21, 1875), a new machine with which a roofing slate may be trimmed and the nail holes punched at a single operation.

In the engraving herewith given, A is the main frame, to which the cutting frame, B, is hinged. CC' are two bearers, adjustably secured, so that they can be adjusted to or from each other, according to the width of the slates to be trimmed. The bearer, C', has one side turned up, as at C'', forming a guide flange for one side of the slate, which is laid against it. A guide is adjustably secured to the front girt between the bearers. The outer edges of the beveled ends of the bearers are flanged upwardly, and sharpened to form cutting edges, b. The cutting frame is composed of two parallel iron bars set up edgewise, bent to form three sides of a frame, with spacer blocks between the bars, which are tied by bolts through the said spacer blocks. The cutters, EE, are adjustably secured under the frame diagonally across its corners, so as to bring their cutting edges just outside the cutting edges of the bearers below. F is a handle across the front edge of the cutting frame, which can thereby be lifted up or thrown forcibly down, the impact upon the front girt of the main frame being eased by rubber buffers.

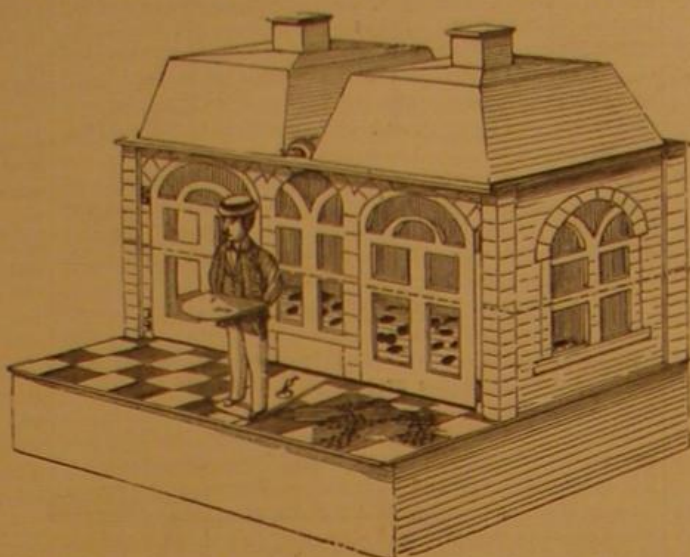
To trim a slate the latter is laid on the bearers, one edge bearing against the guide, C', and the front end against the guide, D. The cutting frame is then thrown down, when its knives will shear off the corners of the slate in line with the cutting edges, b, of said bearers. To punch the nail holes in the slate at the same operation each bearer is provided with an anvil, G, longitudinally adjustable in a slot therein, each anvil having an oval hole through it. Across the top of the cutting frame a cross beam, H, is jacked, said beam being constructed like the cutting frame of two parallel iron bars set up edgewise, and may be moved forward or back by loosening its jack bolts. I are nail hole punches, each having a screw shank which is inserted up through the slots of the cross beam, where it receives a wing nut, I', which secures it in position to have the point enter the anvil hole, first passing through the slate. A spring, J, spirally coiled about the punch, forces off the slate when the punch is raised.

Export of Cotton Fabrics and Breadstuffs.

The exports of domestic cottons from New York to foreign ports in one week, recently, were over 1,000 packages, which bring the total, from the 1st of January, up to 31,500 packages. The shipments of grain are enormous. Last week's exports were of wheat, 13,023,300 bushels, corn, 409,546 bushels, besides a fair quantity of peas, rye, and oats. The prospect of war in Europe has stimulated the grain trade.

Separating Paraffin from Hydrocarbon Oils.

Mr. Joseph B. Meriam, Cleveland, O., says: "Heretofore paraffin has usually been removed from hydrocarbon oils by putting the material into sacks or folds of canvas, or folds of hair cloth, etc., and then subjecting to pressure at a low temperature. The difficulty, however, in those processes was that, the heavier the pressure that was applied, the more open would the pores of the bags or sacks become, and the more readily would the paraffin pass through them, rendering it almost impracticable to make a thorough separation.



A NOVEL MONEY BOX.

"I have discovered that the scales of paraffin that are thus left, after thus extracting the oil by pressure at a low temperature, are separate and distinct, and, except under the application of heat, cannot be, by ordinary pressure, reduced to an impervious mass; and I make use of this property as follows, for the purpose of separating the paraffin from oils.

"I first take suitable receptacles, preferably of metal, protected by a non-conductor of heat, which receptacles have perforated bottoms. I then place over the bottom on the inside a wire gauze, screen, or cloth to prevent the scales of paraffin from falling through. I then fill in upon the said screen a quantity of paraffin scales that have been separated from hydrocarbon oil by pressure under a low temperature, as above described. The hydrocarbon oil to be treated is then prepared as follows: It is first reduced to a low temperature, sufficiently to chill it, and leave it in the condition termed granulated. This oil, in its chilled, granulated condition, is then put into the vat upon the paraffin scales, and then subjected to a pressure under a low temperature, in any convenient way, as, for instance, by a plunger. This pressure drives the oil through the mass of

lution in one ounce of water. The reason of the much greater activity of a hot saturated solution in development will be at once apparent.

Pyrogallol acid, or pyrogallol, occurs in white, brilliant crystalline plates, massed together in light, cottony masses, which, by exposure to the air and light, gradually darken and, in some measure, lose their photographic activity. Colorless samples should, therefore, be selected. It may generally be relied on for purity. The writer was once accidentally supplied with benzoic acid in lieu of pyrogallol, which it somewhat resembles in appearance; but the substituted acid will be readily detected by its aromatic odor.

Nitric acid should be colorless, and the upper part of the bottle containing it free from red vapor. Its specific gravity is about half again as heavy as water. It is very corrosive, staining the skin yellow, and must be very carefully handled, as its corrosive action will give rise to very troublesome sores. The fact of its producing a yellow stain on many organic substances—a quill, for example—may serve to distinguish this acid from most others.

Sulphuric acid is a colorless, heavy liquid, having great attraction for water, and should be stored in well stoppered bottles. If kept in corked vessels it will soon become dark in color from portions of the cork becoming decomposed and falling into it. Any organic matter will cause rapid darkening, and there is most violent reaction when it is mixed with turpentine and other hydrocarbons. Its chief use in photography is in the preparation of pyroxylin, and as a detergent for removing organic and alkaline deposits from glass vessels.

Hydrochloric acid, when pure, is colorless, giving off white fumes on exposure to the air. It may be readily distinguished from other acids by the dense white vapor which forms on its fumes mixing with those of ammonia. The commercial acid is of a yellow color and contains many impurities, but is sufficiently good for the purpose of precipitating solutions of nitrate of silver. Diluted with water, it readily removes stains of the alkaline developer from the hands and ink stains from wood or other materials.

Aqua regia, or nitro-hydrochloric acid, is a mixture of one part of nitric with three or four parts of hydrochloric acid, and is used for dissolving gold in the preparation of the chloride of that metal.

Bicarbonate of soda, often purchased as carbonate of soda, is a white powder and useful for many purposes, culinary and scientific. The quality varies considerably; that known as "Howard's" is considered as the best preparation, being more soluble than the common variety. It is often called carbonate of soda, an appellation only correct when applied to the preparation known as washing soda, or this in its purified forms.

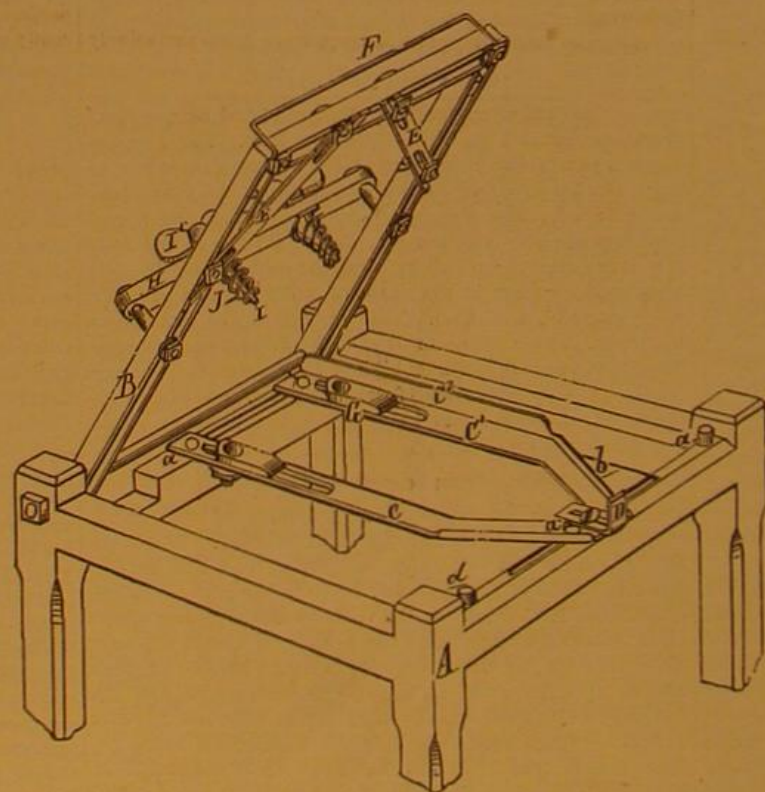
Morphia acetate is an alkaloid obtained from opium, and may be purchased as a dirty white crystalline powder, which inflames like resin. It is a dangerous narcotic, but useful in the preparation of dry plates with very limited keeping powers.

Alcohol, or spirit of wine, is a colorless, volatile liquid of a strength of 56° to 60° over proof, suitable for addition to the above developer, varnisher, etc. A more highly rectified quality termed absolute alcohol, is used in the preparation of collodion, or for diluting the same. The only difference or probable impurity in proof spirit, rectified spirit, or absolute alcohol, is the percentage of water contained in it. A rough method (if the hydrometer be not at hand) of estimating the strength is by watching the rapidity of its evaporation. On a slip of note paper being dipped into it and suffered to dry spontaneously, if the spirit be tolerably free from adulteration, evaporation will take place rapidly; but if much diluted, it will be some time before this takes place.

Rectified ether is an extremely volatile, colorless fluid, boiling at a low temperature, and not miscible with water unless mixed with spirit of wine. Spirit of ether is occasionally supplied in lieu of the rectified ether, and consists of a solution of ether in spirit of wine. The mixture may be readily detected by adding a few drops of spirit of turpentine, which will cause no turbidity if the ether be pure, but will do so if it contain spirit of wine.

Methylated spirit: This should be nothing more than spirit of wine with an admixture of wood naphtha; but it is often impure from the presence of resinous and other matters. Methylated finish is sometimes sold for it, a preparation utterly unsuitable for photographic use, containing, as it does, a large percentage of resinous matters. Good methylated spirit should, if burned in a spirit lamp, form no incrustation whatever round the wick tube, and should not be more than slightly opalescent if mixed with water.

Ammonia: The sesquicarbonate of ammonia, or volatile salt, occurs in semi-transparent lumps of various sizes. Access of air will cause them to be converted into another carbonate, of an opaque white, powdery character, and of less active chemical qualities. Lumps free from this powdery surface should be selected, and the vessels in which it is kept made airtight. It is a good precaution never to reduce it to powder until just before use, as in a state of fine division it is more liable to become inert.—*British Journal of Photography*



DAVIS' MACHINE FOR TRIMMING AND PUNCHING SLATES.

paraffin scales, which filters from it the paraffin that may be contained therein. The greater pressure applied, the more closely will the paraffin scales be pressed together, and the more perfectly will it filter the paraffin from the oil that is being operated upon. In this way I am enabled to make an almost perfect separation of the paraffin from the oil, thus leaving the oil in a practically pure condition."

PHOTO-CHEMICALS.

BY EDWARD DUNMORE.

Gallic acid, obtained from nut galls, consists of small, feathery crystals, nearly white, but which, however, vary in color, some samples being decidedly brown. Preference should be given to the more colorless sample for photographic purposes. It is freely soluble in hot water, but in cold about four and a half grains will form a saturated so-

IMPROVED WAGON BRAKE.

The annexed engravings represent a new wagon brake patented through the Scientific American Patent Agency, April 25, 1876, by Mr. J. W. O'Daniel, of Cloverdale, Ind. The novel features are found in the mechanism, and principally in the devices which allow the levers for working the brakes to remain undisturbed by the oscillations of the same, as shown in Figs. 1 and 2.

The joint by which the front and hind gears are coupled, so that both may oscillate in turning around curves, consists in a tubular nut swiveled to the rear bar, B, of the front gear, and a rod, C, attached to the rear hounds, sliding freely in said nut. The rod is extended both before and behind the nut, so that it may move therein as the distance between the centers of the reach varies. The brake bar, H, is carried on the hounds so as to oscillate with them and the wheels. It is arranged to move forward and backward suitably for engaging and releasing the wheels, and is connected by a bar with the lever, K. Said bar connects with the pivot, E, by a slot, so that it can slide to pull and push the brake, and with the lever, K, by a curved slot and pin, so that it can swing with the wheel. The lever is pivoted to an arm, O, fitted on the reach, and, as already stated, remains at all times in the same relation to the box.

Bergen Hill Minerals.

The new tunnel of the Delaware and Lackawanna railway, through the trap rock formation of Bergen Hill, opposite New York city, is now nearly completed. Mr. Edward H. Fletcher, 124 West 54th street, this city, obtained a quantity of specimens of zeolites and calcites, taken from pockets in the tunnel, at depths of 50 to 150 feet from the surface. They comprise apophyllite, prehnite, laumontite, natrolite, pectolite, stilbite, analcime, datholite, and fine varieties of calcites. Intergrouped with some of these, are also chabazite, heulandite, gmelinite, levyne, copper pyrites, iron pyrites, galena, and blende.

IMPROVED RAILWAY RAIL.

The invention herewith illustrated is an improved continuous rail for railways, by which it is claimed that the battering and breaking of the ends of the rail at the joints is avoided, and less wear and injury to the rolling stock produced. In the sectional view, Fig. 1, A represents two rail sections of symmetrical shape, with base flange and head, each rail resembling the section of a common rail split into halves along the longitudinal axis. The rail sections, A, are joined longitudinally and provided with interior recesses for a longitudinal wooden core, B. By laying the sections so as to break joints, battering at the end is avoided and the rails are rendered more durable. The heads of the rail sections are provided with a tongue and groove, which affords mutual support to the adjacent parts, and also prevent the inside corners of the rail heads from breaking. The compound rail thus constructed is claimed to be stiffer and stronger, and smoother throughout, while the wooden center rail or core imparts a certain degree of elasticity to the same. The interior, wooden rail is covered on all sides and protected against the weather, so that it may last a long time, and may be replaced when required. While twice as many fish plates will be used, they will only need to be half as long and half as thick as usual, thus effecting a saving of one half the material. The same number of bolts will be required as in the old rail, but they will not need to be so heavy, as at every joint there will be the solid middle of a rail section besides the wood to support it. The principal use of the bolts and the fish pieces will be to hold the parts together, which will not require great strength, as the base is double and stands apart, with the flanges extending outward on either side; the tops will gravitate together, and, the greater the weight upon them, the more they will press together. The inventor points out that his device effects a saving of over a solid inch of iron or steel, which will pay double the cost of extra work required in construction. Owing to the smoothness of the road, he considers that there will be less damage

to goods in transportation, and that pleasure and safety in travel will be increased. Less labor will also be required in keeping the road bed level. A side view is given in Fig. 2.

Patented through the Scientific American Patent Agency, February 29, 1876. For further particulars relative to the

Fig. 1.

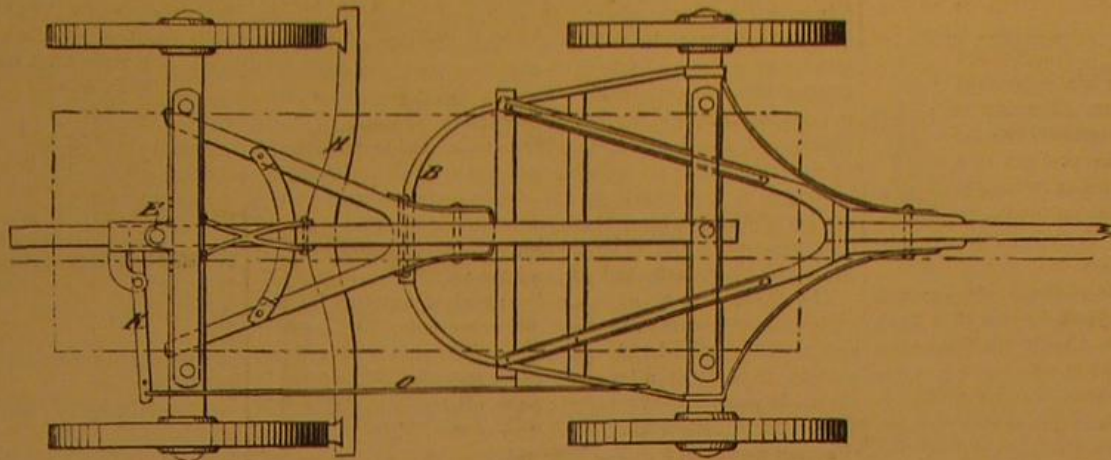
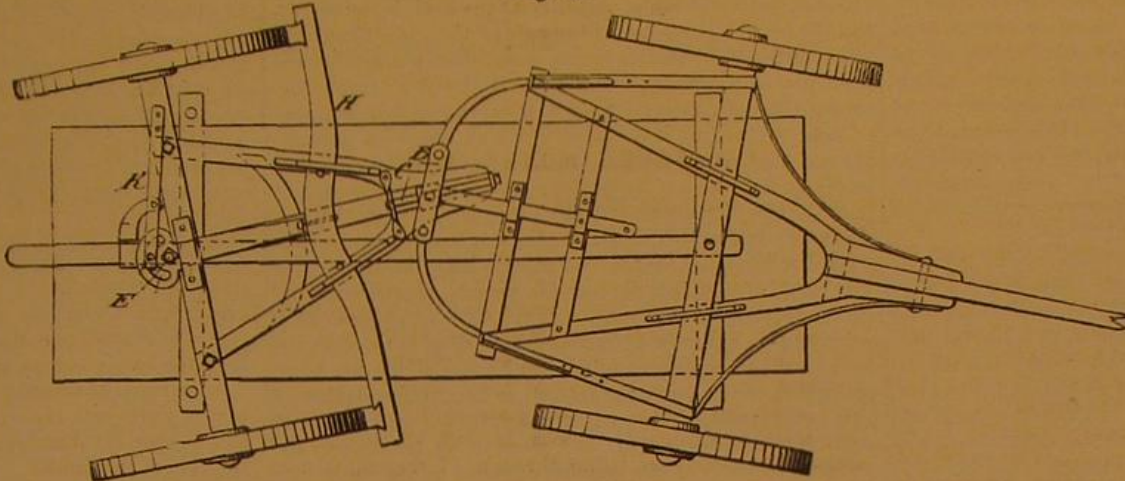


Fig. 2.



O'DANIEL'S IMPROVED WAGON BRAKE.

manufacture and sale of this rail under a royalty, address the inventor, S. Sutton, Lisbon, Linn county, Iowa.

An Improvement in the Manufacture of Silver Mirrors.

At a recent meeting of the Paris Société d'Encouragement des Sciences, M. Débray described a new method designed to remove the previously existing difficulties in the way of preparing silver mirrors. From this address we extract the following:

Up to the year 1840, glass mirrors were made exclusively

silvering is complete. The liquid is then allowed to run off, the mirror is washed with distilled water and dried, and finally the silver film is protected with a coat of varnish.

From $5\frac{1}{2}$ to $7\frac{1}{2}$ grains of silver suffice for a square foot, and $1\frac{1}{2}$ cents worth of silver is enough for a surface that would require 1,000 grains of tin and as much mercury. The great fluctuations in the price of these metals are frequently very embarrassing to large mirror factories. By the new process a mirror can be made in a few hours; while the previous method required at least 12 days, and also required more costly materials. Débray says that this silvering process has almost entirely supplanted the old mercury process. L. Lobmeyr, in his report on glass at the Vienna Exposition, also states that mercury mirrors will apparently soon go out of use.

Silver mirrors, however, always have these objections, that the image is somewhat yellowish, and that the silver does not adhere so perfectly to the glass as is desirable; it often happens, too, that the silver film comes off in spots where it has been exposed to the direct rays of the sun; and finally, notwithstanding the protection of the varnish, the silver gradually blackens under the influence of sulphuretted hydrogen. The latter objection is especially noticed in exporting mirrors across the equator; the mirrors are blackened by the exhalations from the hold of the vessel, where they lie packed for months. For this reason mercurial mirrors, although they frequently suffer much from the heat in tropical countries, cannot be supplanted by silver mirrors, although the latter are proof against injury by heat.

Even if these objections were quite overbalanced by the cheapness of manufacture and freedom from mercurial diseases, it would still be very desirable that they could be avoided. This has now been accomplished in a very simple manner by a Paris engineer, named Lenoir, previously well known through his gas machine. The glass is silvered as before and washed, then flowed with a dilute solution of cyanide of mercury and potassium. This dissolves a portion of the silver and precipitates some mercury, which combines with the remaining silver to form an amalgam, which is much whiter and adheres more firmly to the glass than the silver. The conversion takes place instantly. The quantity of mercury taken

up varies with the time that the mercury solution and silver are in contact; in one experiment, made by Débray, he observed that it did not exceed 5 or 6 per cent. The use of the solution, which is itself a very poisonous cyanogen compound, is not dangerous if very dilute; this solution has been

Fig. 1

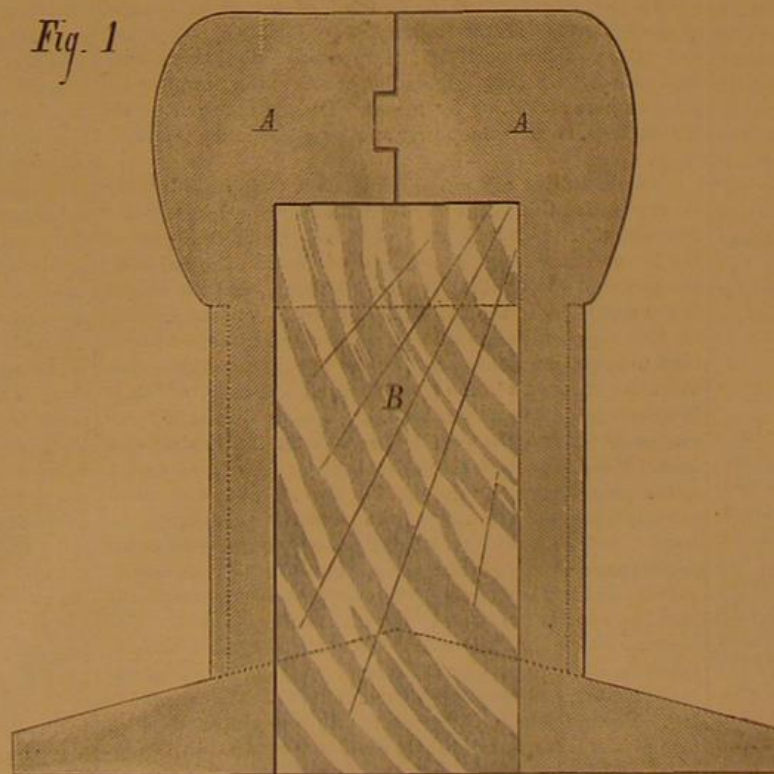


Fig. 2



SUTTON'S IMPROVED RAILWAY RAIL.

with a backing of tin amalgam. The operation was, and still is, as follows: A sheet of tinfoil weighing 1,000 to 1,140 grains per square foot, is spread out perfectly smooth on a flat horizontal stone; upon this is poured a thin layer of mercury, and then a well polished plate of glass is shoved

in use many years for electroplating, and in much more concentrated form than it is employed by Lenoir, without real injury.

An amalgamated silver mirror does not exhibit the yellow shade of pure silver, is far less sensitive to sulphuretted hydrogen, as two years' experience proved, and resists perfectly the action of the sun. Lenoir's process has been introduced into the mirror factory of Mangin Lesur, at Paris.—*Deutsche Industrie Zeitung.*

Correspondence.

A Singular Railway Collision.

To the Editor of the Scientific American:

In your issue of July 1 you mention and illustrate a singular collision. I notice that the *Graphic* locates the occurrence on the Northwestern Railway. Allow me to call your attention to a remarkable coincidence.

Your engraving, with but few exceptions, represents a collision that occurred on the Falls branch of the New York Central road on the morning of September 10, 1872, between the village of Albion and the city of Rochester, $2\frac{1}{2}$ miles from the former place. Both trains were due at Albion at 3.45 A. M. The eastern bound train was one or two minutes late; but the train from the East not having arrived, the eastern bound train started out (having the right of way) at an unusual rate of speed. In running two miles it made up two minutes. At this juncture the engineer saw through the fog the headlight of the advancing train. He whistled down brakes, and reversed his engine. Only three brakes were set. All on both trains jumped. The engineer of the eastern bound train struck on his head, which stunned him for the moment. He sprained his wrists and bruised his face, but all the others alighted in safety. In an instant the monsters came together, hissing and seething in each other's embrace.

Unlike your illustration, they stood more nearly alike on the track, without smoke stack or bell. The tenders were driven under the rear of the engines, and everything that could be thrown from the engines under such a fearful concussion was gone. The boilers did not burst, but the engines appeared to be total wrecks. I understand, however, that one of them was rebuilt. Six cars left the track, and three more were burnt on the track. The trains were heavy freights, and a great amount of merchandise was burnt or otherwise destroyed and stolen. The loss at the time was estimated at \$200,000, but I understand that this was considerably in excess of the fact. Photographers arrived too late for the prize. The engines were quickly separated, and, when disengaged, they rolled some 16 feet down the embankment. The track at the place of accident was smooth and straight.

ALEX. D. TYTLER.

Albion, N. Y.

Flax in Missouri.

To the Editor of the Scientific American:

I wish to call the attention of capitalists and inventors to an opening for them out here. I recently noticed along the road between Sedalia, Mo., and Parsons, Kan., that the farmers grew a great deal of flax, just for the seed. They do nothing with the stalk or straw. Why could not this be put to use? I always supposed that there was a great demand in this country for flax, and it looks like a great waste to let all this stand in stacks to rot or be burnt. The only reason for this that I can see is that, in thrashing out the seed, the stalks become tangled together, which may make it difficult to handle; but our inventors could readily make some machine to overcome this difficulty. There is about 1 ton of flax straw to the acre. The crop is a regular one; many thousands of acres are cultivated every year; and after the seed is thrashed out the straw could probably be bought for a mere song.

S. E. WORRELL.

Hannibal, Mo.

(For the Scientific American.)

ANIMAL MECHANISM.

Most of the mechanical principles used in machinery have their illustrations in animal movements. Some are direct copies from Nature, but others were first contrived by man without his having consciously taken the hint from Nature, and afterwards found to be similarly used in animal mechanics. While this shows that man is created in the image of his Maker, in that the minds of each see truth and the application of principles in the same light, it also shows that man may find it greatly to his advantage to study the mechanism of animals and its applications of force, in order to learn the best means of accomplishing his ends in the mechanic arts. This may be an improvement upon the common method of working out, from the unaided brain, principles which Nature has used and displayed from the earliest time.

The shape and keel of a ship have their best models in the form and fins of fishes, and in several species of water beetles. It was formerly supposed that it was only necessary to have the bows of a ship sharp and well proportioned; now it is found that the shape of the stern has as much to do with its ease of motion as the shape of the bow, or the way it leaves the water is as important as the way it cuts the water. Hence a boat that is made for speed is now made to taper as gradually toward the stern as toward the stem. This mechanical principle has always been in use in the fish, the water beetle, and the bird. The pectoral and anal fins of fishes answer to the keels of ships, and the tails of both fishes and birds act as rudders. The tail of a fish, in addition, acts as the propelling power, on a principle similar to that of sculling a boat or of screw propellers.

Barker's reaction mill, or the force due to unbalanced pressure, is illustrated in the progressive—or rather retrogressive—movement of cuttle fishes, squids, and other cephalopod mollusks. They propel themselves backwards by forcibly ejecting water from an opening near the head.

The toggle joint, which is used in printing presses and in other machinery, has a representative in most of the hinge joints and in some others, of man and inferior animals. The pulley is used in the human body, by the cord which raises the great toe and the foot acting upon ligaments for friction wheels in the ankle; also by the digastric muscle, as it passes through a ring or loop in the muscle which is attached to the hyoid bone, serving the double purpose of raising the larynx in swallowing and of pulling down the lower jaw. The muscle which performs the oblique rolling motion of the eye also works through a loop which serves the purpose of a pulley in changing the direction of motion; as do also those attached to the knee pan.

The three classes of lever are amply illustrated in the various movements of man and other animals. The support and motion of the head upon the upper part of the spinal column illustrates a lever of the first class. The third is shown in raising the forearm by the contraction of a muscle attached a short distance below the elbow. The raising of the body upon the toes has been called a lever of the second class, in which the ball of the foot is the fulcrum, the muscle attached to the tendon of Achilles at the heel is the power, and the weight is applied at the base of the leg. There are some interesting considerations respecting the mechanical principles employed in the last case. If this is a lever of the second class, the question as to how much power is required to raise the weight of a man of ordinary size is an interesting one. On this supposition, the long arm is to the short arm as about 3:2; and if the power were applied outside of the body it would require 100 lbs. of power to raise 150 lbs. But as the power that raises the body is itself a part of the weight to be raised, when the muscle has contracted with the force of 100 lbs., its reaction presses downwards, upon the foot acting as a lever, with the force of 100 lbs. This reaction also has to be overcome, which adds so much to the weight of the body to be raised; and when additional force is applied to overcome the added weight, the reaction of this would necessitate still greater force, which would again increase the weight, and so on in an indefinitely decreasing series. If the reaction occurred at the end of the lever where the power is applied, of course the two would exactly balance each other, and all upward motion would be impossible. It would be like a man's trying to lift himself over the fence by his boot straps. But as this reaction occurs one third of the distance to the fulcrum, two thirds of its force at the lever's end would counterbalance it. The result seems to be possible by demonstration of the algebraic equation based on the law of the lever: that the power $\times$ the long arm = the weight $\times$ the short arm. Then x (the power) $\times 3 = (150 + \frac{1}{3}x) \times 2$; which gives 180 lbs. as the amount of power required to raise 150 lbs. and overcome the reaction of the force exerted. While in theory this seems reasonable enough, in practice the result is widely different. The principle here involved appears the same as when a man stands upon a stiff board one third of the distance from the end of the lever towards the fulcrum, placed at the opposite end, and tries to lift himself by lifting up at the lever's end. And this is practically impossible, whether the power be applied as here stated, or by means of lever and pulley arrangements, so that the power and resistance may act vertically.

The difficulties are not diminished if we consider the movements at this point as illustrations of a lever of the first class. In this case we would call the attachment of the bones of the leg to the bones of the foot the fulcrum, the power at the Achilles tendon as before, and the weight at the point where the ball of the foot rests on the ground. On this supposition the force of muscular contraction would tend to press down the earth; but as this is practically immovable, the result is the pushing up of the body, which is the object most easily moved. We have a similar illustration of this application of the lever in the rowing of a boat. This would require the application of force at a greater disadvantage than in the former case, and consequently a greater strain upon the muscles performing the work. But we know that raising the body on the toes is not accompanied by any painful physical exertion by the individual, and a closer study of the anatomy of the foot shows that the work is not done by one set of muscles alone. The tendons which bend the toes downwards are, after uniting into one, made to pass by a pulley arrangement among the carpal bones, and are attached to a muscle in the calf of the leg. These tendons, being united to the end of the long arm of the lever, enable this muscle to work at an advantage, or, in other words, so that power is gained at the expense of time. But it is probable that the mechanism is even more complicated than this.

The working of the muscles employed in this movement can be illustrated and their force measured by lying on one's back and placing one foot in the loop of a rope which passes over a pulley and has a weight suspended from the other end. As the foot, acting as a lever, is made to move, it will pull the rope and raise the weight, which may be increased till the limit of muscular power has been reached. In this experiment care must be taken that no other muscles are allowed to aid in the process.

The sliding seat in rowing is one that moves forward as the hand end of the oar is advanced, causing the knees to bend or spread. This gives a longer stroke and double purchase upon the water; for not only the muscles of the arms

and trunk are brought into use, but also those of the legs. This new and ingenious contrivance of mechanics, reached without the aid of Nature's suggestions, has been in use before our very eyes from the beginning of man's existence; and we needed but to study and apply the principles of animal mechanism to have employed it in practical life long ago. W. W. Wagstaffe showed, in *Nature*, a few months ago, that the shoulder illustrates the principle of the sliding seat. Besides the very free motion of the ball-and-socket joint at the shoulder, there is a forward and backward movement of six or seven inches, due to rotary motion of the clavicle upon the sternum, and also an up and down movement of about four inches, articulating at the same point, as seen in bell ringing and weight lifting. This gives an additional purchase and advantage, similar to that gained by the sliding seat.

S. H. T.

(For the Scientific American.)

TURNING HARD STEEL WITH THE AID OF PETROLEUM AS A LUBRICANT.

BY JOSHUA ROSE.

Some experiments recently made have given the following determinations:

1. That the use of either petroleum or a mixture of the same with spirits of turpentine as a lubricant for turning tools does not enable the tools to cut metal of any greater degree of hardness than can be cut by the same tool when used dry.
2. That the use of the above-named lubricant does not enable a turning tool to cut metal of any degree of hardness or temper at a faster rate of cutting speed than can be attained by the same tool when used dry.
3. That the above-named lubricant is effective, inasmuch as it will keep the cutting edge of the tool comparatively cool, and hence tend to preserve it longer than would otherwise be the case, the practical difference, however, being very slight.
4. That it is impracticable, under any of the ordinary conditions, to properly turn steel of a hardness or degree of temper greater than a deep purple bordering upon a blue.

Below will be found the details of experiments which were conducted by me at the Freeland tool works, at 360 West 34th street, New York city.

A piece of steel $\frac{1}{2}$ inches diameter and 6 inches long was made red hot and plunged endwise into clean cold water, and held submerged until quite cold. Upon inspection after immersion, the steel was found to be white all over, evidencing that the hardening was performed equally at all parts. One end of the steel was then made red hot and allowed to soften, the temper being permitted to run up at will. It was then placed in the lathe and run at a speed of 10 feet per minute. The lathe tool used was an ordinary front tool, made as hard as fire and water would make it.

A cut $\frac{1}{32}$ inch deep was started at the softened end of the steel, the feed being set at 40 revolutions to an inch. The lubricant, pure crude petroleum, was freely applied from the commencement of the cut. The tool was fed along until finally it commenced to jump, making a cracking noise, due to the excessive pressure with which the tool was forced to its cut. As soon as the cracking began, the tool became dulled and useless; and upon testing the tool with a smooth file, it was found that the file would cut the steel, where the tool cut ceased, the color of the metal being a deep brown. The tool was reground, and applied to the cut where it had left off at the first trial; but it refused to take the cut up any further. It was therefore reground and applied with out any lubricant whatever, the cutting speed and feed remaining the same. It took a cut of $\frac{1}{32}$ inch in depth up to the same distance as on the first trial, leaving the cut much smoother, however, than the first one. From the fact that a file would cut the steel where it showed a temper of a brown bordering upon a yellow, it was evident that the sample of steel under operation was not of the best quality; and it was determined to make a second trial, for which a piece of Turton's hammered round tap steel was selected, its diameter being $\frac{1}{2}$ inch, and its length 6 inches. It was first hardened as hard as fire and water would make it, and then tempered so that the end was purple, the color running up an inch before the deep straw color was reached. The cutting speed was about 7 feet per minute. The tool was ground and applied to the steel where the color was a deep brown bordering on a purple. Crude petroleum was first applied, and by the application of considerable force the tool took a cut about $\frac{1}{32}$ inch deep, carrying it along about $\frac{1}{2}$ inch where the steel was of a deep brown color. The corner of a smooth file was applied to the cut where it left off, and it would just cut it under severe pressure. The tool was then reground and tried under application of two parts petroleum to one of spirits of turpentine, and then of equal parts of turpentine and petroleum; but the cut could not be carried along any further. The next operation was to try the same tool upon the same steel, but without any lubricant, and the result was that it took a cut $\frac{1}{32}$ inch deep, commencing and leaving off its cut at the same place, but requiring a trifle more power to force it to its cut.

The results so far obtained were not sufficiently encouraging to warrant any minute experiments, because the small diameter and slow rate of cutting speed were the most favorable of conditions; while the rapid destruction of the cutting capabilities of the tool was such that no practically useful effects had so far been obtained. Furthermore, the cutting, performed upon any part of the steel whose temper was greater than a blue, was neither even or smooth; and it was a certainty that no finishing tool could be made to stand, whatever the lubricant employed.

The next operation was to make a test upon a piece of steel tempered to a deep purple for about an inch along its

length, the object being to ascertain if, by the use of petroleum or a mixture of petroleum and spirits of turpentine, steel of that degree of temper could be turned at any faster speed than with a tool used dry. The result of the experiment was that the difference, if any, was too slight to be of practical importance. A similar experiment upon a piece of soft steel demonstrated that, by the use of petroleum, no advantage in cutting speed was to be obtained. The cutting speed employed during this experiment was 37 feet per minute.

The last experiment made was upon a piece of Turton's round hammered tap steel, tempered to a clear bright blue along 4 inches of its length, the cutting speed employed being 10 feet per minute. The first cut, $\frac{1}{32}$ inch deep, was taken with a lubricant of three parts petroleum and one part spirits of turpentine, the second cut being taken dry, the result being that the tool stood a little better with the lubricant than without. It has been known for a long time that benzine, kerosene, turpentine, or any of the light volatile oils act as lubricants for cutting tools more effectively than either water or oil, their advantages being that they are more penetrating, and hence approach much more easily and freely to the cutting edge of the tool, which they therefore keep more cool. The difference in their favor is, however, not very great. A short time since, Thomas and Co., of the Freeland Tool Works, had to plane a platen for a printing press, 6 feet by 4 feet, and it was found, after one half had had a cut taken off it, that the other half was chilled so that ordinary tool steel would not touch it. Then Hobson's and Jessop's double refined steels were tried, and it was determined to throw the platen away and cast another. Finally, however, a tool made of chrome steel, $\frac{1}{4}$ by $\frac{1}{4}$, was used, and it carried the cut across the chilled part nicely. During the last part of the cut, Mr. Thomas took a piece of rag soaked with kerosene and applied it to the tool during the back stroke of the planer, with the result that the tool retained its keenness much longer, thus agreeing with our own experiments, the cutting speed employed being in this case 14 feet per minute.

HARMONY AND DISCORD WITH OPTICAL STUDIES.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY PROFESSOR C. F. BRACKETT, OF PRINCETON, N. J.

In the previous lecture it was shown that all matter is endowed with energy. Hydrogen will penetrate through a porous cell; a ball suspended by a string will continue to vibrate for a long time when set in motion. The vibrations of rods and strings were illustrated in a variety of ways. The cessation of sound in a vacuum was shown by means of a bell under a receiver, and the conduction of sound through wood by muffling a music box and connecting it with an æolian harp by means of a wooden rod.

On the present occasion, we shall consider how the vibrations thus studied may be utilized in that most glorious of all arts, music. If the same note is sounded on a flute, a violin, and an accordion, we instantly recognize to which instrument it belongs. By the same power the ear recognizes in an adjoining room the voice of a friend who has returned after a long absence, although we have not yet seen his face. The impression thus conveyed is often so precise that we would be willing to swear to his identity in a court. We see thus that tones differ, not only in loudness and pitch, but also in quality or character. The pitch of a sound by which it sounds high or low, acute or grave, is determined by the number of vibrations in a second which the sounding body makes. The loudness may be illustrated by means of a rod secured at one end; if we pull it back only a little and cause its end to describe a small arc, it will not move with as much force as if we bend it back considerably and let it fly with great velocity. The quality of sounds is due to the manner of vibrating. Instead of fastening the rod at one end only, it might be fastened at both, and then the manner of vibrating would be different. In a stretched string there are present a great many different vibrations, all of which combine to give us the impression of a musical note. When we look upon the restless ocean, we perceive at the same time huge billows surmounted by lesser waves, and perhaps delicate ripples crowning the whole; in like manner musical notes are made up of waves of various sizes.

An organ pipe consists essentially of a fine edge placed in a hole; when the air passes over this edge a whistling sound like that of the wind is produced; but when a tube is placed over it, this whistling is raised to the dignity of a musical note by the vibration of the column of air contained in the tube. The same effect is produced by substituting a resonator of proper size for the tube; a sounding box developed a mere hint or ghost of the same sound. After having dissected an organ pipe in this way, another pipe already adjusted was taken, and it was shown that a second, higher sound could be produced in it by harder blowing.

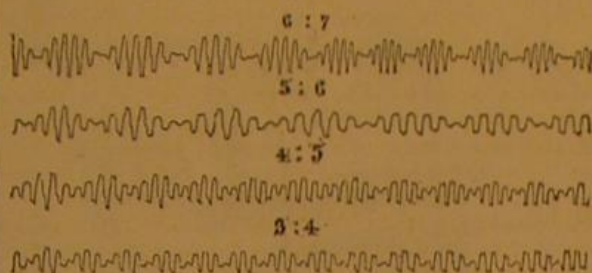
A tuning fork may be set in vibration with a bow in such a manner as to emit no distinctly audible musical tone; when, however, it is held before the mouth, which is opened as though the experimenter were about to sing the corresponding note, the air in the mouth is set in vibration, and the note of the tuning fork is plainly heard. The octave of this note can be obtained in the same way. An organ tube, a resonator, or a sounding box, brought near the tuning fork, will answer the same purpose; but they must be tuned to correspond to the fork, or, in other words, they must contain the proper volume of air. Of a number of resonators on the lecture table, only one responded to the tuning fork used.

If we close the upper end of an organ pipe, a much graver note is produced. The mode of vibration of the air has been

changed. When the sound wave strikes the end of the tube, it develops a nodal point, because it is not free to move further in the same direction, but is reflected back to meet the next following wave at other points. Wherever the crests of two waves or the troughs of two waves coincide, larger waves result; but where troughs and crests meet, they neutralize each other and produce nodal points. The modes of vibration are characterized by the position of these nodal points. With the same tube, for example, harder blowing will change the number and the position of the nodal points. What we are accustomed to call the pure, sweet, simple tone of the organ is really nothing of the sort; it is, in fact, a very complex form of vibration. To get a pure and simple note, we must take a tuning fork; hence, by analyzing the compound note of a musical instrument, we ought to be able to recombine it, by combining a number of tuning forks representing its components. To illustrate this, the lecturer imitated a violoncello note by means of a series of tuning forks.

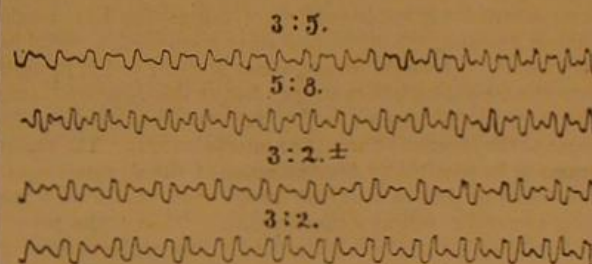
The difficulty in this experiment lies in obtaining the proper relative intensities of the components

Fig. 1.



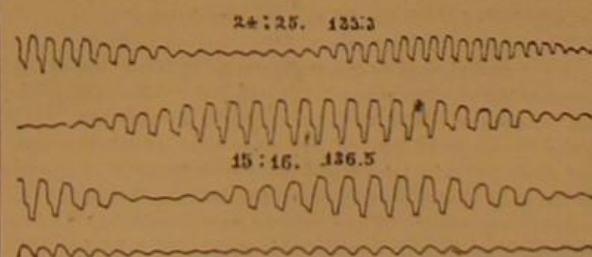
We are not by any means dependent on the ear alone for the study of musical vibrations. They can be made apparent to the eye. If we attach a strip of paper or glass, covered with lampblack or any other fine powder, to one tuning fork and a bristle to another, we will obtain a series of compound curves by drawing the latter slowly over the blackened surface. This curve is a resultant of the two vibrations. In this way very instructive diagrams are produced with tuning forks whose vibrations have certain definite relations, such as those, for example, corresponding to the ordinary musical intervals. In Fig. 1, the ratio of 5:6 corresponds to a minor

Fig. 2.



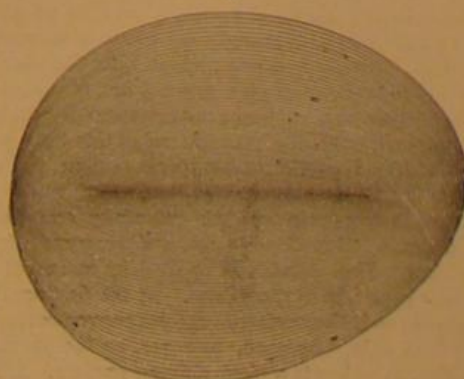
third; 4:5 to a major third; and 3:4 to a fourth. In Fig. 2 the ratio of 3:5 is that of a sixth; 5:8 of a minor sixth; and 3:2 of a fifth. Fig. 3 exhibits the result of operating with two forks whose vibrations differ more slightly in number. It represents the beating thus produced, with its alternations of intensity

Fig. 3.



Another way of studying these resultant vibrations is by the aid of Tisley's pendulum, which consists of a marking point so arranged as to obey the motion of two pendulums swinging at right angles to each other. A variety of effects is produced by lengthening and shortening the pendulums and by varying the intensities of their motion. The result is a series of beautiful symmetrical curves represented in the accompanying engravings. Fig. 4 represents unison,

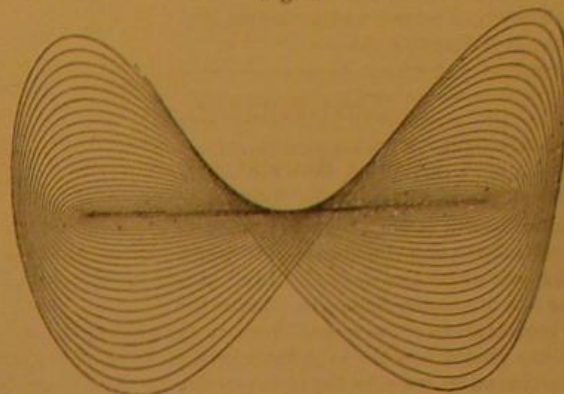
Fig. 4.



where the vibrating pendulums are of equal length. Fig. 5 represents the octave, where one pendulum is twice the length of the other. Fig. 6 is the fourth, the ratio being three to four; and Fig. 7 is the fifth, having the ratio of 2 to

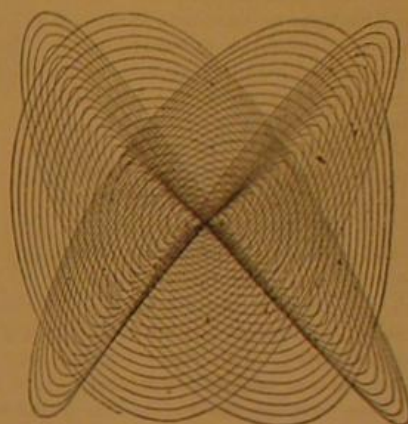
3. It is almost, if not quite, impossible to produce two figures exactly alike with the same arrangement of the pendulums; they will differ as much as the leaves of the same tree. Although the eye readily detects the difference between them, the sounds they represent are identical to the ear.

Fig. 5.



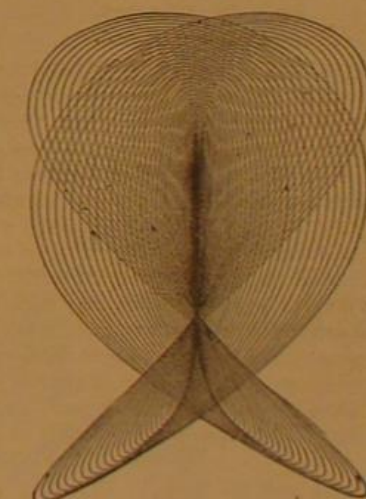
A third method of optical study is by the aid of manometric flames. The vibrations from the instrument to be studied are made to act on a piece of membrane in contact with a stream of illuminating gas feeding a jet. When the gas is

Fig. 6.



lighted and the instrument sounded, the tremors of the membrane cause the flame to vibrate up and down. On revolving a mirror before the flame, the motions of the latter are spread out in the form of serrations differing with the tone. By having a number of such flames and membranes in connection with a series of resonators, composite sounds may be analyzed into their constituents.

Fig. 7.



By means of these and various other apparatus too numerous to describe, even a deaf person could thoroughly study musical vibrations. They enable us to hear, as it were, with our eyes.

C. F. B.

Electricity as a Transmitter of Power.

It is well known that the Gramme magneto-electric machine, which transforms mechanical force into electricity, can also be employed in inverse manner to transform electricity into mechanical force. The property may be utilized to transmit power over long distances. The motor of a factory, for example, could be connected with one machine so as to rotate the same and thus generate a current. This current, carried over distances by cables, might be communicated to another Gramme machine at the point where the power is required. The second machine, by the current, would thus be caused to revolve, and the power would be utilized as necessary.

Of course, in this double operation, there is a loss; but according to M. Magnon, who has investigated the subject experimentally, this is even less than takes place with any other mechanical disposition. If the waste of power equaled that involved in transmission by wire rope, long belts, and like means, it appears that the new plan has superior advantages, in that it does away with a large amount of shafting, belting, etc., and besides allows of power being transmitted over much longer distances than would be practicable by such devices. The details of M. Magnon's experiments, are not given, so that we are unable to review the data on which his opinion is based.

IMPROVED PONY PLANER.

In our issue of October 31, 1874, we published an engraving of a novel machine in which an emery wheel was used for the first time for surfacing files and sadirons, finishing anvils, nuts, gibs, keys, slide valves, straps, crossheads, and, in short, for accomplishing the majority of work usually surfaced on the planer, milling machine, and shaper. The mode of operation consisted in adjusting the object to be surfaced in the chuck to proper elevation, when it was carried under the wheel, and at the same time the latter was drawn across it. This motion continued until the table carried the work out of the action of the grinder. Then, by means of suitable mechanism, the operator slightly elevated the object and caused it to run back again under the wheel. Of this machine the invention herewith illustrated is a modification. The main difference is that the planer bed, A, is made to slide to and fro on its ways by the action of the crank, B, the work being thus moved to and fro in the line of the emery wheel's revolution, while the wheel also has a cross motion imparted to it by the crank, C. This new motion of the table corrects the inaccuracy resulting from gradual decrease in the wheel's diameter, there being a perceptible wear in the wheel, so that it grinds a long flat piece taper instead of plane, when the work slowly passes under it; while, by this crank throw, the whole length of work is brought in contact with the wheel at each throw. The chuck, D, rests on four springs, and rises and falls vertically in planed ways. E E are adjustable stops. When these stops have been adjusted, and the wheel no longer cuts, the work must be plane. The springs force the (chuck) work against the wheel, and yet act as safety appliances against over-friction and pressure. The whole table and bed has a vertical adjustment by the screw, F. Three belts are needed: one to the wheel mandrels, one to the suction fan, and one to the driver. The gears, G, being interchangeable, allow the proportion of speeds between the wheel shafts and the table to be altered in various ways.

The machine stands 32 inches high, and is 2 feet 8 inches each way. It will grind work 9 inches long by 5 inches wide. It is adapted to all small flat work, especially to dies of hardened steel and chilled iron, to parts of gun and pistol locks, sewing machine work, small levels, machine keys, locks, etc. Lastly, it is claimed that thousands of small parts can, by this means, be finished to a gage with greater exactness than can be done in any other way. The remaining portions of the device are similar to those in the device first alluded to above. H is the driving pulley, and I is a small suction blower used to draw away the dust from the machine.

For further information, address the Tanite Company, Stroudsburg, Pa.

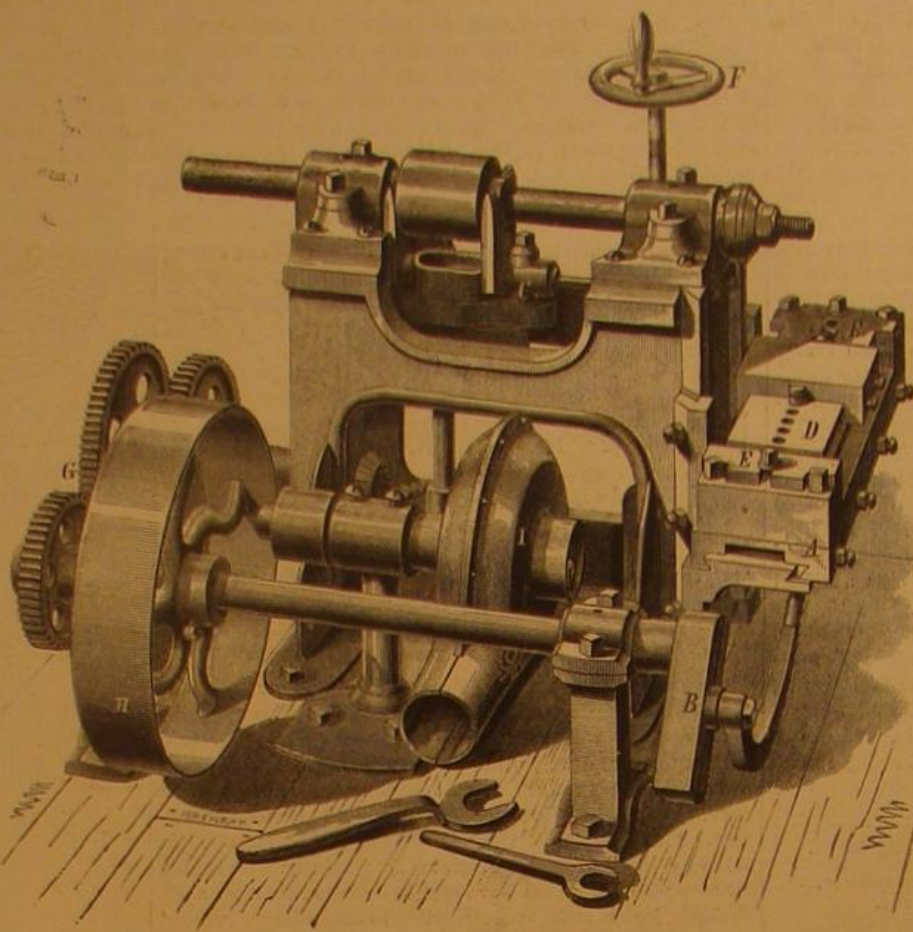
UMBRELLA SUPPORTER.

Mrs. Eliza M. Arnold, of Houston, Texas, has invented a new parasol and umbrella supporter, of which we give a perspective view, illustrating its use.



A A are two rods, curved to fit upon the forward side of and pass over the shoulders of the wearer. The lower ends of the rods, A A, are attached or hinged, as shown at a', to an

open metallic ring, B, of such a length as to pass around, or nearly around, the waist of the wearer, to be secured to a belt, E, buckled or clasped around the waist. The upper parts of the rods, A A, curve toward each other, have a coil formed in them to give them elasticity, and are bent upward; they are connected with or are coiled to form a sock-

**NEWMAN'S PONY PLANER.**

et to receive the handle of the parasol or umbrella. To the rods, A A, are attached straps, C C, to be passed around the arms or across the breast of the wearer, to keep the said rods in place. D D are elastic straps, which are attached to the frame of the parasol or umbrella, the free ends of which are provided with loops or rings to catch upon buttons, a', attached to the belt, E, so that by adjusting the straps, D, the parasol or umbrella may be tilted or inclined forward or backward, or to either side, as circumstances may require. The device may be worn with the rods, A A, passing down in front of the shoulders, or in the rear of the shoulders, or one in front and the other in the rear of either shoulder, as desired.

A New Phase in Gold Mining.

Since the discovery of gold in talco-slate a few months ago, and the active development of a mine of that description in El Dorado county, by the Old Hickory Gold Mining Company, a great interest in that peculiar formation has been displayed by our miners, and we will therefore give a short description of the material and its constituents.

Talco-slate, or the slaty formation of steatite, is of primary period, and is generally found in large ledges and deposits in the slate range. It is ordinarily called soapstone, and consists of silica 62.6, magnesia 32.5, water 4.9. It is perfectly fireproof, and of the same class as asbestos; and considering that its hardness is only two, to seven of quartz, we dare say that the stamping or rather grinding of it can be done very easily. The company now developing the first mine of that description on this coast have 22 feet of a ledge, the assays of which run from \$50 to \$200 per ton; and we are credibly informed that the ore, on account of its softness, will work by pan amalgamation with alkalines for \$2.00 per ton. The sulphurets contained in the ore assay \$329 per ton, and constitute about five per cent. As the ledge is traceable for miles, we may shortly look for interesting developments in that quarter.—*Mining and Scientific Press.*

Elastic Dammar Varnish for Photographs, etc.

An elastic flexible varnish for paper, which may be applied without previously sizing the article, may be prepared as follows: Crush transparent and clear pieces of dammar into small grains; introduce a convenient quantity—say forty grains—into a flask, pour on it about 6 ozs. of acetone, and expose the whole to a moderate temperature for about two weeks, frequently shaking. At the end of this time, pour off the clear saturated solution of dammar in acetone, and add, to every four parts of varnish, three parts of rather dense collodion; the two solutions are mixed by agitation, the resulting liquid allowed to settle, and preserved in well closed phials. This varnish is applied by means of a soft beaver hair pencil, in vertical lines. At the first application it will appear as if the surface of the paper were covered with a thin white skin. As soon, however, as the varnish has become dry, it presents a clear shining surface. It should be applied in two or three layers.

This varnish retains its gloss under all conditions of weather, and remains elastic; the latter quality adapts it especially to topographical crayon drawings and maps, as well as to photographs.—*Pharmazeutisches Centralhalle.*

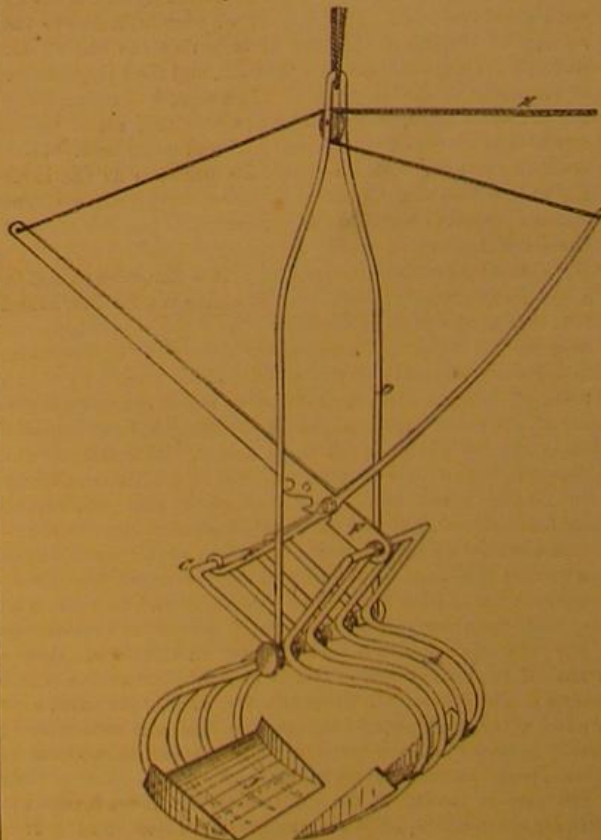
Photo Portraits with Borders.

M. C. Quesnay, of Lille, France, gives the following for producing in one printing a portrait combined with a border in any design, and in the same or two different tints. In taking the portrait, the glass is first cleaned and treated with an ethereal solution of wax; it is then collodionized, sensitized, and exposed in the usual manner. Upon the ground glass of the camera an oval is traced of the exact size the portrait is required, and between the prepared plate and the shutter of the dark slide is fixed a mask, cut to the exact size of the oval upon the focussing glass. By this means the photograph is produced with a transparent border. After washing the negative, flow over it a fifteen grain solution of gelatin to the depth of about one twentieth of an inch, and set it aside to dry in a place free from dust. When quite dry, it is coated with ordinary transfer collodion, and strips of paper are gummed upon the borders when the latter have become dry, the pellicular negative is detached from the glass by cutting round the edges with a sharp penknife. A second negative is then produced of the object or surface intended to be used as the ground for the border, a mask being employed in such a manner as to leave a transparent opening in the center, the exact size of the portrait previously produced; the two negatives are then superimposed and printed from in the ordinary manner. If the back ground or border be required in a different tint, the print, upon removal from the frame, must be washed thoroughly to remove free silver. With a brush dipped in solution of hyposulphite of soda, go carefully over the portion representing the border, and again wash thoroughly. After toning, the portrait will have the usual purple or violet brown tone, while the border will be represented by a sepia tint. This plan may be modified by cutting out the portrait from the pellicular negative, and gumming it, together with an open mask representing the pattern of the border, upon a piece of glass or mica, and proceeding as in the former case.

CHAFFIN'S IMPROVED HAY FORK.

Mr. David S. Chaffin, of Vinton, Iowa, has patented through the Scientific American Patent Agency (April 25, 1876) the new grappling fork represented in the annexed engraving. The apparatus is adapted for handling hay, manure, and like materials by horse power. It also may be employed for removing stones, etc., from the bottoms of shallow ponds, and will find various other convenient utilizations about a farm.

The curved tines, A, are pivoted to each other, and upon their upper ends are formed rigid bails. To the ends of the pivot bolt is pivoted a clevis, D, to which the hoisting rope is attached, as shown. To the bails of the arms are connected the pivoted levers, F, the lower end of one of which is slotted to admit of the passage through of the other. The inner lever has several notches formed in it to receive the pivot bolt, so that the fork may be locked with the points of the tines close together or at any distance apart. The levers, F, are governed by ropes, H. By this construction, the weight of the fork and load is entirely supported by the clevis, D, so that the levers may be easily operated by the trip rope to



cause the discharge. In handling mud and other fine substances, the plates, J, are easily attached to the tines, and act as shovels.

VARIOUS SPECIES OF ANT LIONS.

The *neuroptera* are an order of insects known by the possession of four equal-sized membranous wings, divided into a great number of little cells, technically called areolets. The mouth is furnished with transversely movable jaws, and the females do not possess a strong or a valved ovipositor. In this order are comprised the dragon flies, May flies, termites, lace wings, and lastly, the very curious insects which form the subject of our engraving herewith given, the ant lion. The interesting period of the life of these creatures occurs during their larval state. They then appear as represented at 4 a in the illustration. The shape is ovoid, color a reddish gray, and the body is covered with down. They resemble flattened maggots with rather long legs and very large jaws, the legs being apparently useless as organs of progression, all movements being made by the abdomen. It is on account of this inability to pursue and capture its prey, which is wholly composed of living insects, that Nature has provided the insect with instinct to resort to strategic means to bring its victim within its clutches.

It is common to find in sandy fields of the old world small cavities, varying in diameter from one tenth of an inch to two and a half inches in diameter, and about three quarters deep as wide. These are the pit falls (see engraving at 4b) made by the ant lion, and closer examination will show the claws of the insect protruding, as it lies in ambush, buried in the sand. To make these hollows, the creature selects a locality where there is fine sand. It begins operations by bending down the extremity of its body and then pushing or rather dragging itself backwards by the assistance of its hind legs, but more particularly by the aid of the deflexed extremity of its body; it gradually insinuates itself into and beneath the sand, constantly throwing off the particles which fall upon it or which it shovels with its jaws or legs upon its head, by suddenly jerking them to the rear. It works in a spiral, commencing at the outer circumference of its cavity and gradually diminishing the diameter of its path until the conical pit is formed. Should a pebble be encountered the insect insinuates its head beneath it and labors until it gets the obstacle fairly balanced on its back. Then it attempts to climb up the slope it has hollowed with its load, often unsuccessfully, for the stone easily loses equilibrium and rolls down to the bottom. But the ant lion is obstinately pertinacious and a marvel of patience besides, so that the effort is repeated again and again until the stone is finally thrown clear of the pit. Its trap constructed to its liking, the larva buries itself as already stated, spreads its jaws, and waits. Any insect, whether caterpillar, ant, spider, or fly, serves as food, so long as it is living and active. Dead insects the ant lion rejects and tosses out of its hole in disdain. It is rarely that any crawling insect escapes from the pit after once entering it; its efforts to climb out are fruitless, for the particles of sand roll beneath its feet, and it gradually slides down to the bottom and into the jaws of the watcher. Should the victim, however, attempt to stop its downward progress by thrusting its claws into the sand, the ant lion converts its head into a catapult and throws up sand, which deepens its hole and renders the side steeper, and also covers the unfortunate insect with a shower of particles by which it is compelled to let go its hold. The instant the ant lion grasps its prey, its ferocity redoubles. Neither wasp nor bee can offer any successful resistance, for their captor dashes its prey again and again to the ground, and shakes it in its terrible pincers until it becomes stupefied and motionless. Then the larva quietly devours it.

Previous to assuming the pupa state, the larva forms a globular cocoon (5 and 6 in the engraving) of less than half an inch in diameter, of fine sand, glued with silken thread spun from a slender telescopic spinneret, placed at the extremity of the body. The pupa is small and lies with its

limbs folded upon its breast. When ready to assume the perfect state, it uses its mandibles, which are quite unlike those of the larva, to gnaw a hole through the cocoon, and pushes itself partly through the aperture in which it leaves its pupa skin. The abdomen then extends to nearly three times its previous length; and the perfect insect closely resembles the dragon fly, save that the wings are lighter, softer, and broader.

Various species of the perfect ant lion are represented in the engraving, for which we are indebted to *La Nature*. Nos. 1 and 1a is the *acantholacis occitanica*, during flight and in repose. It is of a reddish brown color, marked with black lines. Its larva, larger than those of the ordinary species of ant lion, are also lighter in color; and instead of digging a pit they back into the sand for a short distance,

fin oil with 6 gallons of water. Both maggots and flies immediately disappeared, and the crop became exceeding large and fine. He recommends that seeds of all kinds should be sprinkled with the oil before sowing, or that a certain portion of paraffin oil should be poured over dry earth or sand, and this prepared earth should be sown as guano. He believes that such earth is a powerful manure as well as a remedy for wire worm, grub, and all garden, field, and vinery pests. He states that grain sprinkled with the oil is quite safe from all birds as well as insect vermin. For watering green vegetables, he recommends a mixture of 2 wineglassfuls of paraffin oil and 6 gallons of rainwater, and states that this will do no injury to the plants, but that the growth succeeding its application is something wonderful, and that onions and carrots should be watered with this when one inch long. Being a Scotchman, he concludes by adding that a glassful of whisky added to the oil makes it more agreeable to the water, and enables it to mix more readily.

We have not yet had an opportunity of repeating these experiments, but hope to do so, and in the meantime recommend them to the consideration those of our readers who are doing business in agricultural districts. When farmers come to seek shopkeepers for their customary supplies of oil, candles, etc., these experiments may be mentioned, and the farmer induced to repeat them. No harm would be done even if they fail, as the seed would not be injured. If they succeed only partially, both shopkeeper and farmer will gain—one by saving his seed, the other by finding customers for respectable quantities of paraffin oil, as such an application as this, on a practical scale, will demand large supplies. We fear, however, that on one point the correspondent of our contemporary has been more or less (probably more) self-deluded. We allude to the great manurial value of paraffin oil. Now we know that paraffin oil is simply a hydrocarbon, and that mere carbon and hydrogen are not the elements which are thus demanded. Therefore we must renounce all that the elaborate and careful investigations of Liebig and his able compeers and successors have taught us, in order to accept the conclusions of the Dunfermline experimenter.

The other use of paraffin oil, namely, that of protecting seed and young plants from birds and vermin, is quite free from any such theoretical objection. On the contrary, it recommends itself, as the hydrocarbons are more or less potent in repelling vermin. Paraffin oil is chemically inert, and will not damage the seed; but if its flavor or the odor of its vapor is sufficiently decided to drive away the creatures that do such serious damage, it will be a farmer's friend indeed, and will thereby be sufficiently recommended without pretending to any miraculous manurial value. To test it fairly, a portion of a field should be sown with the prepared seed, and further fortified by sprinkling it with the dry earth or sand which—to coin a term—has been paraffined, while the other half of the same field is planted in the usual way, both halves having been equally dressed with ordinary manure. If the paraffin repels the vermin, the unprotected half will probably be rather worse than usual, as it would become an asylum for the refugees, and thus the contrast between the two halves would be instructively heightened.—*The London Grocer*.

Rhubarb.

Lieutenant Colonel Prejevalsky, the Russian traveler who recently performed a journey into the interior of Mongolia, refers to the medicinal rhubarb grown in that province, whence it finds its way all over the world. He gives a full description of the plant, the soil in which it grows, the time and manner of gathering it, and the trade itself in rhubarb. It costs on the spot 2 or 3 cents per lb., and in the town of Si-ning, the chief market for rhubarb, 12 cents per lb. It is the opinion of Colonel Prejevalsky that there would be no difficulty in cultivating and acclimatizing it in Siberia.



ANT LIONS.

thus concealing themselves, so as to seize passing prey. Nos. 2 and 2 a represent the *myrmeleon formicarius*, the true pit-digging ant lion. No. 4 is another species known as *myrmeleon formicalynx*. No. 3 is the *palpares libelluloides*, the larva of which takes its prey in the same manner as that of the *acanthaclisis*.

An Agricultural Application of Paraffin Oil.

A correspondent of the *Dunfermline Journal* tells us that he has tried a number of experiments, extending over a course of years, which satisfy him that paraffin oil is something more than a substitute for the best guano. His garden having been overrun with rats and mice, he had to sow double quantity of peas and beans, and sometimes to sow these twice over. Last year he sowed 22 lbs. of beans and 6 lbs. of peas without any manure, but he previously soaked the seeds for a short time in paraffin oil. None were touched; every pea and bean germinated, and the crop was enormous. Formerly his onions were annually attacked by maggots, and his turnips by flies; but during the last eight years he watered between the rows with a mixture of 2 ozs. of paraf-

ICE MACHINERY.

As an appropriate subject for the present hot weather, we select from Mr. E. H. Knight's "Mechanical Dictionary," the annexed engravings and following description of ice machinery. The apparatus illustrated depends upon the vaporization of water, ether, ammonia, benzole, etc., which, in assuming the vaporous form, change sensible heat into latent, extracting it from the reservoir of water, the contents of which are thereby congealed.

The Parisian restaurants have decanters (*carafons frappés*) filled with water frozen by placing them in shallow tanks of sea water, each of which is provided with a copper reservoir connected with a receiver filled with ether. The air is exhausted from the reservoirs by an air pump worked by steam, vaporizing the ether and reducing the temperature of the sea water and that in the decanters below the freezing point. The water in the decanters usually remains liquid until stirred with a glass rod, when it immediately congeals.

Edmond Carré's sulphuric acid freezing apparatus is upon this principle (shown at 1, Fig. 1), and is also used to make the *carafons frappés* so frequently seen in Paris. It consists of a large vessel, resembling the boiler of a steam engine, which is designed to contain the concentrated sulphuric acid; of an air pump with tube connections to be adapted to the wide mouths of the *carafons*, and of a mechanism by which the lever of the air pump is made to keep the acid in continual agitation. The great volume of the acid renders the loss of absorptive power by dilution very slow, and the constant agitation prevents the formation of a superficial dilute stratum, which would interfere materially with the success.

In 1, Fig. 1, *a* is the reservoir of sulphuric acid; *f*, a *carafon* of water connected by the tube, *r*, with the apparatus, and having a stopcock at *l*. *p* is the barrel of the pump, and *h* its lever, which also agitates the oscillator, shown in dotted lines.

Ferdinand Carré's intermittent apparatus, 2, Fig. 1, has a boiler containing the ammonia, connecting by the pipe, *r*, with the refrigerator, *t*, which has a well in which is a pan containing the water, *z*, to be frozen. The boiler, *k*, is placed over a portable furnace, and the apparatus purged of air, which is driven by the evolved gas out at the stopcock, *m*. This being closed, and the refrigerator immersed in a tank of cool water, the temperature of the aqua ammonia is raised to 230° or 240° Fah., at which heat the ammonia is expelled and is condensed in a liquid form in the refrigerator, *t*. The boiler, *k*, being now removed from the furnace and placed in the water bath, the temperature of the water in the boiler will fall and the power of the water to dissolve ammonia will be restored. The gas will be rapidly

Fig. 2.



Ice Plane.

re-dissolved, reducing the pressure, as the liquid ammonia will evaporate with corresponding rapidity, drawing for its latent heat upon the sensible heat of the water to be frozen. The result will be the complete evaporation of the liquefied ammonia and the restoration of an aqueous solution, in the boiler, of the original strength. Between the ice pan and the well is a body of alcohol, which will not freeze, but will act as a conductor. During the refrigeration, the vessel, *t*, has a non-conducting envelope.

Ferdinand Carré's continuous process, shown in the three other views in Fig. 1, depends also for its efficacy upon the evaporation of liquid ammonia. *a* is the boiler, exposed to the heat of the furnace, *b*; *c* is an indicator to show the level of the liquid; *d* is a tube conducting gas to the liquefier, *j*; the vertical pipe above the branch, *i*, leads to a safety valve, and any escaping gas passes by pipe, *e*, to the water tank, *e'*, where it is absorbed. *f* is a tube which brings back to the boiler saturated solution of ammonia from the absorbing apparatus, *u*; this solution passes downward, trickling through the perforated trays, *g*, while the ascending gas

risks in a sinuous course alternately around the edge of one tray and through a central hole in the next, and so on. This condenses and carries back the watery vapor which accompanies the gas.

The gas passes by tube, *i*, to the liquefier, *j*, passing through a box, *k*, and a series of zigzag and spiral tubes in a bath of cold water constantly renewed from reservoir, *z*, which also supplies other parts of the apparatus. The tubes terminate in another box, *k'*, and the ammonia is by this time in a liquid state under the pressure of 10 atmospheres, which is constantly maintained in the boiler. In the liquid state the ammonia passes by the pipe, *l*, to the efflux regulator, *m*, which is the dividing barrier between the part of the machine in which a regular pressure of 10 atmospheres is maintained and the following part where the pressure does not exceed 1½ atmospheres. The regulating device is a floating cup which opens or closes a hole of influx.

The liquid passes from the regulator, *m*, by pipe, *n*, to the

has been brought from the bottom of the boiler, *a*, and partially fills the cylinder, *u*. From this water the ammonia has been nearly exhausted, and it therefore greedily absorbs the gas ejected into it by pipe, *t*. On the left of vessel *u*, is a water level indicator. Within the vessel, *u*, is a worm which receives water by pipe, *a'*, from the elevated reservoir, *z*; after passing to the bottom of the spiral, the pipe curves upward and then (marked *b*) descends nearly to the bottom of the vessel, *y*, where it discharges.

The water from the boiler, *a*, passes by pipes, *u* and *u'*, to the coolers, *x* and *y*, before reaching the vessel, *u*, where it re-absorbs ammonia. Between the boiler, *a*, and the vessel, *u*, the water is cooled so as to fit it for absorbing gas more freely. The pressure in the boiler is sufficient to expel it when the stopcock, *u*, is opened. The vessel, *z*, is formed of two concentric cylinders, between which are two spiral tubes formed of the pipe, *u*, continued, and these spirals are immersed in a liquid which fills the annular space between the cylinders, and is the reconstituted ammoniacal solution on its way from the absorber, *u*, to the boiler, *a*. From *z*, the water in the spiral is conveyed in the pipe, *u*, still continued in a single spiral ascending in the vessel, *y*, and continued further in a pipe, *u*, alongside of the absorber, *u*, into which it discharges into a sieve, *e*, and from which it descends in a shower.

The exhausted solution from the boiler, *a*, flows freely, as has been said, from the boiler, by pipe, *u*, to the absorber, *u*, passing the coolers, *x* and *y*, as described; but it requires some power to force the reconstituted solution back from the absorber, *u*, through the pipe, *f*, to the boiler. This power is a pump, *g'*, driven by a steam engine or other motor, and taking the saturated solution from the absorber by pipe, *h'*, and discharging it by pipe, *i'*, into the vessel, *z*, whence it passes by pipe, *f*, to the dome above the boiler, as described previously. Gas finding its way into the pump is discharged into the upper part of *n*. *e''* is a pipe leading to the enveloping tube, *o*, whence water is conducted by *f'* for the use of ice vessels, *r*. As the water passes through *o* it is cooled by the ascending vapors of ammonia.

In starting the machine, it is first blown through to expel the air. The air escaping from the vessel, *u*, passes by pipe, *c*, to the purger, *d*, and passes beneath the surface of the water therein, which retains any escaping ammonia.

Fig. 2 is an

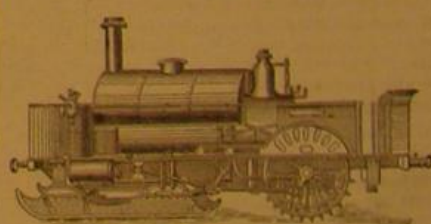
ICE PLANE

for shaving off fragments of ice for cooling drinks. It consists simply of a couple of plane knives inserted in a board, over which the ice is drawn. The shavings fall through the apertures beside the blades and into the vessel placed below for their reception. An interesting device, which we may here add, since it is connected with the subject of ice, is an

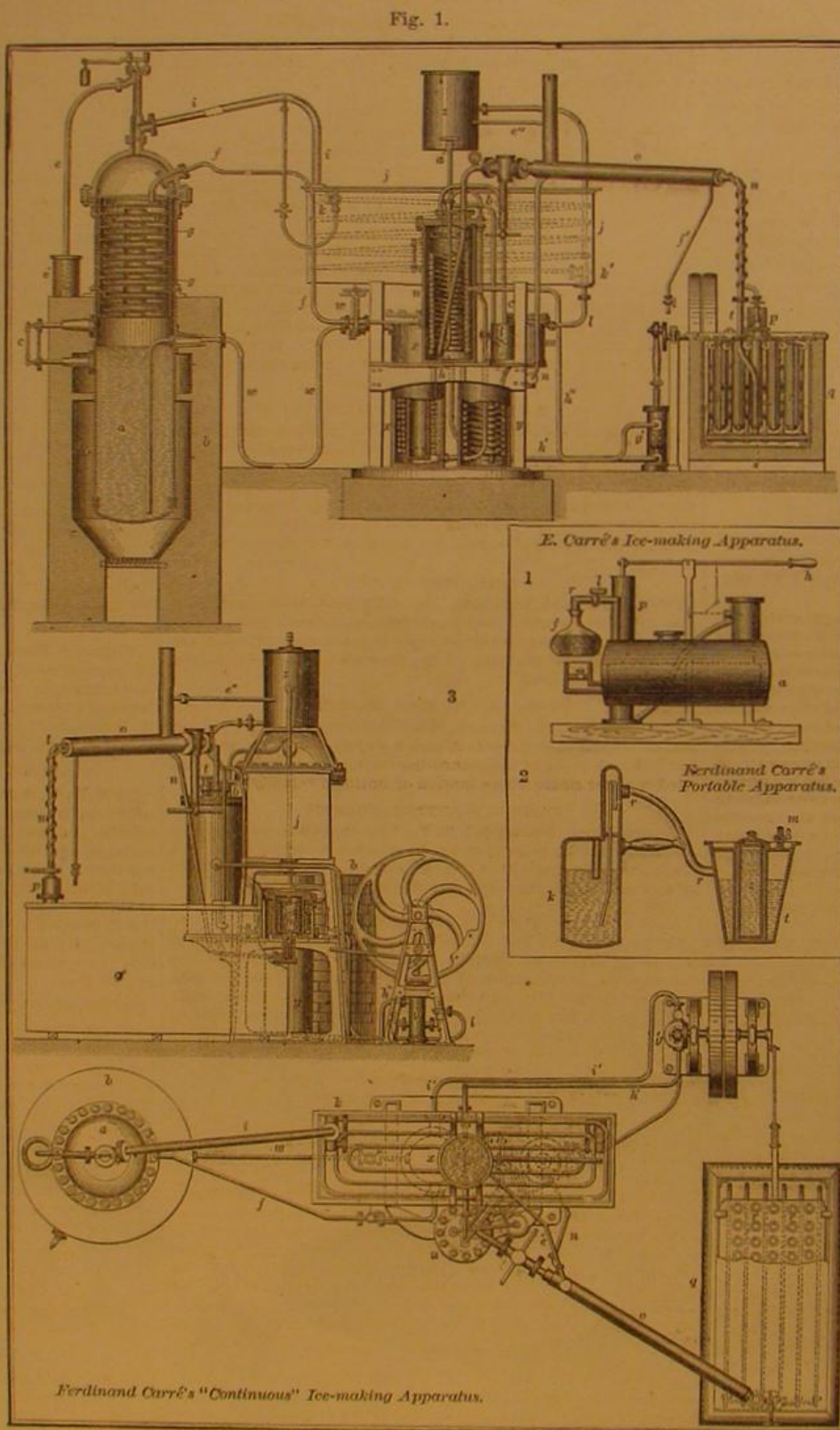
ICE LOCOMOTIVE

or traction engine, for running on ice (Fig. 3). It was constructed by the Messrs. Neilson, of Glasgow, Scotland, and employed for carrying passengers

Fig. 3.



Ice Locomotive.



CARRÉ'S ICE-MAKING MACHINES.

distributor, *p*, the pipe, *n*, being wound spirally around the tube, *t*, through which the vaporized ammonia is returning from the refrigerator, *q*, the vapors serving to reduce the temperature of the liquid in *n* before it reaches the refrigerator.

The refrigerator itself consists of a number of zigzag or spiral tubes—in the apparatus here represented, six in all—immersed in a tank constructed of non-conducting substances. Each one of the six zigzags receives an equal supply of the liquid ammonia from the distributor. The small tubes conveying this supply are shown at *p*. The vessels, *r*, to be refrigerated are sustained on a carriage, which is slid back and forth by the same power that works the pump, *g'*, by which the re-saturated solution of ammonia is returned to the boiler. The space in the tank surrounding the zigzags and the water vessels, *r*, is filled with an uncongealable liquid, such as alcohol or a solution of chloride of calcium. The ammonia in the zigzags, *q*, discharges in a vaporized form into the collector, *s*, and passes through the tube, *t*, to the cylinder, *u*, where it extends nearly to the bottom of the vessel, and there discharges the gas into the water which

and freight between St. Petersburg and Cronstadt, Russia. It has two driving wheels, each 5 feet in diameter and studded with spikes. The front part rests on a sledge, which is swiveled and may be turned by the wheel which has an endless screw, working a pinion that turns a segment rack attached to the sledge body. The cylinders are 10 inches in diameter and of 22 inches stroke. The weight of the engine is 12 tons, and it is said to have attained a speed of 18 miles per hour on the ice.

Mineral Manures for Potato Blight.

Just now, when chemical fertilizers are creating so much attention, it is of interest to note that Mr. Charles T. Hayward, of England, as we learn from the *Journal of Horticulture*, has apparently succeeded in preventing potato blight, by supplying the mineral elements of potato plant food to his garden, which had previously been well dressed with nitrogenous manures. He claims to have secured a better crop, the tubers more even in size, smooth skinned, and free from disease; while the market gardeners about him suffered heavy losses from the potato disease.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

Cellulose.

Dr. Mitscherlich, of Darmstadt, has devised a method of making paper stock (cellulose) from wood by a chemical process, which differs somewhat from those previously in use. The chief peculiarity of this process, which is in use already in Prussia and Saxony, says the *Hesse Gewerbeblatt*, consists in this, that the incrusting substance of the wood is not destroyed, but only separated from the cellulose, and eventually rendered soluble.

In this process, it is not necessary to cut the wood up very fine, as in the Sinclair process, but only to split it up like ordinary firewood for a parlor stove. A chemically prepared solution of lime is boiled for six hours with the wood under a pressure of 3 atmospheres. After the boiling, a portion of the incrusting material is found dissolved in the liquor, and part of it in the pores of the wood, from which it is extracted by a suitable squeezing apparatus.

If it is desired to make a very valuable paper stock, which shall be as white as possible without bleaching, they only employ white wood as free from rosin as possible, like poplar, linden, etc. These kinds of wood are not decolorized any farther in this process, and the albuminoid and gummy substances are mostly dissolved. The success of this process depends less on the pressure during boiling than on the temperature, which must not exceed 248° Fah.

The use of oak wood for paper stock offers one advantage, namely, that the tannin contained in it is obtained as a by-product, and the solution thus obtained can be very profitably employed for tanning, as experiments in this direction have abundantly proved. The solution which runs off from the wood, or expressed from it, in this new process, is already so concentrated that evaporation seems superfluous, and is only undertaken when a very concentrated solution of tannic acid is required either for transportation or for keeping. The other chemicals contained in the lye are in no way a hindrance to the tanning process, but rather aid it. Experiments show that hides prepared in the usual manner, when simply laid in this liquor, were perfectly tanned in ten days.

NEW BOOKS AND PUBLICATIONS.

THE ANDES AND THE AMAZONS, OR ACROSS THE CONTINENT OF SOUTH AMERICA. By Professor James Orton. Third Edition, revised, and enlarged, with Maps and Illustrations. New York city: Harper & Brothers.

In 1867, Professor Orton set out on his first journey across Equatorial South America, and the record of his travels is embodied in the first edition of the present work. In 1873, he made a second expedition, and navigated the Amazon from Para to Yurimaguas, thence over the Andes to the Pacific coast and down to Lima. The main objects of the journey were scientific, and they included a special study of the Marañon region, of which little has hitherto been known, besides the collection of facts illustrating the commercial resources and possibilities of the Valley of the Amazon. We need hardly say that Professor Orton has accomplished his task thoroughly and well, for our readers are already familiar with portions of his journey through the admirable letters which he forwarded to the *Scientific American* from many interesting points along his route. Those who have read these fascinating recitals, and desire to know more of the strange region which they describe, will gladly welcome the present volume, in whose copious pages details, necessarily abbreviated in the newspapers, are presented in full. The illustrations are excellent and lavishly supplied. By them, and together with the two large maps added, the reader cannot fail to realize the journey so lucidly described by the author.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DUMPING CAR.

David Manuel, Readville, assignor to himself and Ezra G. Perkins, Hyde Park, Mass.—This consists of a body supported on rockers, which work on rocker beds mounted on the perch of the car, and having links so connected with the rockers as to allow them to work freely, and at the same time keep them on the rocker bed; and it also consists of a contrivance of the brakes to swing together with the wheels.

IMPROVED STENCH TRAP.

Edward F. Hutchins, Toronto, Canada.—In order to so improve the metallic stench trap in common use that the bursting of the same by freezing is avoided, and that the detaching of the trap for cleaning or melting the ice may be readily accomplished, this inventor proposes a stench trap made of an elastic material, connected in a detachable manner to the pipes.

IMPROVED VELOCIPEDE.

R. Walcott Laurence, New York city.—This invention consists in mounting the steering wheel on the reach of a lever pivoted to the seat and arranged in an axle guide, extended forward to the foot rest. It can be worked by the feet to guide the carriage while the propelling power is applied by hand, and the carriage can also be guided by the driving wheels by turning one faster than the other.

IMPROVED METALLIC ROOFS.

Francis C. Conklin, Monroe, N. Y.—This consists in the combination, with a shingle roof, of strips often extending from peak to eaves, also strips nailed at the butt of each row of shingles, and a wood strip arranged along the margin and edge of the two strips. The latter are similarly connected by hooked flanges.

IMPROVED FLOOR CLAMP.

William S. Spink and Wilber Mason, Providence, R. I.—This consists of a grooved base piece, with floor entering knives, a ratchet slide piece, and an operating lever, together with moving and locking pawls. The operating pawl has a tap pin that releases the locking pawl when the slide piece is to be carried back.

IMPROVED FASTENER FOR THE MEETING RAILS OF SASHES

George Edwards, Brompton Road, South Kensington, England.—This improvement serves to facilitate the disengagement of the devices previous to moving the sashes. It is also provided with means for drawing together the adjacent edges of the two sashes, to prevent rattling and exclude drafts. It is a simple and ingenious spring bolt, having a screw attachment whereby the sashes may be drawn together.

IMPROVED PLASTERING LATH.

Theophilus A. Scheller, Marysville, Cal.—This is an improved plastering lath, by which the plastering is firmly held without danger of dropping and without the use of hair or other binding material. It has dovetail mortises cut into the wood.

NEW AGRICULTURAL INVENTIONS.

IMPROVED ANIMAL TRAP.

William Wallace, Tarrytown, N. Y.—The stationary and movable jaws are pivoted together, and extend above the pivot a suitable distance to be closed quickly by a strong string. The stationary jaw has an extension forming a stake, by which the trap may be set up in the ground; also an arm on which the trip for setting and springing the trap is pivoted. The other jaw has a catch for hooking the trip. A lever, on the upper end of which the trip is formed, extends downward to the point where the jaws are to gripe the animal, and carries a yoke to be set in the runway, so as to be moved by the animals in attempting to pass under it.

COVER FOR THRASHING MACHINE TUMBLING RODS.

William R. Wilcox, Sterling Center, Minn.—This cover for the tumbling rods of thrashing machines will allow the knuckle joint to be oiled without removing the cover.

IMPROVED LAND ROLLER.

Fredus B. Hadley, Monterey, Ill.—This consists of an improved land roller, made hollow, and provided with ribs or flanges upon the inner surface of its shell and the heavy inner cylinder.

IMPROVED GRAIN SEPARATOR.

David E. Fisher, Patterson, Ohio.—For operating or shaking the screen shoe, a differentially ribbed and eccentrically mounted revolving cam is employed.

IMPROVED WEANING BIT.

Philip Heak, Toledo, Iowa.—This consists in the hollow bit having a V bend formed in its middle part, and perforated with a number of holes, and provided with the rigid arms. The rigid attachment of the arms prevents the bit from turning in the animal's mouth and getting into such a position as not to be effective.

IMPROVED PLOW.

Robert Cassidy, Thomas R. Lamb, and Chauncey L. Vaughan, Beloit, Kan.—This improved plow is without side draft, and of lighter draft than ordinary plows, and may be readily adjusted to run deeper or shallower in the ground, and to take more or less land, as may be desired. The plowshare is of special form, and has the cutting edge at right angles with the land slide. It is combined with a slotted standard, curved inwardly to bring the plow beam nearly over the center of the share.

IMPROVED WHEEL PLOW.

William A. Ruddick, Carthage, Mo.—This improvement consists of an A frame mounted on the plow beam transversely with a castor wheel on the apex of the frame, to run on the land. There is a larger wheel at the end of one of the bars of the frame, and a tongue connected with the base of the frame. Wheels are contrived for raising and lowering at will to adjust the plow for furrows of different depths, and for carrying the plow above the ground.

IMPROVED PLOW.

David H. Jarrard, Talladega, Ala.—This plow is so constructed that the plow standard may be adjusted to give any desired pitch to the plow, and may be held securely in place when adjusted, and which will support the wing of the plow plate to prevent it from being bent or broken.

IMPROVED MOWING MACHINE.

Charles B. Martyn, Waupun, Wis.—This improves the construction of reapers and mowers in such a way as to convert the long and unequal stroke of the connecting bar into two short and equal strokes of the sickle with a motion of uniform velocity.

IMPROVED BUTTER WORKER.

Charles Plyer, Hempstead, N. Y.—This invention consists of a concave dish with raised center, to which a swinging lever, of a shape corresponding to the dish, is swiveled. This is to be worked all around the dish for cutting up the butter.

IMPROVED GRAIN HEADER.

Charles K. Myers and John W. Irwin, Pekin, Ill., assignors to said Myers and Peter Weyrick, same place.—The object here is to improve the construction of grain headers, so that the reel may be moved farther from and closer to the cutter bar automatically as the cutter bar is raised or lowered to operate upon taller or shorter grain. The device includes five new mechanical constructions.

NEW TEXTILE MACHINERY.

MECHANISM FOR OPERATING TAKE-UP ROLLERS FOR KNITTING MACHINES.

Ira Tompkins and Albert Tompkins, Troy, N. Y.—This consists of the tension spring employed to regulate the tension of the cloth interposed between the crank rod and the rod for working the take-up pawl lever. It is so arranged that when the machine does not deliver cloth for any reason, as when not making stitches, the spring will compress and allow the crank rod to work its regular course, while the pawl lever will be held by the tension of the cloth until the cloth is delivered from the machine again.

IMPROVED SELVAGE GUARD FOR LOOMS.

John H. Mills, Leaburn, Pa.—This is a wire finger, with a spring lever fitted to a little block, to be so attached to the loom temple that the finger projects down past the selvage at the point where the filling is beaten up, so that the shuttle draws the filling around said finger until it arrives at the box at the other side. The reed then strikes the spring lever, and raises the finger out of the loop after the shuttle enters the box. The guard moves along with the temple relatively to the cloth, so that it is always in the right position. There is a guard on each side for each selvage. The object is to make the selvage more uniform and regular than it is ordinarily made.

IMPROVED ROSE GOODS.

Henry G. Hubbard, Middletown, Conn., assignor to Russell Manufacturing Company, of same place.—The invention consists in an improved rose goods, having one or more selvages upon one edge, and two or more upon the other edge, to interlap with each other in forming the seam.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED REED ORGAN STOP ACTION.

Henry Smith, Gananogue, assignor to himself, Joseph George, and Charles Mee, Kingston, Canada.—This consists of a cam lever, pivoted to the key board, and connected to the stop, and so arranged as to act directly on the valve or mute, making a simple and cheap contrivance.

IMPROVED INHALER.

George L. Crosby, Hannibal, Mo.—This invention consists in combining a glass stopper, having an acid receptacle and air passages, with a grooved stopper and tubes. From the acid receptacle the fumes are drawn down through a tube into the liquid in the body of the inhaler, to be inhaled through a flexible tube.

IMPROVED FAUCET.

Patrick Skelly, New York city.—This relates to improvements in faucets for barrels of all kinds, that a tight seating of the stopcock without leakage, and a superior and readily applied coupling with the liquid-conveying pipe, are obtained.

IMPROVED SOAP FRAME.

Daniel Whitaker, Boston, Mass.—This soap frame can be conveniently set up and taken down, and its side and end plates are more firmly connected than others of its class. The base of the frame is made in three parts, secured to each other by transverse screw bolts, whereby they are adapted to enter grooves in the base of frame, and are attached thereto by hooks and staples. The end portions of the frame have clamping bars attached, whereby they may be locked to the sides, in such a manner as to hold the ends vertical, and form a tight joint between them and the sides, and lastly, the side portions of the frame are provided with truss-like braces, whereby they are prevented from buckling, warping, etc.

IMPROVED END FASTENING FOR SUSPENDERS.

John H. Murfey, New York city.—A clip of sheet metal is contrived for fastening one or two ends to the buckle, hoop, loop, or other device, for connecting the end to the principal strap. The said contrivance is such that the clip can be made by stamping or punching it out at one blow of a press, and can be fastened on the strap without sewing, riveting, or other means required to puncture or slit the end.

IMPROVED HARNESS CLAMP.

James McCormick, Glidden, Iowa.—This consists of rubber-faced metal plates for attachment to the jaws of harness makers' sewing clamps, to hold the leather to be sewn without injury to it, and, at the same time, firmly. The said plates are constructed with a groove in the face side, which receives the rubber facing, and holds it without other fastenings.

IMPROVED EVAPORATING PAN.

Sydney S. Connor, Amite City, La.—This consists in an improvement in evaporating pans by providing them with detachable partitions having angle bars to make tight connection with the bottom.

IMPROVED PEDAL ATTACHMENT FOR CABINET ORGANS.

Benjamin L. Boomer, Campello, Mass.—This is a contrivance for closing up the opening in the front of the case for the pedals, and fastening and unfastening the panel which closes it by the desk. The object is to make a better and neater appearance, and protect the instrument from dust, mice, etc.

IMPROVED STOPPER FOR SHIPS' RUNNING GEAR.

John W. Knight, New York city.—The object of this invention is to prevent the chafing and wear of the sail of a vessel from the rope or buntline by which it is drawn up; and it consists of a stopper attached to the mast or any part of the rigging by which the rope is held, so that it will hang loosely over the sail, and so that when the fall of the rope is hauled in, it will let the rope go free.

IMPROVED METAL TOY.

William A. Harwood, Brooklyn, N. Y.—This improvement in toy horses consists of the contrivance of the support by which the horse is mounted on the wheels, so as to be elevated and to make a stronger support than is now used, and yet employ less metal to do it. It consists of a narrow strip of metal or wire, bent so as to make a light support, and at the same time stiffen the metal.

IMPROVED BREECH-LOADING FIRE ARM.

Ira M. Earle, Guilford Center, Vt.—This consists of a hammer contrived to explode the cartridge and close the breech at the instant, the said hammer moving as the radius of a circle, and forming, with the housing, arcs of concentric circles, in such manner that it bears at all times the same relative position to the solid housing, which supports it in its rear, and sustains the shock of the explosion. The hammer cannot explode the cartridge till it is in position to close the breech. The invention also consists of the shell extractor, so arranged that it is operated by slight extension or continuation of the thumb pressure in the motion of cocking the piece.

IMPROVED COUNTER STIFFENER FOR BOOTS AND SHOES.

George W. Simpson, Federalburg, Md.—This consists in a skeleton counter or back stay made of spring steel, and consisting of the parallel bars and the cross bars, having their projecting ends bent inward to adapt it to be applied to boots and shoes. Its object is to prevent boots and shoes from being run over at the heel.

IMPROVED FISH TRAP.

James McRoberts, Toledo, Iowa.—This is an improved trap for catching fish at the outlet of lakes and ponds, and in other places so constructed as to prevent the escape of the fish within the trap when another fish is entering, and to prevent the smaller fish from being destroyed by the larger ones.

IMPROVED ARTIFICIAL FLOWERS.

Mrs. Eliza F. Penley, Brooklyn, N. Y.—This consists of flowers, leaves, and other articles cut of layers of rattan pith or other wooden strips, wound in continuous strands or coils and cemented together, the leaves being attached to a suitable stem.

IMPROVED PASSENGER REGISTER.

William Mehan, Hoboken, N. J.—In the doorway of a car is pivoted a vertical shaft to which a turnstile is attached. In the floor of the car beneath one side of the stile is placed a weighted platform, of such a size that the passenger cannot step over it. A set of ordinary registering wheels is so arranged as to turn the first wheel of said register through the space of one tooth at each depression of the platform.

IMPROVED LETTER BOX.

France Iersche, New York city.—This consists of a letter box with two or more downward inclined letter spaces, with slotted bottom parts, so that the letters may be seen through the openings in the doors of the adjoining boxes below.

IMPROVED BALE TIE.

Beall Hempstead, Little Rock, Ark.—This improvement consists in a buckle slotted at one end so as to allow the bale band to be fastened thereto by simply bending it around the same, thereby economizing hands; and having at the other a button upon the under side, having two extensions, one of which is larger than the other, which button is adapted to pass through a slot in the other end of the bale band and thus secure the band around the bale. The button may occupy any position with respect to the buckle, and the arrangement is such that to loosen the band the buckle must be brought to a position that the strain of the band will not naturally allow it to assume, thus insuring a secure fastening.

IMPROVED FAUCET ATTACHMENT.

Harry L. Sadler, Brooklyn, N. Y.—This invention consists of a screw threaded bushing of the faucet hole, in connection with an interior tube, having recesses, and a wooden closing plug. The plug tube has interior projections, that are engaged by logs of a hollow and threaded key that screws into the bushing and carries in a socket with wooden lining, the faucet, opening or closing the keg by the insertion or withdrawal of the faucet key.

IMPROVED FISHING ROD REEL.

Charles L. Noe, Bergen Point, N. J.—This consists of a brake for stopping the overrun of the line after the lead has fallen into the water. It is composed of a plate fixed on a joint, so as to be borne on the spool by a spring, and having a thumb lever, by which to hold it off until the moment the lead strikes.

IMPROVED PROCESS OF RESTORING CRAPE, LACES, ETC.

Aaron Joseph Shriver, Baltimore, Md.—This invention relates to a novel process of cleaning and restoring rumpled and faded crape, lace, and other similar thin material. It consists in immersing the fabric in a specially prepared solution consisting of alcohol, a suitable dye stuff, and shellac, and afterwards subjecting the material to the action of steam, which brings out the color of the dye and crimps the fiber, the shellac serving to hold the fiber in its crimped form, so as to present the original texture of the fabric when new.

IMPROVED COMBINED STEREOSCOPE AND GRAPHSOPE.

James Lee, New Brighton, N. Y.—When the lens holder is raised into an erect position it is caught and held by a spring catch, and is thus not liable to fall back and mar the instrument or break the lenses. Wings or side shields are employed to keep the light from the eyes when using the instrument. Said wings may be closed against the lens holder.

IMPROVED TUG BUCKLE.

Herbert C. Ward, Willmar, Minn.—When the draft strain comes upon the buckle the ball slips forward, and the tug is clamped between a cross bar of the ball and a front cross bar of the buckle frame, thus relieving the tongue from the most of the draft strain. The principal use of the tongue is to prevent the tug from slipping when the draft strain is being applied, and to prevent the said tug from working loose.

METHOD OF UTILIZING THE LEATHER OF CARD CLOTHING.

Frank E. Brummitt, Walpole, Mass.—This inventor takes the old card clothing as it now comes from the mills and is thrown away, removes the teeth, and gums the leather with gum tragacanth. He then resets the leather with new teeth, pricing the holes in the opposite way to the first setting, so that they will not go in the same holes which they would be liable to do if set in the same direction. The gum fills the old holes, and in some measure restores the leather to the original condition for receiving and holding the teeth.

ANKLE SUPPORTS FOR SKATES AND IMPROVED SKATES.

Julius Drucklieb, Jersey City Hights, N. J.—The first invention consists of an outwardly curved supporting rod that is applied to a socket pivoted to the side of the runner. The supporting rod makes it easier to beginners to learn to skate, while it gives to the accomplished skater a support for the lower muscles, so that he can hold out longer and practice with less fatigue. The second invention relates to such improvements in skates that the same may be instantly and rigidly applied to the heel and sole of the shoe. A set screw allows the adjustment of the skate to any size of heel, while a swinging lever produces, by being carried up until retained by a stop lug, on the runner, the tight attachment of the skate to the boot heel, releasing the same when the lever is lowered and the gripping of its sharp edge is discontinued. The front part of the boot or shoe is connected to the skate by an adjustable toe holder.

IMPROVED CARTRIDGE.

Albert Hall, New York city.—This relates to improvements in the construction of paper cartridge shells, by which the same are considerably stiffened, and the anvil rigidly and strongly secured in position in the shell. The invention consists of a diametrical anvil, made in one piece with an encircling socket tube, retained securely by a paper shell and metallic cap piece.

IMPROVED SHOE FASTENING.

William J. Vitt, New York city.—The flap is fastened to the upper by a number of tubular clips applied to the shoe. The clips of the flap and upper are arranged to alternate with each other, and connected by a string that is secured by a knot to the lowermost clip. The string is then passed through all the clips, the upper end giving readily for the opening of the flap in putting on or taking off the shoe. The end of the string is applied to and rigidly retained by a suitable clamping device, and then passed through a hole or eyelet of the upper to the inside to be wound around the ankle.

NEW HOUSEHOLD INVENTIONS.

IMPROVED SASH FASTENER.

Thomas Hill, Portland, Me.—The invention relates to a fastener so constructed and applied as to lock the upper and lower sash together in any adjustment. The fastener consists of a notched and slotted plate, secured to the side bar of the upper sash, and a button or catch pivoted to the top of the lower sash, the arrangement being such that the catch works in the slot of the plate, and engages the notches thereof to hold the sash at the desired height.

IMPROVED WASHING MACHINE.

Francis M. Hellstrom, Lawrence, Kan.—The rubbing surface of the suds box is formed by attaching half-round strips of wood at their ends to strips of zinc. The movable rubber is formed by attaching half-round strips of wood to the curved edges of segmental disks. When the levers are arranged in a vertical position their ends rest against cleats attached to disks of the movable rubber, against which they are locked by catches, so that the rubber will be operated by operating the levers.

IMPROVED KNIFE-SCOURING MACHINES.

Herbert Symonds, Troy, N. Y.—In this device the polishing powder is fed downward to the polishing pads from the reservoir. There is also a new mechanical construction of the pads.

IMPROVED BOLT.

Francis Robinson and John H. Ferris, Trenton, N. J.—This consists of a bolt that slides and turns in a barrel by means of an inclined elliptical collar of the bolt bearing on the correspondingly beveled end of the barrel. The bolt is retained in locked position by a shoulder or seat of the handle.

IMPROVED CARPET STRETCHER.

Joseph S. Ingham, Knoxville, Pa.—This is an ingenious combination of lever and pulley for drawing the edges of carpets out taut.

IMPROVED DOOR BELL.

James M. Hinchey, Philadelphia, Pa.—This consists of a bell mechanism operated by a swinging lever that winds up a spring and rings the bell on a release of the pull, by the action of the spring and transmitting gear wheels.

IMPROVED HEATING ATTACHMENT FOR STOVES.

Lars M. Madson, Danville, Dak. Ter.—This is an improved heating attachment for cooking and heating stoves, by which the heat of the fire gases is more completely utilized before escaping into the chimney. It consists of a sectional pipe, made of jointed elbows at suitable inclination, and supported on the stove and on an adjustable brace standard.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PROJECTILE.

James M. Pollard, New Orleans, La.—This invention consists in a projectile having a central cylindrical portion, with ends symmetrically tapered to a conical or paraboloidal form, the rear end of the projectile being upset or molded with a raised circumferential bur, which is of less diameter than the cylindrical portion, and has a convex end. The double paraboloidal form adapts the projectile to the least resistance from the air, while the raised bur acts in the nature of a guide, as a feather to an arrow.

IMPROVED FEATHERING PADDLE WHEELS.

John H. Clow, Orange, Wis.—Certain improvements are made in that class of paddle wheels designed for the propulsion of boats in which the paddles are pivoted upon one side of the center so as to feather or move edgewise in rising from the water so as not to carry dead water. The invention consists mainly in the particular construction of a locking bolt, arranged to be operated by a lever and cam, and located in the central part of the wheel so as to engage with the middle part of the paddle, and lock or release the same at the proper time.

IMPROVED PORTABLE DERRICK.

Shirwood Y. Reams, Belleville, Texas.—This consists of an adjustable crane mounted on a truck platform, having an overhead frame for the support of the upper end of the crane post, and braces for staying the frame. The crane can thus be turned around to overhang the sides. The whole is a simple apparatus, which may be moved readily from place to place by hand or by horse power.

IMPROVED WINDMILL.

James Ward, Winnemucca, Nev.—This consists of an upright wheel with spirally curved floats, in connection with a corresponding number of fixed and hinged and weighted shutters, of which the latter are regulated by weights and a connecting governing string.

IMPROVED AUGER HANDLE.

James Magers, Gervais, Oregon.—By suitable construction, a locking plate prevents the bit from turning in the handle when the auger is in use, and at the same time allows the bit to be readily detached and attached when desired.

IMPROVED SAW SET.

Henry Itskin and John Gregg, Rockfield, Ind.—This is a set to be used with the hammer. It has a wedge-shaped notch in the end, and a gage to regulate the position from the side of the saw, so that by placing the notch on the point of the tooth, and hammering the end of the tool, the same as an upsetting gage, the tooth will be set by bending it laterally. There is also an upsetting notch in the tool to adapt it for both kinds of teeth.

IMPROVED NUT LOCK.

Samuel Henry, Chenoa, Ill.—This improved nut lock is formed of a curved plate, having its ends curved upward, and having notches with inclined sides and straight bottom formed in said ends, to adapt it to be applied to the nuts of a pair of bolts.

IMPROVED TIRE UPSETTER.

Ebenezer B. Rose, Goshen, assignor to himself and George M. Bull, New Baltimore, N. Y.—The tire or other iron to be shrunk is heated, placed upon plates, and clamped against toothed blocks by eccentrics. Then one plate and its toothed block and eccentric are forced forward, shrinking the iron.

IMPROVED MACHINE FOR MAKING WEDGES.

John Lennerton, Truro, N. S.—The first part of this invention consists of two revolving cylinders fixed upon a shaft furnished with four cutters in each cylinder, so arranged as to cut the wedges to the required thickness and taper. The second part consists of two other revolving cylinders, similar to the first pair, so arranged upon the same shaft as to cut the wedge to the required width. The third part consists of a circular saw and movable table top, so combined and arranged as to cut the wedge to the required length, and working in conjunction with the other parts.

IMPROVED TIMING ATTACHMENT FOR WATCHES.

Thaddeus Ackley, Warren, Ohio.—A spiral spring is arranged between a top plate and a grooved disk, and serves to throw the disk into contact with the spurred catch at the instant when the lever releases the disk-lifting spring. The spurred catch engages the grooved disk at any position, so as to instantly turn the same with the arbor, and move thereby the second wheel. By pulling out the controlling lever the disk is detached from the spurred catch, and thereby the second hand stopped, the lever being pushed in at the moment when the timing is to begin, so that the second hand moves until, by pulling out the lever, it is stopped again, so that the time taken up by the race is indicated in reliable and convenient manner.

IMPROVED MECHANICAL MOVEMENT.

Miner G. Mosher, Wichita, Kas.—This is an improved device for converting a reciprocating into a rotary motion which has no dead points. It mainly consists in the combination of a U fork, provided with two pairs of hook pawls, with the wheel provided with the bolts; and in the combination of the three three-armed or T bars and their connecting rods or chains with the U bar or fork and with the two sets of hook pawls.

IMPROVED STEERING PROPELLER.

Flavius J. Ashburn, West Union, W. Va.—This consists of propeller blades arranged horizontally on and hinged to vertical crank shafts suspended from a horizontally revolving frame above the water, and connected by their cranks to the crank of a shaft in the center of the carrying frame, and around which they swing. All the paddles thus face in the same direction, so that in the forward motion they turn upon a hinge and work edgewise, and in the back motion they work broadside against the water to propel the boat. This invention also consists of a stationary crank around which the bucket swings, made to be turned in either way, and provided with means for turning it, which may work either by the engine or by the pilot wheel, whereby the direction in which the paddles act is changed at will to reverse the motion of the boat, and to utilize the propeller for steering it.

IMPROVED METHOD OF ANNEALING PLOW MOLD BOARDS.

Ed H. Babcock and John C. Whiting, Canandaigua, N. Y.—The object of this invention is to enable chilled mold boards and other chilled castings to be cooled without warping or being strained, and thus keep them in exactly the required shape. It consists in removing the castings from the chills as soon as they are cool enough to be handled, placing them in hot forms, and cooling them under pressure, and under a gradually diminishing heat.

IMPROVED CAR TRUCK SHIFTING APPARATUS.

Robert H. Ramsey, Cobourg, Canada.—This invention consists of a couple of trucks on each side of the track on which is the car whose trucks are to be shifted, carrying a beam extending across from one to the other under the car body at each end. There is a depressed portion of the main track, down which the trucks to be removed run, and detach from the car, while the latter runs on the beam carried by the side trucks, which run at the same time on level tracks. The trucks to be connected are run up the grade, and thus brought into connection with the car.

IMPROVED KEY-HOLE GUARD.

John La Blanc and Xavier St. Pierre, San Francisco, Cal.—This consists of a sliding guard plate operated by a crank pin, sliding in a segmental recess of the face plate of the lock, and in a slot of the guard plate.

IMPROVED AUTOMATIC CAR BRAKE.

Ira Robbins, Hughesville, Pa.—This invention relates to an improved construction of car brake, designed to apply or remove the brakes automatically, or by hand, as may be desired. It consists chiefly in the arrangement of a bellows operated continuously by the car wheels, which is employed for releasing the brakes by acting upon a tripping rod when the cars stop; in the mechanism operating in connection with said bellows; and in devices for automatically applying the brakes by the impact or concussion of the cars.

IMPROVED CAR COUPLING.

Nicholas Darrow, Hempstead, Texas.—The cars are arranged with spring buffers, of which the buffers of one car have side-extending guard plates, to which the tapering heads of the buffers of the adjoining car are fitted. The guard plates guide and assist in the coupling of the cars, and also prevent the cars from swinging too much from one side of the track to the other.

IMPROVED NUT LOCK.

Isaac Van Kuran, Omaha, Neb.—This consists of a washer of steel over a cavity in the fish plate, and surrounding the bolt, so that the pressure on the bolt on the fish plate is transmitted to the surface of the plate surrounding the cavity by the washer. This allows of any required amount of pressure, and at the same time affords a spring with sufficient reactionary power against the nut at all times to prevent it from becoming slack, so as to work off or unscrew.

IMPROVED CAR COUPLING.

Jacob F. Roehm, Hiawatha, Kan.—When the drawheads approach for coupling, the spring-supported links enter the mouth of the corresponding cavities at opposite sides of the drawheads, strike against the pins, so as to throw them back and push them in upward direction on the guides, to allow the passage of the links. When the links have entered beyond the pins, lever handles are thrown forward, and the pins dropped by the concussion of the drawheads, so as to couple the links.

IMPROVED METALLIC GIRDER.

John L. Nostrand, Brooklyn, E. D., N. Y.—In the neck of the head or flange is formed a longitudinal groove or channel, to receive the edge of the web, where it is secured in place by bolts or rivets. By this construction, beams of a greater strength can be made by using the same quantity of iron, or of an equal strength, by using a less quantity of iron, and also, the strain is transferred from the rivets to the shoulders of the heads, against which the edges of the web rest.

IMPROVED WATCHMEN'S TIME DETECTOR.

Jacob H. Massey, Allentown, Pa.—This is a watchman's time detector, which is applicable to a building for inside and outside use. It consists of a dial with concentric circles, revolved by a clock train, and operated by a suitable spring-marking device, in connection with a pull from the inside or outside of the building. The marking device is set for each day by a crank shaft engaging a rack of the marker.

IMPROVED LEATHER-STRETCHING MACHINE.

William Coupe, South Attleborough, Mass.—This is an improved machine for stretching leather for belts and other uses, so constructed as to stretch the leather evenly when varying in thickness, and which may be readily adjusted to stretch the leather to any desired extent.

IMPROVED VIBRATING PROPELLER.

John Forgie, Sr., and John B. Forgie, Jr., Hicksville, N. Y.—This invention consists of carrying paddles in the form of the slats of a window blind, and working alternately sidewise and edgewise to the water as the frames swing backward and forward. The said frames are pivoted at the upper end, in such manner that the lower end works parallel with the engine rod, to which it is connected, to be worked by the steam power applied directly to the rod.

IMPROVED DOUBLE-ACTING FORCE PUMP.

George W. Hooper, Greene, Me.—In using the pump, as the piston moves downward, a vacuum is formed above it, and the water is forced, by atmospheric pressure, through passages and a valve, and passes into the upper part of the cylinder. At the same time the water in the lower part of the cylinder is forced out, opening another valve, and passes into the pump tube and out through it. As the piston moves upward, the water passes in through other openings and valves, and passes into the lower part of the cylinder. At the same time, the water above the piston is forced into the pump tube.

IMPROVED VALVE GEAR.

John E. Giles, Hazleton, Pa.—The crank pin which works the valve is carried in a block in a slotted disk which slides along the disk for shifting the valves, and to the opposite side of the axis for reversing, and is worked by a sleeve on the shaft of the disk to which the shafting lever is connected. The disk is geared by a toothed rim with a wheel on the crank shaft (which gears are eccentric), by which the irregularities of the crank are overcome. For a lap valve, the slot in the disk for carrying the crank pin is arranged out of the center of the line of the axis of the disk to just the measurement of the lap and lead of one end of the valve.

IMPROVED BARREL FOR WATCH SPRINGS.

Sherman D. Johnson, East Haddam, Conn.—This invention consists of the combination of the mainspring barrel by suitable pawls with a separate toothed wheel around the barrel, that is capable of motion independent of the rim on the breaking of the spring.

IMPROVED CAR BRAKE.

Jacob Blanshan, Le Fever Falls, N. Y.—This relates to brakes on opposite sides of wheels, the object being to relieve the axes of the lateral pressure to which they are subject when the brakes apply to one side only.

IMPROVED SHARPENING MACHINE.

George W. Ingersoll and Harvey L. Fisher, Toledo, Iowa.—This is a new tool-holding device, whereby any cutting tool may be sharpened at an exact bevel without help, as one hand can turn the stone and the other guide the tool against the same. By rolling a gage rod, gouges may be ground with the same bevel in superior manner. It is readily adapted to any size of grinding stone.

IMPROVED FURNACE FOR BURNING SAWDUST, TAN BARK, ETC.

Frederic T. Kidder, Claremont, N. H.—This invention consists in using feeders under or in the bottom of the mass of the fine fuel, with which the stove is filled. The said feeders are pieces of wood extending from the front at the draft inlet along the stove to the back, and which, being ignited at the front end, burn slowly, together with the sawdust or tan bark immediately around them, while the heat, ascending up the bank of other fuel, converts it into charcoal, and prepares it for burning as it falls down to the fire. In case the fine material is very wet, perforated pipes are placed horizontally in the same, a little above the wood pieces, to conduct some of the heat into the mass, for drying it in advance of the fire by passing from the tubes up through the fuel.

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Temples and Officers. Draper, Hopedale, Mass.

Notes & Queries

H. M. will find, on reference, that the denitric acid described on p. 72, vol. 34, is a good one.—F. J. M. is informed that there is no formula for the horse power of a boiler. Ample boiler power for your engine is always to be recommended.—A. L. F. should use marine glue for fastening cloth or paper to wood. See p. 43, vol. 32.—C. W. F. will find directions for etching on glass on p. 409, vol. 31.—H. S. can calculate the speed of his planer by using the formula given for speeds of pulleys on p. 556, vol. 34. He should temper his molding knife to a brown color. See p. 21, vol. 31.—H. H. should cover the copper connections in his Bunsen battery as described on p. 235, vol. 34.—A. A. can temper his millpecks by the process described on p. 106, vol. 25.—W. D. Y. can calculate the lifting power of hydrogen by the formula given on p. 74, vol. 31.—W. H. S. can prevent rust on iron and steel by the method described on p. 103, vol. 33.—V. R. A. will find directions for galvanizing iron on p. 315, vol. 33.—W. L. D. will find a description of lighting gas by electricity on p. 4, vol. 29.—G. W. B. will find a recipe for a black Japan on iron on p. 598, vol. 26.—W. S. R. will find a description of a process for rendering tallow on p. 499, vol. 34. To bleach tallow, see p. 27, vol. 31.—M. M. M. will find a recipe for a bug exterminating liquid on p. 21, vol. 31.—G. B. M. A. J. W., J. C., J. McC., D. H. P., K. J., L. W., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) E. J. D. says: I use large quantities of water for irrigation; and at present I raise it by a windmill and pump, but it is very uncertain, as the wind gives out just when it is wanted. Can I compress air enough with my windmill for a two

horse power engine? A. We think you would find it more satisfactory and cheaper to pump the water by means of the windmill, and store it in a tank for use during calms. You might compress air by means of the windmill, for the purpose of driving an engine. But the air receivers would need to be larger and more expensive than the water tank.

(2) P. H. S. asks: 1. How can I granulate soft solder to about the size of common shot? A. Melt the solder and pour it in a thin stream from some height into a vessel of cold water. 2. Does common half hard brass wire in the coil suffer a loss of strength by being exposed to the air? A. The loss, if any, is very slight.

(3) R. T. S. asks: 1. What remedy can I use to destroy the insects which infest the rose bushes? A. Tobacco water. 2. How can I prevent weeds from growing? By hoeing or pulling them up.

(4) A. says: I have been trying to make nitrous oxide gas, but have not succeeded. After I have heated the ammonia for a few moments, the water from the wash bottle comes in to the chemical flask. How can I remedy it? A. Place pure nitrate of ammonia in a capacious flask, provided with a suitable perforated stopper, through which a piece of glass tubing, bent at right angles, just passes. This is to be connected by means of rubber tubing with an empty bottle, fitted in a similar manner to the ordinary wash bottle, with the exception that neither of the tubes must extend to the bottom of the bottle; they should be cut off just on the inner side of the stopper. This will serve for condensing the greater part of the moisture that comes over, and at the same time prevent the retreat of the liquid into the hot flask on the removal of the source of heat; it is well to keep this bottle immersed in cold water during the operation. The purifying bottle may consist of a tall, slender (dry) wash bottle, filled with coarsely broken lumps of protosulphate of iron (copperas). The inlet tube of the purifier must extend quite to the bottom of the vessel, so as to force the gas to pass through the entire column of copperas. When the evolution of gas ceases, the reservoir should immediately be disconnected from the purifier and the stopper removed from the generating flask, before the heat is removed. If these latter precautions be observed, there will be no danger of a retreat even if a wash bottle be employed.

(5) A. L. E. says: Please give me a good recipe for removing paint stains from white shirts. A. Moisten with benzole and cover on both sides with warm pipe clay. Place under pressure for several hours, and repeat if necessary. You should have stated, if possible, what kind of paint produced the stain, to enable us to properly answer the question.

(6) S. H. D. asks: Are the engines of Mr. Corliss at the Centennial exhibition connected on one shaft at right angles? A. Yes.

(7) H. W. asks: What liquid must I add to your mixtures for colored fires in No. 13, vol. 34? I have tried the liquid given in the same number with the result that it will not harden or burn. A. Colored stars may be made by using any of the recipes for colored fires with a mixture of isinglass (pure gelatin) ¼ oz., camphor ¼ oz., and alcohol ¼ oz. Make into balls of the requisite size, roll in gunpowder, and dry in the sun.

(8) W. L. S. says: The packing box around the stem of the slide valve on my engine has got stuck fast with old tallow and perhaps iron rust, so that I cannot move it either way, and the box needs new packing. How can I loosen it with out taking off the steam chest? The box is of the usual form, set up by two bolts. A. Try driving wedges behind the flange.

(9) W. H. W. asks: What can I add to aniline black so as to keep it black, in dyeing leather? When dissolved in water or spirits, it turns to a brown color. A. Try the addition of a small quantity of sulphate of copper to the liquor; and after dyeing, pass between warm copper rollers.

(10) J. R. C. asks: Is there any known simple and cheap method or process for forming, dissolving, and retaining in perfect solution the protocarbonate of iron, in a common mineral fountain? A. The protocarbonate of iron is by no means a rare salt. It dissolves as completely as bicarbonate in carbonic acid water. Large quantities of the pure carbonate are employed in the preparation of artificial mineral waters. On exposure to the air, the iron is finally deposited as an ochery deposit of the hydrated peroxide.

(11) J. A. W. asks: A friend and myself have had an argument about a vacuum. My friend states that, if we take a cylinder that will stand an external pressure of 25 lbs. to the square inch, we can collapse it with an air pump that is strong enough for the work. I claim that 15 lbs. per square inch is the limit. Who is right? A. The atmospheric pressure upon each square inch of surface equals 15 lbs., so that a boiler capable of resisting this pressure would not collapse under the circumstances you mention.

(12) B. F. G. asks: How is pyrolignite of iron or iron liquor made? A. It is obtained by dissolving scrap iron in pyroligneous acid (crude wood vinegar) and evaporating down until the required strength.

(13) R. W. C. asks: Is there any way to clear the smoke from a mine with a 100 feet perpendicular shaft, and about the same length of horizontal tunnel at the bottom? A. The usual way is to improve the ventilation by a suitable shaft.

(14) R. W. asks: Can you inform me how to color fabrics to a yellow or fawn color? A. Wash several times in dilute solutions of carbonate of soda and soap, rinse thoroughly in clean water, and bleach with sulphurous acid.

(15) J. S. asks: I cannot get a fine line on tracing cloth. Please tell me how to work it, and how to color plans on tracing cloth. A. Use tracing cloth with one side glazed. The other side has a dead finish, and the cloth will take as fine an ink line as desired on the glazed surface. To color, use the brush only damp with the color, and apply on the back or dead finished side, and the color will show through. Do not get the brush too wet with color, and you will succeed.

(16) H. S. J. says: We are using three boilers for steam heating, and we find a great deal of unconsumed material is wasted with the ashes. We use Illinois soft coal on grate bars with 1½ inch openings. A. Decrease the width of openings as much as possible.

(17) A. E. asks: When cold water is suddenly brought into contact with red hot iron plates, as in the case of many boiler explosions, does it become decomposed into hydrogen or oxygen, or is it merely converted into steam? A. It is not at once converted into hydrogen. A small portion of it is converted into steam of a high tension, which buoys up the remaining water and prevents actual contact with the hot iron.

(18) C. W. J. says: Home made potash soap with us will not keep. It has a tendency to spoil, and in a short time it smells badly. We therefore do not put up at a melting as much as we wish. Please inform me what will preserve such soap from this tendency. A. The trouble is probably due to the fact that the conversion of the fat into soap is not complete, either from an insufficiency of the alkali, or that the boiling is not continued long enough.

(19) H. P. J. asks: Will you give me the proportions of the smallest steamboat that can be built for practical working, to make 10 miles per hour in still water? A. Probably it could be made as short as 25 feet. See p. 185, vol. 29.

(20) W. A. H. asks: 1. Is there any metallic compound softer than lead, and that has as high or higher a point of fusion? A. We do not know of such a metal or alloy. 2. What would be the amount of wear upon small steel dies used for stamping lead? A. This could best be determined by experiment.

(21) W. O. H. says: If you take two vessels of equal size, fill one with water and the other ¼ full of very finely sifted coal ashes, you will find that all the water in one vessel can be poured into the vessel containing the ashes without any overflow; also that all the ashes in one vessel may be slowly transposed into the vessel containing the water without the latter overflowing. Do the facts prove that ¼ of the body of ashes is composed of air cells? A. If you place the same quantity of water in a tube, having about a quarter inch bore, mark the center of the meniscus at the top of the liquid, and finally add the quantity of ashes mentioned. You will find that every grain of ashes introduced will cause a corresponding displacement of the surface mark.

(22) E. C. N. asks: 1. In two water tanks of the same dimensions, the temperature of both and the amount of water drawn from each being alike, in which will a 10 lbs. cake of ice last the longer, the one in which the ice is cut in small pieces, or the one in which it is put in a large piece? A. Other conditions being the same, the ice in the tank containing the fragments will melt the quicker. 2. Why? A. Because it exposes a larger surface of contact with the water.

(23) F. J. asks: Will an engine 1½ x 3 inches have sufficient power to run a screw-cutting lathe of 12 inches swing, 3 feet between centers? A. No.

(24) N. W. H. asks: How can I soften small castings of gray iron, so as to drill them with twist drills? They are chilled in cooling. A. If you use carbolic acid with your drills, you need not soften the iron.

(25) G. E. H. asks: 1. What is a pitman rod? A. A pitman has a reciprocating motion at each end. 2. Is the connecting rod of an engine a pitman rod? A. A connecting rod performs a rotary motion at one end.

(26) T. F. M. asks: Please give me a rule for calculating the horse power of a rotary engine. A. There are no known rules applicable to the horse power of rotary engines.

(27) G. E. B. asks: Please give me a recipe for making a face on a fine polishing wheel for steel and iron. A. Use a leather-faced wooden wheel and Vienna lime.

(28) R. C. M. asks: How can I set black carbons in steel cutters, and fasten them immovably? A. Make holes a trifle larger than the carbons; then insert them, and rivet the metal round them with a small set and hammer.

(29) S. A. B. says: How can I make a nice smooth finish on the barrels of cannon stoves? A. Use Albany or Waterford sand, or a facing sand composed of 1 part of coal dust to 8 or 10 of Albany sand.

(30) H. H. says: Please give me a recipe for a cleansing composition or mixture that could be rubbed upon bright steel tools, which can be best heated in lead and, after being hardened in water, will still be bright. A. We know of no method of accomplishing your object.

(31) H. M. A. asks: 1. Can you tell me how to make a cheap and simple battery, or a magneto-electric machine? A. You can construct a gravity battery, one of the cheapest forms, in the following manner: Place a copper disk at the bottom of a jar filled to within one or two inches of the top with water; dissolve a little sulphate of zinc in the water and suspend a zinc disk from the top of the jar. The wire leading from the copper disk should be covered with gutta serena. A handful of sulphate of copper crystals dropped in is sufficient to put the battery in action. Any

desired strength of current can be obtained by properly regulating the number and size of the elements. 2. In Mr. M. Alfred Naudet's machine, illustrated on the first page of your SUPPLEMENT, No. 9, what size and how long should the iron for the electro-magnets be? A. They can be made of almost any dimensions desired; from 1½ to 2 inches long and ¼ inch in diameter will be found convenient. 3. What sized wire should they be wound with? A. No. 23 will answer for currents capable of overcoming considerable resistance. The size is varied to suit particular requirements. 4. What should the wire be covered with? A. Silk is best, though cotton will do. 5. What should the radial connecting pieces be made of? A. Brass or copper. 6. Is quantity, or high tension and small quantity, better for shocking purposes? A. High tension currents are best for producing shocks.

(32) O. A. W. asks: Is there any substance that, when rubbed on a person's hand, will enable him to hold hot iron and molten lead without being burnt? A. Yes, water.

How can I prepare phosphorus so that it will, when rubbed on a person's hands, remain luminous for 10 or 15 minutes? A. Make the solution in hot olive oil.

(33) D. G. asks: Does the piston of an inclined engine cause less friction on the cylinder than that of a horizontal engine? A. There is no practical difference.

(34) V. W. asks: Do you know of some cheap substance that can be molten and put in around the box in a hub to fasten it after it has been trued? Glue would do if there were some way of solidifying it. A. Red lead mixed with your glue will solidify and harden, and will probably answer your purpose.

(35) S. B. says: It has been asserted that strychnine is used in making whisky, and that traces of the poison may be discovered after the liquor emerges from the distilling process. I applied to Dr. J. R. Nichols, Boston, and he stated that he had never in a single instance found a trace of strychnine in whisky, and that "it is a vulgar notion to suppose that it is ever used by distillers." Is he not right? A. There is no better authority on the subject than Dr. Nichols. If, after examining so many samples, he failed to detect traces of the poison, his statements with regard to the matter are undoubtedly well founded.

(36) E. B. asks: How can I produce chloride of sulphur? A. Chloride of sulphur is prepared by passing chlorine gas over sulphur heated to about 257° to 266° Fah. The product is rectified by distillation.

(37) J. J. says: 1. A friend says that the Corliss engine is always a high pressure engine. He is wrong. 2. Also, that it is not used on any large steam vessels. A. He is right. 3. Also, that a cut-off is never used on low pressure engines. A. He is wrong.

(38) H. J. S. says: I have a glass cylinder fitted with crank, and a silk pad, for an electrical machine. How can I complete the apparatus? A. Mount a tin conductor of two or three inches in diameter, with rounded ends, on a glass rod, and place it in front of the large cylinder. The conductor must be provided with projecting points to collect the electricity. Then make a leather cushion, stuff with horsehair, and attach it to the board mentioned. Attach also, to the upper part of the cushion, a piece of silk which may be long enough to nearly reach the projecting points on the conductor. Better buy the required amalgam for the cushion from an electrical instrument maker.

(39) X. asks: What is the strength of a current of electricity from a small thermo-electric pile, supposing the difference of temperatures between the electrodes to be about 100°, compared with that from a Bunsen pile? A. The value of the current depends upon the resistance in circuit. If this is small, 100 bismuth-antimony pairs may be made to give a current equal to that from an ordinary Bunsen element.

(40) R. R. asks: Which is the cheapest, steam or water, to raise a load of one ton through a shaft 100 or 200 feet deep? A. Water power, if conveniently at hand, would be the cheaper motor.

(41) C. M. B. asks: 1. Please give me the rule for finding the angle for the teeth of a worm gear, the diameter at pitch line and pitch of screw being given. A. You will find it explained in Rankine's "Machinery and Mill Work." 2. Where should a crowned pulley be measured, in the center or on the edge of rim? A. In the center, for determining velocity ratio. 3. Is a cathead that part of a sliding or self-feeding boring bar to which the cutters are fastened, or is it a piece of cast or wrought iron pipe with set screws at each end, to be slipped on small shafting, trued up by means of the set screws, and then held in the jaws of a back rest? A. So far as we know, the term has no meaning that is generally agreed upon. We would be pleased to hear from mechanics in reference to the matter.

(42) F. A. asks: How far will an injector for feeding water to steam boilers draw water perpendicularly? Do you know of any injector which will draw twenty feet? A. An ordinary lifting injector will raise water from 6 to 8 feet. It might be possible to make one lift 20 feet.

(43) M. asks: Why is it that a carriage with large wheels draws easier than one with small wheels? Is it a question of leverage or friction or both? A. Both.

(44) L. D. M. asks: Is the effect of falling water calculated by the effect that each cubic foot would have, falling the given distance? A. Yes. At what temperature does the combustion of coal take place? A. It begins at about 1000° Fah. Why does amalgamation protect zinc when

alone in acid and not when with copper? A. The effect of amalgamation is merely to neutralize the impurities of commercial zinc, which cause local action on its surface when placed in acid water.

(45) G. E. asks: Is the old ship log in use at present, or is there any new improvement for measuring a ship's speed? A. It is still used, but many vessels carry in addition patent logs, which register the speed continuously by the action of a small propeller on gearing which moves indexes.

(46) A. E. D. says, in reply to C. S., who cannot get heat enough from a charcoal fire to do ordinary welding: Be sure that your bellows is in proportion to the work, and that your twer is set slightly inclined towards the fire bed. First upset the iron so as to make the scarf a little thicker than is usual in welding with stone coal; and place the iron considerably higher, say from two to four inches above the twer and considerably in advance, making sure that the blast passes through a thick mattress of incandescent coals, but never striking the iron. The bulk of charcoal must of course be greater than if it were stone coal.

(47) W. H. P. says, in reply to A. P. McC.'s query as to ventilation of a schoolhouse: I would suggest the placing of a part of the heating surface in chambers, in the basement, into which chambers fresh air from out of doors should be introduced, that it may be slightly warmed. Thence it should be led to the apartments to be ventilated, and brought into the room near the ceiling. In the floor should be registers of suitable size, connected with air ducts, leading to chimneys or to a central shaft, which should be strongly heated to produce a powerful current at all times. These chimneys, or the central shaft, should be so arranged that they may be heated at all times, whether heat is needed in the building or not, thus drawing the foul air out and leaving the fresh air free to flow in to take its place. A. We are aware that the system of ventilation which you propose is the one more generally recommended, where a plan has to be chosen at the inception of a building; but the schoolhouse in question is now provided with a heating apparatus which warms by direct radiation, and which the trustees would not doubt wish to alter as little as possible, provided a reasonable degree of ventilation could thereby be obtained; and it was in view of this state of things that our suggestions were made. However, the theory that the more vitiated air is always at the lower part of the room is not found to be always correct in practice, as those who have had the experience of entering an upper gallery in a crowded church can testify; but where the air has remained undisturbed for some time, and is of even temperature, the bad air, being the heaviest, will no doubt lie upon the floor. In the case in question, the air that has remained longest in the room will be the warmest, the lightest, and the most vitiated, and consequently should pass off at the ceiling. Where the heating is done by indirect radiation the conditions are different and call for different treatment.

(48) R. P. G. says, in reply to J. S., who asks how to make a raw hide perfectly transparent: Take a green hide (a dried one will not do) wash it, flesh it well, put it in hot water until the hair is loose, which will be in a few minutes, put it on a beam, remove the hair, and put it in cold water. Do not let the water be too hot; try it with a small piece of hide. If it shrinks, add a little cold water. If a printed card is covered with such hide it can be seen as plainly as through a glass. When dry, varnish.

(49) J. V. H. N. says, in reply to correspondents who are troubled with Canada thistles: The mode that I found most expeditious and effective is to wait until the thistles are in full bloom and before the seeds were far enough advanced to ripen, and then mow them down with a scythe, which always ended the curse. The reason for this is that the stalk becomes hollow after the plant blossoms, and after the stalk is cut it fills with water, which rots the roots; and the seeds not being old enough to ripen, the vitality ends. There may be a few plants which have not blossomed, and which therefore will not rot but sprout again, which will require cutting again when they get in bloom; and as they are all cut at once, they will grow and blossom at the same time, so that the second cutting will finish them. I have cleaned a field, that was so full of them that a cow could not be driven through it, in one season by this method.

(50) J. C. W. says, in reply to H. B., who asks how to calculate at what rate of interest, compounded yearly, \$2,000 is of the present value of 120 monthly payments of \$40: First find the present worth of the monthly payments for one year at simple interest: suppose it 10 per cent, which is \$455.67+. Then get the present worth of an annuity of the \$455.67 for 10 years at 10 per cent compound interest, which makes the present worth \$2828.77, making an error of \$28.77, which shows that the rate of interest must be more than 10 per cent. Then call it 20 per cent, and work it the same way, making the amount or present worth only \$1902.42. Then by double position, work out the problem and find the rate of interest required, between 18 and 19 per cent. The rule will give a correct answer, but it is a long operation.

(51) To D. N. G., of N. J., and many other correspondents: We know of nothing but poison of some kind that will kill potato bugs; and there is nothing less objectionable, that is effectual, than Paris green. Two tablespoonfuls of good Paris green, mixed with a pail of water and applied to the potato vine early in the morning, before the insect hides away under the leaves to avoid the sun) by sprinkling with a garden syringe or a whisk broom, will relieve you of your trouble. If the bugs appear on your tomato or other like vines, we would advise picking them off instead of using any exterminating powder.

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

A. C. R.—These are the green and blue carbonates of copper.—A. A.—The magnesum could not be extracted profitably from your rock.—J. F.—It is silicate of alumina (clay) colored by oxide of iron. It is not injurious to the boiler, but its presence in the water is unfortunate, as by its caking upon the surfaces of the iron, and its non-conducting property, a larger consumption of fuel is necessary in order to properly heat the water. An analysis of the water is not necessary, as this sediment reveals the nature of its impurities. The formation might in great part be prevented by filtration, before its introduction into the boiler.—N. W. D.—No. 1 is a fragment of quartz rock. No. 2 is also quartz.—G. B. C.—It is decomposed granite.—D. D. N.—The small piece mineral appears to be a rich ore of copper containing tin. Send us a larger specimen.—J. C. G.—It is not of natural origin; but in what manner this impure iron was formed, we cannot say.—W. G.—True small consists of finely crushed cobalt glass. The samples you send are not small, but appear to be sand covered by means of some gelatinous substance with various salts of copper, ultramarine, and organic pigments.—W. E. N.—It is iron ore, but is too poor to work.—G. W. McC.—They are iron pyrites, sulphide of iron.—S. K. H.—No. 1 contains mica and hornblende. No. 2 is compact sulphate of lime. No. 3 contains malachite (green carbonate of copper) and copper glance (chalcocite), a lead-colored sulphide of copper.—J. P. G.—No. 1 is titaniferous iron ore. No. 2 is hornblende and mica schist. No. 3 is granite. No. 4 is trap rock. No. 5 is granite. No. 6 is chalcopryite in quartzose rock. No. 7 is garnetiferous hornblende rock.

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 Age of the World. By E. O. L.
On Steam Pleasure Wagons. By D. G. P.
On Fish Tanks. By A. S.
On a Memorial of the Centennial. By R. P. D.
On a Cause of Fire. By J. S.
On Skylights. By A. B. H.
On the Bessemer Saloon. By A. K.
On Grain Testers. By E. L. W.
On Reading Rooms. By J. O. C.
On the Kentucky Meat Shower. By A. M. E.

Also inquiries and answers from the following: C. S. B.—W. M. F.—W. L. S.—S. B. L.—T. G. R.—D. K. E.—D. C.—W. J. D.—J. F. H.—C. J. McC.—T. C.—F. C.—U.—H.—C. R.—C. S.—N. S.—D. C.—J. P. H.—G. W. C.—L. Z. Jr.—E. L. 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 inquiries analogous to the following are sent: "Who sells small engines and boilers, and what do they cost? Who makes spiral springs? Whose is the cheapest air pump? Who sells box-wood for engravers' use? Why do not makers of agricultural machinery advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

June 13, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Mann & Co., 37 Park Row, New York City.

Alarm and extinguisher, fire, Nevins & Smith..... 178,600
Alarm, portable burglar, N. W. Palmer..... 178,553
Alarm recorder, electric fire, H. Ennis..... 178,730
Annunciator, electrical, C. W. Holtzer..... 178,611
Anger, earth, D. N. Root..... 178,675
Baby tender, T. Shaw..... 178,680
Baby walker, N. Nelson..... 178,548
Bag holder, Brown & Colbert..... 178,727
Bag holder, Bhumaker & Moorhead..... 178,682
Baggage seal, J. L. Harley..... 178,766
Bale tie, B. K. Fowler..... 178,734
Bale tie, A. A. Goldsmith..... 178,592
Bale tie, B. Hempstead..... 178,771
Bale tie, S. Palmatier..... 178,665
Bed bottom spring, S. Holman..... 178,776
Bed bottom spring, W. P. Rhess..... 178,560
Bed bottom spring, S. H. Reeves..... 178,671
Bedstead, book support, etc., A. M. Eastman..... 178,747
Bee feeder, W. E. Hamilton..... 178,765
Bee hive, Elliott & Lucas..... 178,614
Belt, voltaic, A. M. Dye..... 178,611
Blackboard rubber, H. H. Burrington..... 178,739
Blind stop, J. L. Crawford..... 178,739
Boiler, circulating tubular, G. S. Faulkner..... 178,517
Boiler, steam washing, A. S. Herr..... 178,525
Bonds, canceling machine for, J. L. Harley..... 178,736

Boots, etc., driving nails in, S. Harris..... 178,768
Boots, etc., making, C. W. Collyer..... 178,598
Bottle, smelling and perfume, H. Warner..... 178,918
Bottle stopper fastener, E. Dreher..... 178,745
Bottles, molding, A. R. Weber..... 178,819
Bracket, wall, C. W. Latham..... 178,534
Broom machine, Walrath & Bronson (r)..... 178,715
Brush-making machine, J. M. Pickering..... 178,556
Burial apparatus, L. H. Shular..... 178,681
Burner, lamp, J. Curzon..... 178,692
Burner, lamp, J. Engle, Jr..... 178,615
Butter package, W. B. White..... 178,693
Button, W. Orr..... 178,552
Button fastener, R. W. Huston..... 178,779
Button fastening, A. T. Perrine..... 178,755
Calendar and adding machine, W. Broomhall..... 178,505
Can, heating and cooling milk, M. Downey..... 178,610
Can, refrigerating, J. G. Gimpy..... 178,761
Can, sheet metal, A. A. Chevallier-Appert..... 178,501
Can, sheet metal, J. F. Merrill..... 178,544
Can, etc., valve for varnish, D. T. Crockett..... 178,601
Car axle box, J. M. Brosius..... 178,723
Car coupling, J. Davenport..... 178,741
Car coupling, R. Loomis..... 178,787
Car coupling, C. L. Storrs..... 178,811
Car coupling, S. Ustiek..... 178,817
Car coupling, W. L. Yohn..... 178,828
Car, stock, J. R. McPherson..... 178,798
Car, street, J. Stephenson (r)..... 178,717
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Chairs, reclining, T. M. Bristall..... 178,591, -730, -721, -725
Chair, rocking, D. J. Powers..... 178,557
Chandler, Carter & Browne..... 178,793
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Lamp chimney, L. D. Gunn..... 178,521
Lamp, street, J. M. Bruce..... 178,592
Lantern signal, H. H. Doty..... 178,607
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Mill, crushing, F. H. Smith..... 178,564
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Millstone dress, Welch & Hann..... 178,820
Molding machine pressing bar, H. Bauer..... 178,712
Motor, reversible water, O. J. Backus..... 178,592
Motor, water, Crandell & Brower..... 178,737
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Paper vessel, A. Wensch..... 178,827
Pen, fountain, H. H. Perkins..... 178,667
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Planter, hand corn, J. Nitkey..... 178,530
Plow, feet, W. M. Towers..... 178,815
Plows, sulky, W. Henry..... 178,524, 178,824
Plow, sulky, J. B. Halston..... 178,538
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Portraits, incasing pocket, J. R. Applegate..... 178,708
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Printing press, trimming, W. H. H. Clague..... 178,597
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Pump, rotary, R. B. Reynolds..... 178,672
Pumps, valve for steam, H. Epping..... 178,616
Pumps, valve for steam, W. H. Laurie..... 178,648
Railway drawhead, C. Kelley..... 178,644
Railway gate, H. Graybill..... 178,628
Railway track, portable, M. de M. C. y Martinez..... 178,682
Railway water tank, E. S. Duval..... 178,816
Rain water cut-off, L. U. & A. Cray..... 178,738
Rake, horse hay, R. Hoffheim..... 178,779
Register, M. D. Williams..... 178,514
Registering, needle board for, P. McAleer..... 178,790
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Separator, grain, B. L. Downton..... 178,743
Separator, grain, D. E. Fisher..... 178,691
Separator, grain, Hancock & Leaman (r)..... 178,789
Sewing machine threaders, E. S. Norcombe..... 178,662, -661
Sewing machine seam gage, E. Shaw..... 178,679
Shingle-planing machine, J. Flint..... 178,733
Ships, construction of, T. Allen..... 178,738
Shirt bosom supporter, F. Korf..... 178,533
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Stove water heater, J. E. Montell..... 178,547
Stove water heater, J. A. Frey..... 178,758
Straw cutter, L. Becker..... 178,713
Straw cutter, L. Seefeld..... 178,676
Stud and button, C. N. Brown..... 178,736
Syringe, vaginal, J. T. Ruttrick..... 178,598
Table, folding, G. Hess..... 178,715
Table leaf support, Pleuharp & Shilling..... 178,666
Tablet, writing, J. H. Hodder (r)..... 178,710
Tank regulator, H. C. Meyer..... 178,656
Telegraph relays, Allan & Wallace..... 178,578, -579, 178,580
Thrashing rods, cover for, W. H. Wilcox..... 178,684
Ticket case, C. N. Ayres..... 178,607
Tinning or coating metals, Morewood et al..... 178,657
Tobacco packing case, L. M. Marburg..... 178,538
Trace carrier, L. Carr..... 178,781

Track clearer, J. T. Jensen	178,643
Track clearer, Temple & Miller	178,687
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Washing machine, W. A. West	178,572
Washing machine, T. McC. Wilson	178,696
Washing machine, boiler, F. O. Wenell	178,571
Watch key, J. C. Dueber	178,746
Watch, stop, H. A. Lugin (r)	7,173
Waterwheel, A. Edwards	178,612
Waterwheel, L. Johannesson	178,529
Waterwheel, H. Van De Water	178,567
Weather strip, S. A. Rankin	178,670
Weights, raising and dropping, J. F. Crawford	178,600
Wells, tubing, D. L. Newcomb	178,549
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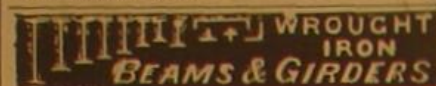
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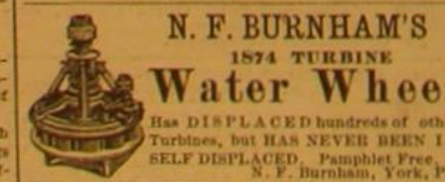
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NEW YORK JULY 22, 1876.

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THE CENTENNIAL EXHIBITION.—THE CAMPBELL PRINTING PRESS.

About 200 feet west of Machinery Hall, upon a commanding eminence, is situated the building illustrated on page 391, volume XXXIV, which has been erected by the Campbell Printing Press Company, at their own expense. On one floor of the building are ten of the different styles of printing machines manufactured by this company, the most noticeable of which is the perfecting and folding press. This machine uses duplicate forms, and is claimed by the inventor to print on both sides, from a continuous web of paper, fold, lay away in piles, and count 30,000 copies of an ordinary daily newspaper per hour: a figure which will be readily comprehended when reduced to 500 sheets per minute, or 8½ per second; and, as they are printed on both sides, it is equal to 16½ impressions in each second of time.

Our illustration shows this machine in perspective; on the right is seen the roll of paper from which it is fed, with spare rolls ready to replace the one in process of being printed on. From this roll, the paper passes, first to the upper, then to the lower impression cylinder, and thence on to the left side of the machine, where it is cut, folded, and counted; which latter operation is recorded on the register shown just above the pile of paper on the front.

When the rotary press of Richard M. Hoe was the acknowledged fastest press of the world, the paper was printed on one side only; it needed a second feeding through to perfect it, and required as many feeders as the machine contained impression cylinders, which, in the largest size, were ten; and as the sheets from each cylinder were laid away by a separate fly, there was no difficulty in disposing of any number of sheets properly, as fast as the machine could print them. But when the perfecting or web press had been so far improved as to overcome the difficulty of preventing the offset of the ink, there was a difficulty in disposing of the sheets as they came from the press. In the printing of a newspaper at the rate above-mentioned, the paper must issue from the machine at the rate of nearly 2,000 feet per minute; and for laying away in an orderly pile such sheets of paper, issuing from a machine and succeeding each other at the rate of 8 or 9 in a second, the ordinary fly was out of the question. The Campbell press not only lays the sheets out in perfect order, but folds them twice, thus dispensing with one of the most vexatious and costly (in point of time wasted) suffixes to the labor attaching to the newspaper printing press.

Underground Pumping.

At a recent meeting of the Society of Engineers, London, Mr. V. Pendred, President, in the chair, a paper by Mr. Henry Davey, on the underground pumping machinery at the Erin Colliery, Westphalia, was read. The paper described what is probably the largest example of underground pumping engines extant. The system, which was originated by the author, may thus be briefly described. In the mine (which is 1,200 feet deep), 920 feet from the surface, is placed a pair of compound differential pumping engines, capable of raising 1,400 gallons per minute to the surface, at the same time supplying power through the medium of the rising column to two differential hydraulic pumping engines placed at the bottom of the mine, and employed in lifting 1,000 gallons per minute to the main engines. Steam is carried down to the main engines, from the surface, at a pressure of 70 lbs. per square inch. After passing through the engines it is condensed, and a vacuum of from 24 to 26 inches of mercury is obtained by means of a separate condenser which produces at once the vacuum on the engine, and enables it to start to work against the full column. The methods of actuating the valves in the steam and hydraulic engines were fully shown. In the latter case the valves are worked without any metallic connections, by means of a modification of the differential gear. The paper was illustrated by detail drawings of the steam and hydraulic engines, and also of the separate condenser, as well as by working models of the machinery.

American Kaolin.

About a year ago, in describing the process of manufacture of porcelain, in the vicinity of this city, we called attention to the fact that beds of kaolin undoubtedly existed in this country, and all that was required was the enterprise necessary to develop them. There is every inducement, both in the shape of a demand for the material by potters and of a protective duty of \$5 per ton, to attract our citizens to obtaining from our own resources the clay which now is imported from England, and, at the same time, there is the higher incentive of aiding in building up an American industry to supply us with the manufactured products which we now principally buy from France.

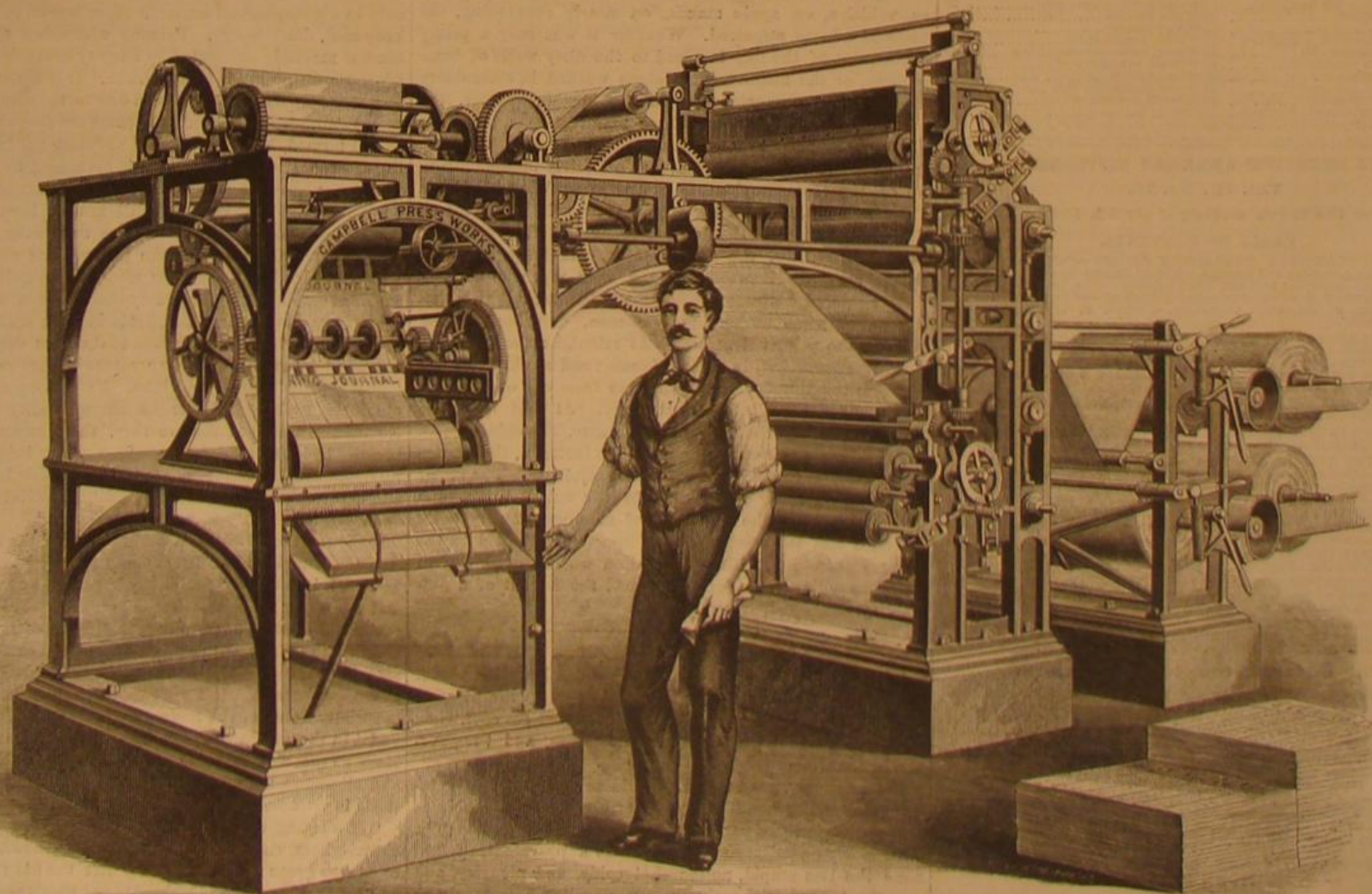
Since the publication of the article referred to, many of our readers have informed us of kaolin beds, located in various parts of the country; and this information has been, in the columns of this journal, laid before porcelain makers.

The trouble, however, with most of the native deposits is the impure nature of the material. To make fine porcelain, which must rival in purity and whiteness the famous productions of Limoges and other French towns, the material must be strictly pure. Clay that is coarse and contaminated with metallic oxides serves well enough for opaque stone ware, and we have never heard that any lack of that substance has been encountered; but it should be borne in mind that such will not answer for fine goods of the kind where-with our potters hope successfully to compete against foreign manufactures, at least until some one discovers an excessively cheap and perfect method of purification. It is cheaper to import the English clay, a fact obvious when it is considered that the merest admixture of ocularly imperceptible iron impurities in the paste results in the finished goods being blotched with ineradicable spots, and of course in their ruin as first class marketable articles.

Whether the large deposits recently found in Illinois will turn out of sufficient purity for general use, we are not yet prepared to say. Mines of kaolin have been discovered over 120 acres of Union County, Illinois, and in adjoining localities; and a town named Kaolin has there been established. We are indebted to Mr. Moritz J. Dobschütz, the owner of a large portion of the tract, for samples of the material, and for information relative to the mines. The kaolin is of a pure white, blue, white and pink quality, and appears sometimes naked to the eye, and sometimes in pockets 60 to 70 feet deep. Mr. Dobschütz states that there is every facility for the establishment of a pottery in the vicinity.

Electroplating of Leaves, Insects, etc.

A new and improved method of metallization of organic substances, so as to fit them for receiving galvanic deposits, has been devised by M. Cazeueneuve. It is both more rapid and more safe for the operator than the ordinary way. The nitrate of silver which serves for the metallization is dissolved in wood spirit, by which means a thorough impregnation of the object is obtainable. After maceration (more or less) the object is dried through rapid agitation, but while still moist it is submitted to a saturated solution of ammonia gas, and thus is formed a double nitrate of silver and ammonia, easily reducible. Drying is then completed at a mild temperature, and the object is then suspended in mercurial vapors and completely metallized in a few minutes. By this method, the author says, he has obtained a regular layer of copper on leaves, flowers, insects, etc.



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VOLUME XXXV., No. 4. [NEW SERIES.] Thirty-first Year.

NEW YORK, SATURDAY, JULY 22, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

American and English engines.....	50
Answers to correspondents.....	50
Ashes, wood.....	51
Atmosphere, the earth's.....	51
Ball thrown in the air (25).....	51
Barometer, the best (18).....	51
Baroscope, the (20).....	51
Baryta crystals, cleaning (40).....	51
Bessemer steel in France.....	51
Best race, university.....	51
Bottle, thickness of a (41).....	51
Bulls and bulls, proportions of.....	51
Business and personal.....	51
Canal du Midi, the grand.....	51
Carbonic acid in rheumatism.....	51
Carbonic acid and the stomach (12).....	51
Car best grinder.....	51
Carriage shells, shell for.....	51
Cement, a sensible.....	51
Cement for outside work (5, 9).....	51
Centennial, a Swiss.....	51
Centennial exposition, the.....	51
Coal bed, self-discharging.....	51
Coal, do not get.....	51
Curves, normals to (20).....	51
Deep, the wonders of the.....	51
Diameter of a circle (18).....	51
Draft of vehicles (49).....	51
Earth, the, and its atmosphere.....	51
Electroplating leaves, etc.....	51
Engines for boats (7).....	51
Engines for sawing (34).....	51
Facts and formulae.....	51
Fertilizers, potatoes, and grapes.....	51
Filling for teeth (16).....	51
Floors of buildings (19).....	51
Franklin Institute at Centennial.....	51
Gases, compressing (8).....	51
Gas meters (25).....	51
Gold size (21).....	51
Gun cotton experiments.....	51
Guns, depressing (15).....	51
Guns, proportions of (39).....	51
Horsehoes, tool for bending.....	51
Ink, new indelible.....	51
Ink, red.....	51
Inventions patented in England.....	51
Iron, precipitating (19).....	51
Iron rust from marble (45).....	51
Kaolin, American.....	51
Kaolin, pocket and drag.....	51
Leather, softening (29).....	51
Locomotives at Crewe, England.....	51
Marsh grass for paper (17).....	51
Mechanical movement, new.....	50
Mill rocks, raising (19).....	50
Mining, deep.....	50
Molding cylinders, method of.....	51
Muck beds, heat of (41).....	51
Muck from butter (44).....	51
Oil pipe lines.....	50
Optics of photography, the.....	50
Painting magic lantern glass.....	51
Paper pulp, hardening (13).....	51
Patent decisions, recent.....	51
Patents, American and foreign.....	51
Patents, official list of.....	51
Pattern making.....	51
Photographs, coloring (2).....	51
Photography, optics of.....	50
Pipes for pumps (16).....	51
Plans, multiplying.....	51
Practical mechanism—No. 7.....	51
Printing press, the Campbell.....	47
Propellers, proportions of (37).....	50
Pulleys, faces of (30).....	50
Pumping, underground.....	47
Pump, steam jet.....	50
Saws, driving fret (45).....	50
Screw, jack, power of (31).....	50
Siphon, effect of a (40).....	50
Soap mines, Californian.....	50
Soldering liquid (47).....	50
Springs under pressure (25).....	50
Steam jet and combustion.....	50
Stone in a stream, a (29).....	50
Strength of buildings (38).....	50
Telegraph, longitude by.....	49
Temperance investigations.....	50
Vacuum in water bottle (22).....	50
Water and power (27).....	50
Water at a distance, raising (1).....	50
Water for steamers (35).....	50
Water melons.....	51
Water plants.....	50
Water, pumping (4).....	50
Water, some sources of bad.....	49
Wheels on a curve (29).....	50
Wood ornaments (18).....	50
Wrench, improved.....	51
Zinc in boilers (14).....	50

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 30.

For the Week ending July 22, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876—Full Official List of the Judges, American and Foreign; Engines, by Cramp & Sons, 1 engraving.—American Iron and Steel Exhibit.—The International Carriage Exhibit, full description.—The Exhibit of Car Springs.—Notes of the Patrons of Industry, 1 engraving.—Exhibit of Lighthouses.—The Photometer.
II. ENGINEERING AND MECHANICS.—A Fly Wheel Accident, by J. H. B. R. 1 diagram.—Collier's Shearing Machine, 1 engraving.—Prime Movers, by F. J. BRANWELL, C. E.—Anti-Incorrustation Alloys. Apparatus for Laying Submarine Foundations, 4 figs.—Great Water Filter for Montreal Water Works.
III. TECHNOLOGY.—How to Build Cheap Boats, No. 4.—The Twelve-Dollar Boat, with 14 illustrations.
IV. LESSONS IN MECHANICAL DRAWING. By Professor MACCORM. With 15 illustrations.
V. CHEMISTRY AND METALLURGY.—Quino-Acetate of Calcium.—Thermic Formation of Gases.—Absorption of Free Nitrogen.—Origin of Organic Ferments.—Transparency of Flames.—Visibility of Beacon Lights.—Law of Duboué and Pettit.—Aniline Black.
VI. ELECTRICITY, LIGHT, HEAT, ETC.—New Theory of the Aurora, 2 engravings.—The Diathermometer, 2 figures.—Curious Atmospheric Phenomenon, 1 engraving.—Animal Electrical Currents.
VII. NATURAL HISTORY, ETC.—Duration of the Sense of Touch.—The Kentucky Shower of Meat.—The Goniometer, 5 figures.
VIII.—AGRICULTURE, HORTICULTURE, ETC.—Tobacco Culture.—The Jersey Breed of Cattle, 2 engravings.—Fruits of Keeping Cows.—A Cheap Milk House.—How Long to Milk a Cow.
IX. MEDICINE, HYGIENE, ETC.—Addition Perspective Glasses.—Pneumatic Method for Morbidity.—Arsenic in Diabetes.—Deaths from Snake Bites.—Transplantation of Hair.—Marriage of Near Kin.

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A SENSIBLE CELEBRATION—WHAT WAS DONE IN NEW YORK CITY.

The people have very good cause to congratulate themselves over the very sensible manner in which the Centennial anniversary was celebrated. In this city—and the same appears to have been the case generally elsewhere—the tendency to abandon the Chinese method of signifying rejoicing by hideous noises of fire crackers, torpedoes, pistols, and similar ear-splitting contrivances, and to substitute therefor the silent but more eloquent display of banners, flags, and illuminated lanterns was plainly manifest. By what process of election, during the early history of the nation—unless we mingled ideas of Guy Fawkes' day, derived from the mother country, in a very uncomplimentary manner with our national holiday—we were ever induced to adopt the fire cracker as a symbol of joy, must remain a mystery. Suffice it, however, that the popular predilection for the noise nuisance is on the wane; and we may hope, in each recurring holiday, to see the inherent taste of our people exemplified by new and beautiful decorations, and all classes gratified, instead of a few finding pleasure in a species of amusement of which the annoyance of others and the endangering of life and property are the too common results.

Those who can recall the illuminations of New York city during the war, after Union victories, or her magnificent outburst of patriotism, demonstrated by draping almost every edifice in bunting, shortly after the rebellion broke out, say that even these demonstrations were exceeded in grandeur by the display made recently in New York. For weeks past the dry goods stores have been filled with national flags by the million. It would seem as if manufacturers of cotton goods and delaines have, of late, made nothing but the stars and stripes, or red, white, and blue fabrics. For the first time we saw an innovation in the shape of American flags of bunting, 9 and 10 feet in length, and also smaller silk ones, entirely printed on a single piece. It certainly is a curious fact that, during the immense demand for flags in the war time, no one produced them in this way, and that, with the exception of the cheaply printed affairs for children, there were no flags made except those sewn together piece by piece.

Foreseeing the prospective demand for lanterns and lights, for illuminating purposes, a variety of ingenious contrivances were devised. There were lanterns made of pasteboard, in flower pot shape, with holes covered over with colored paper in fanciful designs. Inside of these, instead of a candle, was a little cup, full of a composition of tallow and wax, in which a wick floated. The cup had a long handle, and was made of tin or other cheap metal. The light emitted was equal to that of two or three candles, and the contrivance was far more safe than the latter. Another form of lantern was a large black box which fitted on the window sill. Each box had three or four colored disks let in apertures in it, so that a house, having boxes at all the windows, looked as if in each window there were balls or globes of colored fire. We noticed two or three ingenious devices for holding flagstuffs at an angle in windows, which were quite new, and which met with a ready sale.

Not only on the great thoroughfares, but even in the most unfrequented streets, up in the windows of crowded tenements, on the roofs of street cars, on the heads of horses, on vehicles, on apple stands, on nearly everything, the national colours appeared. Whether it was only a penny paper print of the flag fastened to the dirty walls of some rookery, or the magnificent designs worked in embroidery on the elegant mansions in the fashionable quarter, the patriotic feeling was everywhere manifest. On the night of July 3 came the culmination. From river to river, from Harlem to the Battery, New York fairly blazed. High up on the topmost pinnacle of the great Western Union Telegraph building, an electric light threw its beams far up Broadway and across the rivers to Brooklyn and New Jersey. On Union Square, the central point, the lofty buildings which surround it were outlined with myriads of brilliantly colored lanterns; while just before midnight a procession of some fifteen thousand men, carrying torches, paraded the principal streets. At midnight the vast concourse had gathered in Union Square; and as the hour was reached, the thunder of a heavy gun from one of the forts in the harbor pealed over the city. At that instant a myriad of rockets shot up from the square. The chimes in all the churches, the steam whistles of the factories, the cannon in the forts burst forth in a chorus of rejoicing. The music of the national air was played by the united bands of a dozen regiments, the hundreds of members of the choral societies and the vast crowd of spectators joined in the anthem; and thus, with a celebration worthy of herself as the metropolis, New York welcomed the advent of a new century.

DO NOT GET COOL—HEALTH HINTS FOR THE SEASON.

"Is this paper out of its senses?" we can hear the reader exclaim, as he casts a wrathful glance at the vagrant mercury, rambling among the nineties. "Do not get cool, when the sun is scorching and there is no breeze, and the pavements are almost red hot?"

Hasten slowly, good reader. We do not object to refrigeration of oneself when it is done sensibly, but the trouble is that the majority of persons throw common sense aside with their heavy undergarments. There is a prevalent, though none the less stupid, notion that colds, and pleurisy, and pneumonia, and like maladies are peculiar only to winter and early spring, but the facts are that it is slightly easier if anything to incur these diseases with the thermometer at ninety, and infinitely more difficult then to get rid of them,

unless dealt with promptly. Therefore we believe that "don't get cool" is sound advice, for it is better to endure the heat while well than to endure it while sick and debilitated. We recently met with some of those axiomatic sayings of the late Dr. W. W. Hall (who recently died a victim to a malady against the contraction of which he most persistently warned others), written many years ago, but always timely. We have not room for all, but the substance compressed into a paragraph will serve our purposes. If on any occasion, he says, you find yourself the least bit noticeably cool, or notice the very slightest disposition to a chill running along the back, as you value health and life, begin a brisk walk instantaneously, and keep at it until perspiration begins to return: this will seldom fail to ward off a summer cold, which is more dangerous than a cold taken in winter to all persons having the slightest tendency to consumption. If you have walking and riding to do, ride first, because if you walk you may get overheated; and then, when you ride, you may be exposed to a draft of air likely to be followed by a chill, a cold, pleurisy, or lung fever, which is pneumonia.

Not a summer passes but that the papers report numerous deaths from drinking ice water by overheated people. For purposes of quenching the thirst, water not cooled to a very low degree is much less harmful and more grateful; but if icy cold water be taken, safety lies only in drinking slowly. Take one swallow at a time, remove the glass from the lips, and count twenty slowly before taking another. It is surprising how little water will quench the thirst when thus drunk. Soda water is a favorite beverage, and bears about the same relation to cool spring water as candy does to bread. It does not slake the thirst as well as water, and, besides, one is apt to drink too much of it.

When you reach home after a day's work, tired and weak perhaps with an undefinable feeling of lassitude or depression, don't attempt to raise your spirits by drinking ice water, however thirsty. A cup of hot tea may be wisely taken by most persons, but does not agree with all. The heat is of more value than the tea itself, but both combined act beneficially on most persons. The degree of debility and downward progress of the system is arrested by the warmth of the water and the stimulating quality of the tea, until strength begins to be imparted to the system.

Never take a nap in the daytime uncovered. Many lie down for a few moments, merely to gain a brief rest, without intending to go to sleep. Too often, however, on waking up, a chilly feeling admonishes one that he has taken cold, which may be the precursor of serious illness.

Both comfort and cleanliness are subserved by wearing woolen gauze next the skin. Furthermore, this fabric prevents the sudden cooling of the body and absorbs the perspiration. Colds are caused by the temperature being too suddenly lowered. Woolen fabrics worn next to the person prevent this, as we have said, and at the same time obviate the disagreeable feeling of dampness felt when linen, especially, is next the skin. All garments worn during the day should be removed at night and thoroughly aired and dried. All changes from a heavy to a lighter clothing in summer should be made at the first dressing in the morning. It is safer to wear too much clothes than too little, especially for children, invalids, and old people.

We will relax our negative advice in one case, and then only in a metaphorical sense: in other words, in hot weather keep cool, don't worry. Persons who allow themselves to become mentally exhausted, by anxiety or strain of any kind, are particularly liable to sunstroke. It is a foolish popular idea that this terrible malady is due to the concentration of the sun's rays on the head. Persons are frequently struck, as it is termed, in the night, but are more apt to be so late in the afternoon, when the system is depressed by the heat and nervous exhaustion. The way to avoid sunstroke is to order one's doings so that vitality shall not be lowered, and the conditions favorable to the disease superinduced. A sunstroke, if not fatal, leaves the patient less able to endure mental or physical work ever after, and requires from him constant care against pulmonary disease or a second visitation. Avoid worrying the brain and an undue exposure to the sun, and, more important still, do not depress the system and lower the bodily temperature by the use of mis-called "stimulating" alcoholic drinks. To sum up all in one sentence: Do nothing to lower the normal bodily temperature. No matter how hot the weather, the temperature of the healthy body is invariable at 98°. Cooling below this is not refrigeration but depression, no matter how it is produced; and depression means loss of vitality, proclivity to disease, and death.

Since the above was written, a report of the sanitary committee of the Board of Health of this city has been made, in which it is said: "Sunstroke is caused by excessive heat, and especially if the weather is 'muggy.' It is more apt to occur on the second, third, or fourth day of a heated term than on the first. Loss of sleep, worry, excitement, close sleeping rooms, debility, and abuse of stimulants predispose. It is much more apt to attack those working in the sun, and especially between the hours of 11 o'clock in the morning and 4 in the afternoon. On hot days wear thin clothing. Have as cool sleeping rooms as possible. Avoid loss of sleep and all unnecessary fatigue. If working in doors and where there is artificial heat, see that the room is well ventilated.

"If working in the sun wear a light hat (not black, as it absorbs heat) and put inside of it, on the head, a wet cloth or a large green leaf; frequently lift the hat from the head and see that the cloth is wet. Do not check perspiration, but drink what water you need to keep it up, as perspiration prevents the body from being overheated. Have, whenever possible, an additional shade, as a thin umbrella when walk

ing, a canvas or board cover when working in the sun. When much fatigued, do not go to work, or be excused from work, especially after 11 o'clock in the morning on very hot days, especially if the work is in the sun. If a feeling of fatigue, dizziness, headache, or exhaustion occurs, cease work immediately, lie down in a shady and cool place, apply cold cloths to and pour cold water over head and neck. If any one is overcome by the heat, give the person cool drinks of water or cold black tea or cold coffee, if able to swallow. If the skin is hot and dry, sponge with or pour cold water over the body and limbs, and apply to the head pounded ice wrapped in a towel or other cloth. If there is no ice at hand, keep a cold cloth on the head, and pour cold water on it as well as on the body.

"If the person is pale, and very faint, and his pulse feeble, let him inhale ammonia for a few seconds, or give him a teaspoonful of aromatic spirits of ammonia (hartshorn) in two tablespoonfuls of water with a little sugar."

SOME SOURCES OF BAD WATER.

There is no such thing as pure water, neither at the sources nor anywhere else, except in a laboratory. Pure water, therefore, or good water, in ordinary parlance, is understood by the engineer to mean a palatable wholesome water, not insipid like rain water, and not foal by the reception of that class of impurities which endanger the individual health. Unpolluted water, as we have explained in a previous article, is tasteless, inodorous, possesses a neutral or faintly alkaline reaction, rarely contains in 1,000,000 lbs. more than $\frac{1}{16}$ lb. of carbon and $\frac{1}{16}$ lb. of nitrogen in the form of organic matter, and is incapable of putrefaction, even when kept for some time in close vessels at a summer temperature. The chief causes of pollution are found in the refuse fluids from factories and in animal sewage. By a recent law in Massachusetts, the Board of Health of that State was required to investigate the pollution of rivers, estuaries, and ponds, by such drainage and sewage. And in the seventh annual report of that body we find a valuable and complete record, in which are included detailed descriptions of industrial refuse, which now, as our industries expand, threatens greatly to impair the purity of our water sources, and so react unfavorably upon the public health.

Than some of the liquids for which there is no utilization, and which are allowed to contaminate running streams, it is difficult to imagine anything more nauseously filthy. To make thirty tons of woolen cloth, for example, over eighty-six tons of matter composed of grease and dirt from the raw wool, urine, oil, glue, pigs' dung, pigs' blood, urine (second use), soda, common salt, soap, fullers' earth, dyestuffs, and alum are discharged into the nearest water courses. Cotton manufacture involves the pollution of large volumes of water, partly by mineral, but chiefly by organic matters. Nearly the whole of madder dyestuff is waste. We may gain some idea of the extent of the pollution from the fact that an average factory, of 250 hands, sends out some 600,000,000 gallons of foul water per annum, charged with some 1,446,000 lbs. of refuse matter, including 42,560 lbs. of arsenate of soda, containing 833 lbs. of metallic arsenic. All the chemicals used find their way into the stream. From calico dye and print works, the total impurities are found to be 76.2 per 100,000 parts, and, from Turkey red dye works, 105.7 parts. Linen and jute bleacheries discharge caustic soda, lye, waste chloride of lime liquor, waste sulphuric acid liquor, and waste carbonate of soda and soap liquor. Works for dyeing linen and jute contribute polluting liquids essentially the same as those produced in the calico industry. Silk works discharge comparatively small quantities of dyes and gums. Papermakers contribute refuse from the dusting process, lime refuse from the treatment of soda, alkaline waste liquors from the boiling process, the insoluble part of bleaching powders, the waste bleaching liquor if used in excess and without due caution, and the drainage of the making machines. Next to the fouling of water by the washing of filthy rags, the discharge into rivers of the soda liquor in which esparto has been boiled is the most formidable source of pollution from paper mills.

In comparison with the damage which is inflicted upon river waters by the sewage of towns and by drainage of textile fabric factories, the damage caused by the metal trades, with one or two exceptions, is quite insignificant. It consists of pollution by cinders, scoriae, and furnace ashes, by acids, and by metallic salts. Iron works pollute streams in an insignificant degree by the water used for cooling the rolls, which becomes charged with tar or coarse grease from the bearings. The waste liquors discharged from wire and galvanizing works are the most intense and noxious sources of pollution contributed by any of the metal industries. The waste contents of acid baths render river water unfit for the support of fish life, and the free acid corrodes the cement and loosens the brickwork of sewers. In some tin plate works, the sheet iron, previous to receiving its coating of tin, is pickled repeatedly in dilute sulphuric acid; but the waste liquor, instead of being discharged as formerly into the neighboring stream, is concentrated in shallow leaden evaporators, until, on cooling, it deposits a copious supply of crystals of green copperas, which is sold at a small profit. The mother liquor from these crystals is fortified with fresh sulphuric acid, and used over and over again, none being allowed to go into the streams.

The effect upon fish of a number of leading and potent polluting substances, occurring as manufacturing refuse, was the subject of elaborate experiments in Scotland some years ago. The information thus obtained was of great value, as showing the degree of dilution at which the noxious

matters prove fatal or are within safe limits. Goldfish and minnows were employed, the one species for its tenacity of life, the other on account of its delicate vitality. It appeared that, of nitric and sulphuric acid, one part in fifty thousand of water killed the fish. Carbolic acid was found peculiarly destructive; and tannic acid, in the proportion of $\frac{1}{4000}$ for minnows, or $\frac{1}{8000}$ for goldfish, caused death. Sulphate of copper was the most virulent metallic salt, a strong fish dying in water which contained only $\frac{1}{100000}$ part. Other substances proved fatal, as follows: Sulphate of iron and of alum, $\frac{1}{100000}$; acetate of lead, $\frac{1}{100000}$; chloride of lime (saturated solution), $\frac{1}{100000}$; chlorine (saturated solution), $\frac{1}{4000}$; iodine, $\frac{1}{80000}$; bromine, $\frac{1}{320000}$; caustic potash, $\frac{1}{300000}$; foundry coke, $\frac{1}{100}$; furnace cinders, $\frac{1}{100}$; coal tar, $\frac{1}{80000}$.

The most deadly of all contaminations is sewage, and this is now believed by chemists to be all but indestructible, being only rendered insensible in the water by being diluted with at least 100 times its volume of good water. Ordinarily, the human stomach is apparently unaffected by water exposed to a considerable measure of impurities; but it becomes fearfully sensitive to the same waters during the prevalence of an epidemic. This was conclusively shown to be the case during the terrible cholera visitations in London in 1849 and 1854. It may be added that the evil effects of much polluted water, as compared with water but little polluted, which become so palpable during epidemics, cannot cease to exist, except in degree, when no epidemic prevails. Accordingly as the river waters are cleansed from the impurities which now are expected to hide themselves there, the general health of all living things depending on them and using them must be benefited.

THE CENTENNIAL EXPOSITION.

The ceremonies at Philadelphia on July 4 partook of a national character, and in this respect they must be distinguished from the local celebrations which took place in every city, town, and village in the country. Although not occurring on the Centennial grounds, they were, nevertheless, a part of the great scheme whereby we emphasize our rejoicing over the completion of the first century of national existence, and they therefore must be chronicled with the history of the Exposition.

The military parade which preceded the ceremonial included representative militia regiments and companies from the different States, the U. S. Corps of Cadets, detachments of sailors and marines, and civilian societies, making a display fully in keeping with the importance of the occasion. At a comparatively early hour, Independence Square, where the grand stand had been erected, became thronged; and when the formal proceedings commenced, the crowd was estimated at over 100,000 people. On the platform was grouped an array of distinguished men, such as has rarely before been seen. The Vice-President of the United States, in the absence of President Grant, presided. About him were the Emperor of Brazil, the Crown Prince of Sweden, Governor Hayes of Ohio, and the Governors of several other States, General Sherman, Count Rochambeau, besides the Foreign Centennial Commissions, the Diplomatic Body, and other dignitaries. The orchestra opened the proceedings by performing the grand overture composed for the occasion, which was followed by prayer by Bishop Stevens, of Pennsylvania. The hymn of welcome to all nations, by Dr. O. W. Holmes, was then sung. The most impressive episode of all succeeded. The Vice-President's announcement of what was to come was not audible to the vast crowd; but when the Mayor of Philadelphia stepped upon the rostrum, holding aloft a faded yellow piece of parchment enclosed in a simple frame, the cheer which arose attested the recognition by the people of the original Declaration of Independence. The scene of enthusiasm which the production of the immortal document elicited baffles description. The applause became a mighty roar, the infection spread to the sedate dignitaries on the platform, and all rose to their feet and joined in the tremendous ovation. None cheered more lustily or swung his hat more vigorously than did His Majesty Dom Pedro II. Again and again the acclamations burst forth, until at last, through sheer weariness of its makers, the noise died away. Then Mr. Richard Henry Lee, grandson of the mover of the Declaration in the Centennial Congress, received the document, and in a clear voice read it. The Brazilian hymn, composed in honor and by order of Dom Pedro, was next rendered by the orchestra and chorus, and its repetition was demanded by the people. A superb ode, by far the finest lyric production which the Centennial year has brought forth, was recited by its author, Mr. Bayard Taylor, and received with storms of applause. Lastly followed Hon. William M. Evart's oration, a noble address, a shade too purely intellectual in character, perhaps, for the average thought, but none the less brilliant, masterly, and able. Its nature is such as to forbid abstraction; but the keynote of all was that the Declaration created what was declared, the independence of a new nation. The oration terminated the formal proceedings at Independence Square.

On the Exposition grounds, the Catholic temperance fountain and the Humboldt monument were dedicated with appropriate ceremonies. The attendance (in all 46,125), was somewhat above the average, a fact remarkable in itself in view of the other attractions in the city. Thousands of visitors from New York and other cities arrived, taking advantage of the holiday, and manfully doing the Exposition, despite the almost intolerable heat of the weather.

The Exposition itself is now running as smoothly as could be desired, and the only discontented people are those foreign exhibitors who are converting the fair into a market by selling their articles. They are required, under present

custom house regulations, to pay duties on an entire in voice before a single object pertaining thereto can be delivered to the purchaser, and this regulation they are endeavoring to have abrogated. The encampment of the West Point cadets in the grounds has added a new attraction, and the morning and evening parades are attended by thousands of people.

We gave last week a brief account of the

RUSSIAN EXHIBIT

in Machinery Hall. The principal display made by that nation is in the Main Building, and no part of the Exposition will more richly repay careful study. Russia is but little known to Americans by her productions, although accounts of her recent achievements in industry have not been wanting. The opportunity here afforded, of learning something definite regarding the wonderful growth, notably in art industries, the taste for which did not exist in 1851, but which now in Russia has reached almost a mania, is therefore of the highest value. It is not extravagant praise to say that the Russian exhibit is superb. The silver work is not excelled in the entire fair. Very curious effects are produced by imitations in white silver of the Russian napkin, with the border worked out in such a faithfully minute manner that the threads can almost be counted. These napkins sometimes form the covers of punch bowls, sometimes appear as if carelessly thrown over salvers; and so exquisite is their workmanship that they might easily be mistaken for real fabrics of linen. A peculiar Russian industry is the manufacture of a variety of articles from stones found in the Ural mountains. Malachite, jasper, and lapis lazuli are the materials mostly used; but there are also articles made of minerals quite unfamiliar in this country, such as labrador, rhodonite, and nephrite. Very beautiful are the bunches of fruits carved from the various stones, the natural colors of which reproduce almost exactly the colors of the natural fruit. We have already, in a previous article, described the magnificent malachite mantelpiece and vases. There are also numerous small tables of the same precious mineral, valued at from \$100 to \$1,000 each. A unique collection of fabrics come from Circassia, all of which are exquisitely embroidered in silk and in gold and silver. The display of furs is the finest in the Exposition, and some idea of the beauty of the articles may be formed from their cost. A little bunch of sable skins, of the finest quality, is valued at \$2,400, a lady's cape of black fox fur is marked \$1,400, and a cloak made of the backs of sables is valued at \$2,700. Some gold jewelry is exhibited, remarkable for the delicate shadings of color, varying from the lightest straw yellow to brownish red. This is produced, we learn, simply by subjecting the metal to various degrees of heat. A pavilion of graceful form is devoted to the display of rubber goods, an American industry introduced recently in Russia, which has met with remarkable success, the product of the single factory making the goods amounting, it is said, to \$5,000,000 in value per year. Some handsome carved work comes from the government school in St. Petersburg. The most noticeable object is a peasant's chair in black walnut, across the seat of which lies the imitation of a towel made of some white wood. The handles are formed of hatchets. At the back of the seat is a pair of mittens admirably carved, and in the frame appears the characteristic motto in the Russian language: "Go slow and you will go far."

The Russian government is represented by superb collections of minerals and fossils, and of school books, school furniture, and other objects relating to education. Among the other exhibits are pianos, scientific instruments, amber, soap, chemicals, ladies' cloaks of velvet lined with the white hair of the Thibet goat, fans, and umbrellas. There is also a jeweled figure of St. Alexander Nevsky standing in a kind of shrine, which may be purchased for \$3,500.

In Agricultural Hall the Russian display well represents the farming industries of the empire. There are grains of all kinds in sacks with glass covers and in sheaves, flax, wool, and dried fruits, canned goods, biscuits, wines, liquors, and so on through a long catalogue. The agricultural implements consist only of a mower, a thrasher, and a few fanning mills. Russia also makes an admirable exhibit in the Shoe and Leather Building, showing shoe and upper leathers, kid boots, shoes, gloves, etc., all of fine manufacture.

For a long time it was supposed that Russia would make no display at all; but when her government concluded to participate, it evinced prompt energy and liberality. A commission appointed at the eleventh hour made a list of the articles wanted and of the manufacturers who produced the best of each kind. The government undertook the payment of freight and insurance to and from Philadelphia, and of all expenses of installation. Thus, in a remarkably short space of time, a thoroughly good and, in some respects, exceedingly brilliant exhibit was organized.

Longitude by Telegraph.

The *Philosophical Magazine* has an article on the determination of the longitude of Cairo, from Greenwich, by the exchange of telegraph signals, by Captain C. Orde Brown. The actual experiments were between Portcurnow and Alexandria, the whole series of cables being joined direct. The total length of cable was 3,222 nautical miles; 40 Menotti cells were used, although signals were read with 12 cells. The mean loss of time before the signal or make of circuit was visible was 134 seconds, and that before break of current signal was 128 seconds, the mean being 131 seconds.

The Society of Arts, Geneva, Switzerland, celebrated the first century of its existence on June 1, 1876.

IMPROVED STEAM JET PUMP.

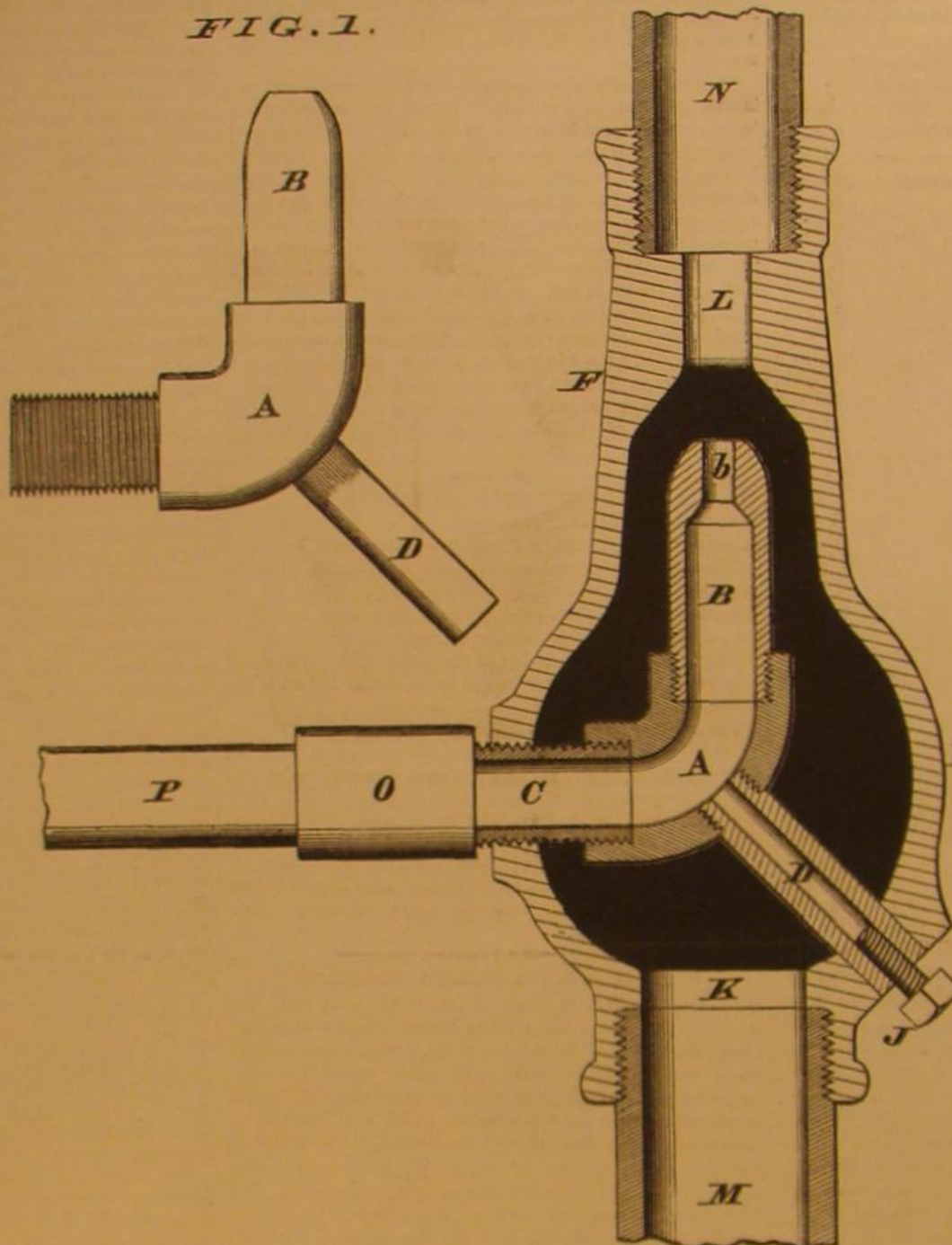
It has been customary to cast the nozzle of the above named pumps in one piece with the shell of the pump; but, owing to the peculiar shape and internal position of the nozzle, it has been found to be a difficult matter to impart a smooth finish there. An undue amount of friction is thus opposed to the passage of steam and water through the pump, which impairs the efficiency of the device.

The device herewith illustrated is mainly intended to overcome the difficulty. A, Fig. 1, represents an ordinary elbow, such as is used with gas and steam fittings, and a side elbow has the nozzle or jet pipe, P, screwed into it, as shown in Fig. 2. This nozzle is furnished with an ajutage, b, of a bore adapted to the capacity of the pump. Projecting horizontally from this elbow is a short pipe, C. Radiating from said elbow is the tube, D, whose office will presently appear. The above described devices A, B, b, C, c, and D, after being fitted together in the manner shown in Fig. 1, are then placed in a suitable mold, and the shell cast around them, after which the core is removed and the body of the pump is complete.

By referring to Fig. 1, it will be seen that the shell is composed essentially of an enlargement, E, and a neck, F, the enlargement being chambered out so as to afford ample space around the elbow and nozzle for the passage of water. The tube, D, is tapped for the engagement of a screw-threaded plug, J, that can be readily removed whenever it is desired to drain the pump, so as to prevent freezing. K and L represent, respectively, the inlet and discharge orifices of the shell. M and N are, respectively, the suction and discharge pipes, which communicate with the previously described orifices. O is an ordinary coupling that unites the projecting end of the pipe, C, with the steam pipe, P. The body, EF, with its unclosed nozzle, ABC, is ready for use almost as soon as it is taken from the mold. The coupling, O, and steam pipe, P, are now applied, after which steam is turned on, and the apparatus then operates in essentially the same manner as ordinary jet pumps. An economy is claimed by the inventor to result from the unimpeded flow of steam within the nozzle, formed of A and B, and of water around the same, which cannot be obtained when the parts, A and B, are rough castings.

The invention was patented March 7, 1876, by Mr. Hanson P. Tenant, of Newcastle, Ind.

FIG. 1.



TENANT'S STEAM JET PUMP.

COMBINED POCKET AND DRAW KNIFE.

An ingenious device, patented February 29, 1876, by Mr. John W. Pierre, of New Bedford, Mass., is a tool which may be used for a draw knife, and for all purposes required of an ordinary pocket or clasp knife. It consists in a clasp knife, having one or more blades, one of which latter is provided at its outer end with a ring of sufficient size to admit the finger, as shown in the annexed engraving. To use the tool as a draw knife, the handle is grasped by one hand of the user, and one of the fingers of his opposite hand is inserted within the ring. When the blade is closed, the ring



will extend beyond the butt of the handle, and afford a convenient means whereby the knife may be suspended from the person.

Bessemer Steel in France.

In an action brought by Mr. Bessemer against M. Schneider, of Crenet, a decision was given by the Court of Appeal against the plaintiff on April 29 last. "This decision," says the *Bulletin* of the Committee of French Forges, "extinguishes the claims of Mr. Bessemer, and is of extreme importance for the whole of the French trade. Had the claims of Mr. Bessemer been recognized, this recognition would have affected every maker of steel except M. Schneider." Bessemer steel is at present a cheap article in France, and this decision will not increase the price.

The Coca Leaf.

Sir Robert Christison showed recently, before the Edinburgh Botanical Society, that diversity of opinion had existed among chroniclers and travelers in regard to the effects

of coca upon those who chew it; for, while most of them considered that it possessed wonderful powers of sustaining strength under prolonged fatigue without food, some thought its use pernicious and dangerous, others, not only innocuous, but beneficial to health. The annual consumption of the leaf, by the eight millions of people along the Cordilleras of the Andes who use it, is thirty millions of pounds. After giving a description of the coca plant, and the method of gathering and drying its leaves, Sir Robert gave an account of some experiments made upon some of his students and himself, in which he had found that it was both a preventive of

isolation of the water from all the workings; the durability of the shafting; the great diminution in the cost of the sinking the shaft; the obviation of any necessity for pumping machinery during the boring and nearly so afterwards; the greater degree of comfort to the miner by the absence of water and the possibility of traversing any number of water levels irrespective of the amount of water they contain.

Lecture Experiments with Gun Cotton.

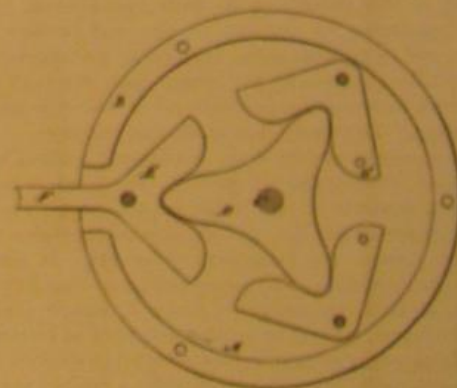
Dr. A. Vogel describes several methods of proving that nitrous and nitric acids are among the gaseous products of the combustion of trinitro-cellulose or gun cotton. A tuft of gun cotton is placed in a large test glass which tapers to a point beneath, ignited, and covered as quickly as possible with a glass plate. The interior of the glass is immediately filled with the characteristic yellowish red fumes of nitrous acid. When gun cotton is ignited on a piece of moistened litmus paper, it colors the paper red. It also reddens tincture of litmus, if burned in a beaker glass on the bottom of which is some of the tincture. When burned on a strip of moistened iodide of potassium and starch paper, gun cotton leaves a dark blue spot. The characteristic test for nitric acid with brucine can be obtained by burning the gun cotton in a conical test glass, at the bottom of which are a few drops of water, and covering with a glass plate. The water at the bottom of the glass has a strongly acid reaction and exhibits this reaction if placed on a watch glass in contact with brucine and sulphuric acid.

A curious reaction takes place when an ounce of collodion is mixed with an equal volume of concentrated nitric acid. The reaction is very violent, red fumes are evolved, heat is generated, and at the conclusion of the reaction nothing remains in the vessel but cotton, the alcohol and ether being totally destroyed or evaporated. The cotton, which now apparently possesses a fiber, is not only not explosive but is almost totally incombustible, its character having been totally changed during the experiment.

NEW MECHANICAL MOVEMENT.

We illustrate herewith a new mechanical movement for converting a rotary into a vibratory motion. It is adapted for use upon reapers, mowers, sewing machines, pumps, hammers, saws, and similar apparatus.

The case consists of two circular plates, A, attached to a hoop or flange, B, by which they are kept at the proper distance apart. To the center of the plates, A, is pivoted a shaft, C, to one end of which the power is applied. To the shaft, C, within the case, is rigidly attached a three-armed cam, D. To the case are pivoted one, two, or three blocks, E, which are made triangular in their general form, and are pivoted at their angle. The third sides of the blocks, E, are turned toward the cam, D, and are notched in such a way that, as the said cam revolves, each of its arms will strike the first arm of the block, E, push it back, enter the notch of said block, strike its other arm, and push it forward, so that each block will receive six distinct impulses at each revolution of the cam, D.



Motion may be communicated from the block, E, to the object to be vibrated by an arm, F, formed upon the said block at its pivoted angle, as indicated at the left hand side of the figure, or by connecting rods pivoted to the ends of the arms of said blocks, as indicated by the pins, G, at the right hand side of the figure. The device was patented through the Scientific American Patent Agency, May 30, 1876, by Messrs. J. Jordan and George Naylor, of Salt Lake City, U. T.

fatigue and a restorative of strength after severe bodily exertion, and that it had no reactionary effect upon the system. In regard to the use of coca as a medicine, he advised no one to try it until something more was known about it, or, at least, not to make use of it without consulting a physician. He had succeeded in extracting a liquor from the leaf, as a more satisfactory mode of administration than chewing the leaf; but he had not been able to ascertain whether this retained all the properties of the article. A similar liquor of coca was to be had in Paris.—*Medical and Surgical Reporter*.

American Engines vs. English Engines in Holland.

The majority of pumping engines hitherto employed in Holland, for elevating water, have been furnished by English builders, who have practically had a monopoly in this respect of the Dutch market. They now find formidable rivals in American manufacturers. "The Fitchburg (Mass.) Steam Engine Company," says the *Moniteur Industriel Belge*, "delivered its first machine in Holland six months ago, and has recently delivered its eighth engine in Amsterdam."

"This shows," continues our contemporary, "that with perseverance, profitable results may be attained, and it is certain that, if the American builders can compete advantageously with the English in a country like Holland, they will succeed in time, and by patient efforts, in establishing for themselves outlets of trade in every European market."

Deep Mining.

At a recent meeting of the American Institute of Mining Engineers, Philadelphia, M. Julian Dely, of Belgium, read a paper on the process of sinking deep shafts. The difficulty to be surmounted in sinking mining shafts below the water level is to get a tubing strong enough to sustain the outside pressure. M. Chaudron, a Belgian engineer, finally solved it by constructing a tube of cast iron in sections with flanges, each section being thoroughly tested with hydraulic pressure. The advantages of this system are the complete

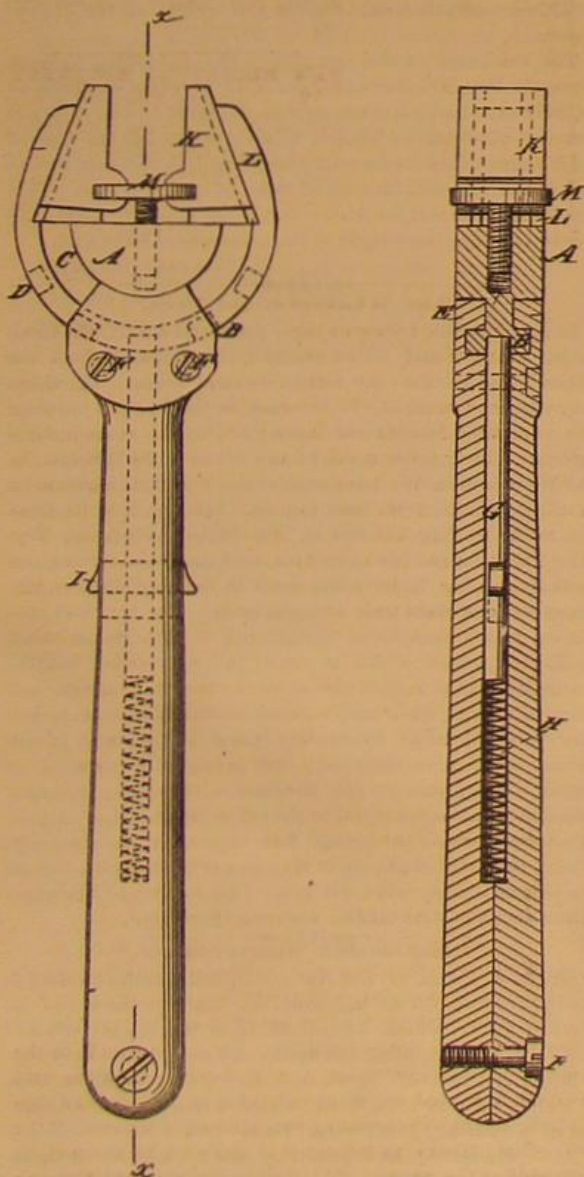
IMPROVED SELF-DISCHARGING COAL HOD.

We illustrate herewith an improvement in coal hods, designed to facilitate the discharge of coal into the stove, and to obviate the clumsy and awkward exertion with which every one is familiar. A rock shaft, B, is journaled in bearing plates, D, below the bottom of the hod, and is provided with a handle, E, in the rear and a crank in front. This crank is connected through the rod, C, with an eye, F, which latter passes through a narrow slot in the hod, and is riveted to a sliding shovel, A. By tilting the hod and twisting or rocking the shaft, B, to and fro, as in Fig. 1, the shovel, A, slides back and forth under the coal, and discharges it smoothly and uniformly into the stove without spilling. The additional cost to a hod is but trifling, as all the parts necessary to fit up an ordinary hod are shown in Fig. 3, namely, a shovel, A, formed of one half pound of No. 17 sheet iron, and one half pound of malleable iron castings, B C D E F, costing in all about ten cents. The invention is a cheap, simple, useful, and apparently practical one. It adds but imperceptibly to the weight of a hod, and does not interfere with the holding capacity of the same. It is attachable to any of the hods in use, and does not destroy the utility of the hod even if the devices become broken. It avoids battering the end of the hod, and dispenses with the rear handle. It does not soil the hands while operating the hod, and its attachment to the hod involves no change in the shape of the latter which would prejudice its popularity.

Patented through the Scientific American Patent Agency, February 9, 1875, and March 16, 1875, by Edward W. Byrn, 309 C street, N. W., Washington, D. C. Correspondence is solicited with manufacturers with a view to effecting a sale or manufacturing on royalty.

IMPROVED WRENCH.

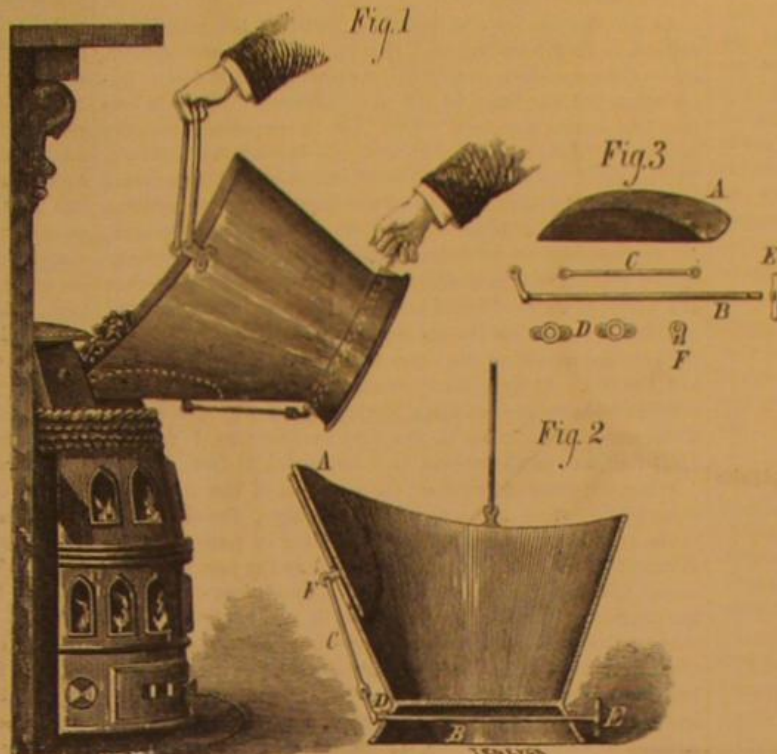
Mr. Wilbur J. Squire, of East Haddam, Conn., has patented (March 14, 1876) through the Scientific American Patent Agency, a novel form of wrench, engravings of which are given herewith. The jaw head, A, is constructed with a circular base, B, and a circular groove, C, on each side, also with pin holes, D, in the base. The handle is made in two parts longitudinally, which are grooved to receive the base and have a curved flange, E, to fit in the grooves of the head and secure it when the parts are fastened by screws, F. The parts of the handle are also grooved to receive the stop pin, G, and the spring, H, which are used for fastening the jaw head. These are notched to let the thumb studs, I, project sufficiently to pull the pin back for releasing the jaws. The latter are dovetailed on the inclined forks, L, of the head, to slide forward and backward so as



to be adjustable for different sized nuts. The disk-headed screw, M, is notched in the jaws and screwed in the head so as to work the jaws backward and forward.

Injections of Carbolic Acid in Rheumatism.

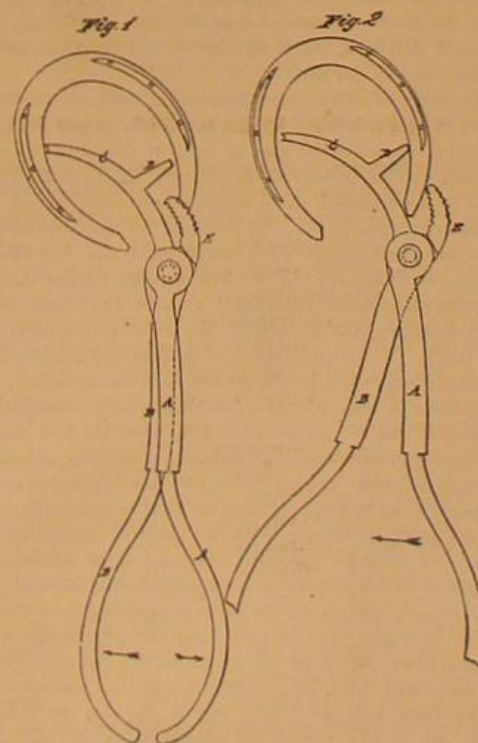
Injections of carbolic acid have been used with benefit to relieve the pain of acute rheumatism, by a hospital surgeon, Dr. A. Scharpinger. The method is similar to that practised at St. Francis' Hospital, and consists in using an aqueous solution, containing from three to five per cent of the acid. About twenty minims of this solution are used at each injection in the neighborhood of the affected joint, and the results, though not permanent, are sufficient to relieve the patient temporarily. In regard to this species of medication an important question arises, and it is this: Does the relief come from the water of the solution, or from the contained acid? When it is remembered that a large

**BYRN'S SELF-DISCHARGING COAL HOD.**

number of cases have been reported in which water alone proved sufficient to relieve paroxysms of pain for a short time, it would seem that our knowledge of the effects of hypodermic medication is by no means complete, and that further observations are necessary in this direction.—*New York Medical Journal*.

IMPROVED TOOL FOR BENDING HORSESHOES.

Mr. William Ray, of Poplar Post, Ohio, has invented a tool for straightening and bending horseshoes, of which Fig. 1 is a side view, shown in position for straightening a shoe. Fig. 2 is a side view of the same, shown in position for bending a shoe. A and B are the two handles of the tool, which are pivoted together in a manner similar to a pair of pinchers. Upon the forward end of the handle, A, is formed a



long jaw, C, which is curved outward, and its end is notched to cause it to take a firmer hold upon the edge of the shoe. Upon the middle part of the inner or convex side of the jaw, C, is formed a short arm, D, projecting at right angles, or nearly at right angles, with the jaw, C. Upon the forward end of the other handle, B, is formed a short jaw, E, which is curved inward, and has teeth formed upon both its inner and outer sides, to cause it to take a firmer hold upon the end or heel of the shoe.

In use the tool is placed between the ends of the shoe, with the end of the long jaw, C, resting against the inner edge of the shoe between the first and second nails, or thereabout, and the short jaw, E, resting against the inner corner of the end of the shoe, as shown in Fig. 1. Then, by drawing the handles, A B, apart, the shoe will be straight-

ened or spread. To bend the shoe, the long jaw, C, is placed within the shoe, with the end of the arm, D, resting against the arm of the shoe to be drawn inward or bent, and with the short jaw, E, resting against the outer corner of the heel of the said arm of the shoe. Then, by moving the handles toward the heel of the other arm of the shoe, the said shoe will be bent or contracted.

Water Melons.

Mr. George R. McKee, of Georgia, writes as follows:

"We do not market more than one third of the melons that we can produce, the balance being virtually wasted. It is with a view to utilizing this wasted crop that I request the subject continued."

To this, the *Maryland Farmer* replies:

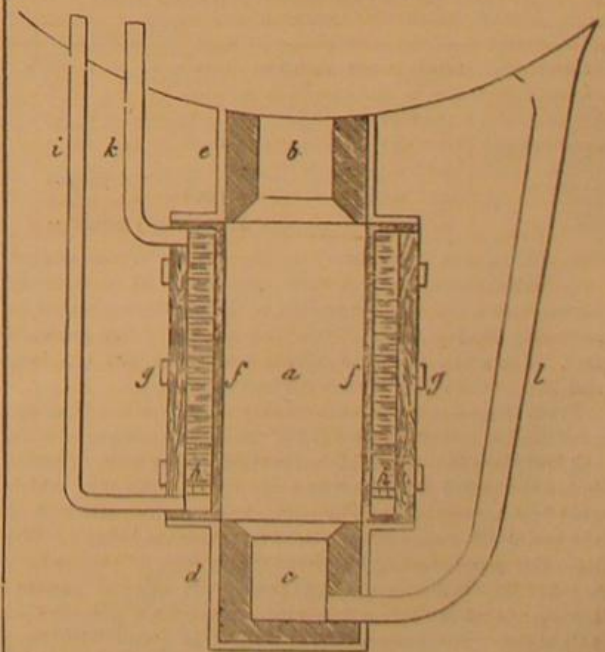
"There has been so little done in this direction, and so little experience had, that we can only give our own operations. We peeled off the rind, took out the seeds, and then crushed the melons in a cider press, squeezing out the juice; then boiled and evaporated it, in the same way as we do the sap of maple or the juice of the sorghum, and each operator will know when he has boiled it to the consistence or thickness desired; and then it should be stirred in shallow pans—like milk pans—over a gentle heat, until it becomes granulated, or "sugared off," as they say in the maple sugar works, when sirup is converted to sugar.

"We can give our readers another useful hint for utilizing their surplus water melons. It is this: Last year we saw some Virginia farmers feed water melons to their milch cows, when they came up at night, with very good effect, by increasing the quantity and improving the quality of their milk. In other instances we have seen the good results of feeding cows sound water melons; after standing in the stall or yard over night, they eat melons with avidity in the morning."

NEW METHOD OF MOLDING CYLINDERS.

The method ordinarily employed for hardening the surface of cast iron cylinders consists in casting them in iron molds with thick sides. Besides possessing a large number of other disadvantages, this system does not allow of deep tempering, since the mold itself heats very rapidly and does not serve to cool the cylinder cast in it. The method devised by M. A. Tuck, of Donawicz, Austria, says the *Bulletin du Musée*, and in which water is employed to cool the cylinder, allows of continuing the cooling process as long as is desired, and of carrying the temper as far into the interior of the cylinder as the same is generally possible by outside refrigeration.

This result is obtained by a circulation of water outside the mold. The shell, f f, or rather the part of the same which surrounds the body, a, of the cylinder to be tempered, has double sides, so as to receive the water; the trunnions, b, have single sides. The interior envelope, that is to say, the real mold, f is of thick boiler plate. Its joints are welded, and it is provided with strong welded rings of wrought iron. This mold is placed vertically and surrounded by a cylindrical cover of wood, g, the heads of which are made watertight. As shown in the engraving, the tube, i, leads the water into the lower part of the mold, and the water enters by the openings, h, becomes heated, rises, circulating between the envelope, f, and the wooden wrapper, and leaves by the tube k, at the upper portion. The trunnions, b and c, of the cylinder, which are not to be tempered, are cast in molds, e and d, and in earth, placed with great care so as to prevent any possible contact of the molten iron with the



water. The molten metal is conducted in the ordinary manner by a conduit, l, which terminates at the lower portion of the lower trunnion, a. In the same way as the cooling can be regulated by the length of the water circulation, so can its intensity be varied by regulating the temperature of the water used.

(For the Scientific American.)

FACTS AND FIGURES CONCERNING THE EARTH AND ITS ATMOSPHERE.

It has recently been to me a matter of surprise that there are no published analyses of the atmosphere in the United States, or indeed in America, by an American. It is not that any notable difference is observable in the composition of American air, as compared with that of Europe, but because the intimate relations of the atmosphere to health and climate are assuming daily a more universally acknowledged importance.

A little more than half a century ago, Lord Cavendish bestowed his unsurpassed experimental skill upon the problem, to the extent of making five hundred determinations of the percentage of oxygen. With methods which now appear entirely inadequate, he finally settled upon the number 20.833, as expressing the average. The best mean result of the present day is 20.95, a little more than one tenth of one per cent over the number obtained by Cavendish. And yet Lord Cavendish could not satisfy himself that his experiments showed any difference between the air in London and in the country. Sufficient is now known to render it probable that the air in no two contiguous places is precisely the same. With all the mighty apparatus of winds and mountains, of diffusion and changes of temperature, the homogeneous mixture of the constituents of the atmosphere is never perfectly achieved.* The difficulty is better understood when the vast quantities of matter involved are considered, quantities not adequately realized when hundredths of one per cent only are discussed in the analytical results. I could not lay my hand upon these figures in a convenient form; and after calculating them from the best data available, the thought occurred of giving them a permanent form.

In his "Meteorology," Sir John Herschel states that, if the diameter of our globe be taken as 7,926 miles, the weight of the atmosphere is 11,070,853 trillions of lbs., or, making allowance for the space occupied by the land above the sea level, 11,100,000, that is, 11 trillions of lbs. A little closer approximation can be obtained by using the most recent determinations of the earth's dimensions. These are as follows:

	Polar radius in feet.	Equatorial radius in feet.
Bessel.....	20,853,662	20,923,596
Airy.....	20,853,810	20,823,713
Clarke.....	20,852,429	20,923,171

According to the last named authority, the equator also is elliptical, its major axis being 41,852,700, and minor axis 41,839,944 feet. Taking Clarke's figures as a basis, the volume of the earth is 38,239,431,000 cubic feet. By combining the results given above, we obtain 41,707,268 feet for a mean polar, and 41,846,980 for a mean equatorial diameter, and for the earth's mean diameter 41,777,124 feet or 7912.36 miles. If the earth's volume be calculated as a spheroid, on the former supposition, it amounts to 38,113,308,410, or trillions cubic feet: if a sphere, to 38,178,110,000 cubic feet which is 64,791,000 cubic feet in excess over the former somewhat more exact calculation. Accepting the latter number, however, as sufficiently correct for our purpose and much more convenient in the following calculations, we obtain for the volume of the earth 259,356,52 millions of cubic miles, its surface 196,68 millions of square miles, or 5483.1x 10¹² square feet, or 7895.98 billions square inches. Multiplying this figure by the average pressure the atmosphere exerts at 32° Fah. on every square inch of surface at the level of the sea, or 14,7304 pounds avoirdupois, we have a result not widely different from that given by Herschel, namely: 11,030,653x10¹⁵ pounds, or 5192,5523x10¹² tons.

If we assume that the weight of the atmosphere is approximately 11x10¹⁵ lbs., the weight of that portion of it displaced by the elevation of the continents is 630,658 billions of lbs. In fact it is not so much; it is 125,238 billions lbs. This calculation is readily made by recurring to the mean heights, obtained by Humboldt and other eminent geographers, for the elevation of the continents above sea level. We shall have, putting the results in tabular form:

Surface of	Area in square miles	Mean Elevation.		
		As calculated	As spread over entire continental area	As spread over earth's surface
Europe	3.5 millions	670 feet	45.98 feet	11.923 feet
Asia	17 "	1,150 "	393.38 "	99.92 "
North America	15 "	748 "	291.17 "	75.506 "
South America	5 "	1,900 "	300.78 "	80.551 "
Africa	11.5 "	900 "	75.12 "	7.677 "
Australia	3 "	300 "	1119.67 "	288.008 "
Land	58 "			
Water	145.08 "			
Earth	196.68 "			

It will be seen from the above that if the excess of land in America above sea level were spread over 51 millions of square miles, the mean elevation of the continents would be increased 291 feet, and, if over the surface of the globe, 75 feet. The mean elevation of the continents is 1,111 feet, and that of the entire earth's surface 288 feet.

From these figures, we can readily obtain quite a close approximation to the true weight of the earth's atmosphere. In the first place the weight of that portion resting upon the sea is found and added to that resting upon the continents, which give us a correct total. The pressure on each square inch of the sea, at 32° and at mean barometric pressure, being 14.7304 lbs., the corresponding weight of that portion of atmosphere is 8,614,751x10¹⁵ lbs. At 1110.67 feet of altitude the barometer stands at 28.755 inches and represents a pressure of 14.119 lbs. The corresponding weight is 2,890,671x10¹⁵ lbs.; 11,505,422 trillions of lbs., then, is the total. Or, in the second place, the entire surface of the globe, at a mean elevation above sea level of 288 feet, may be multiplied by the mean pressure at that altitude. This, at a barometric height of 29.672 inches, is 14,5631 lbs. The result is 11,503,461 tril-

lions of lbs., very slightly differing from that given above.

The weight of a cubic foot of air at standard pressure and temperature being 0.080066 lb., we get from the weights previously found 142,64x10¹⁸ cubic feet or 142,6166x10¹⁸ cubic feet for the entire volume of the atmosphere. This result is best understood by calculating the thickness of the envelope which such an atmosphere would form around the globe. It would be either 25,982 or 25,978 feet, according as the former or latter number is taken as representing the true volume of the atmosphere. A simple way of arriving at the thickness is by finding the relative heights of a column of mercury and a column of air at mean temperature and pressure. These would evidently be as the relative weights, which are as 1 to 10,513, and the corresponding height of the atmosphere is 26,214 feet above sea level.

At an altitude of 288 feet, the height of the barometric column is 29.672 inches, and the height of the atmosphere, above the mean elevation of the continents, 25,996 feet. Lubricating 288 feet from 26,214, the difference, 25,926, is less than the former numbers. This is to be expected from the increase of density as we go towards the earth's surface. The mean of the three values is 25,985 feet, and represents very nearly the actual height of the atmosphere of uniform density. This is 415 feet less than five miles. The very careful experiments made to determine the earth's density have shown that its weight cannot be very far from 5.56 times that of a globe of water of equal bulk, and this would be 5900,8681 trillions of tons. As the atmosphere weighs 5134.5 billions of tons, the weight of the latter is to that of the former, as 1 to 1,149,000. Their relative volumes are as 1 to 267. If the relative weights and volumes are represented by circles, the diameters of the circles in the first case are as 1 foot to 1,071 feet, and in the second, as 1 foot to 16.35 feet.

When we come to calculate the amounts of the many various bodies which make up the atmosphere, the variations in the results of the observers, depending in part upon the different methods of analysis employed and in part upon the actual variations in composition of the specimens of air analyzed, present us with a long array of figures to choose from. Besides the four principal constituents of the atmosphere, there are various compounds of nitrogen and oxygen, of carbon and hydrogen, of nitrogen and hydrogen, of hydrogen and sulphur, of hydrogen, nitrogen, and sulphur, to say nothing of salts of chlorine, sulphuric acid, nitrates, etc., diffused throughout the atmosphere by processes of combustion and evaporation, or set free by the agency of decay and putrefaction. It is only through its great complexity of composition that the atmosphere is qualified to discharge the multitude of services required of it by the vegetable and animal kingdoms, and in the general economy of the globe. We may fairly assume, from the vast accumulation of the results obtained by many eminent analysts, that the volume of oxygen in the atmosphere rarely exceeds 21.1 per cent or falls below 20.1. But the range of variation actually falls within extremely narrow limits; and if the oxygen either exceeds 20.99 per cent, or falls below 20.9 per cent, there is reason to look for accidental circumstances modifying the average composition. This was strikingly shown by the 100 analyses of the air of Paris made by Régnault, the oxygen percentage varying from 20.913 to 20.999, giving a mean of 20.96. Of 9 specimens of air from the neighborhood of Lyons, 30 from Berlin, 10 from Madrid, 23 from Switzerland 15 from the Mediterranean, 5 from the Atlantic Ocean, and 3 from South America, the extremes were comprised between 20.908 and 20.998 per cent.

It may seem of little consequence that the amount of oxygen should be diminished by one tenth of one per cent, and it would be, were not the loss in oxygen replaced by other and generally less beneficial ingredients. Many curious facts have been ascertained from a close observation of these changes in composition. The younger De Saussure, who devoted many years to this work, established the fact that the amount of carbonic acid in the atmosphere during the three summer months was considerably greater than that in December, January, and February, the relative amounts being as 100 to 77. From multitudes of determinations continued during fourteen years, he concluded that the ordinary range of variations in the volume of carbonic acid was included between 6.2 and 3.7 parts in 10,000, and that 4.9 parts in 10,000 fairly represented the mean. A similar remark applies to the extreme multiplication of these carbonic acid determinations as to those of oxygen: that single experiments are often quite at variance with the general results, and that the analyses must be repeated until the laws affecting the composition of the atmosphere are established beyond doubt. What, for example, could be more surprising than the fact, indicated by many experiments, that the percentage of carbonic acid about the tops of mountains is greater than at their feet: and this, too, notwithstanding carbonic acid is more than half as heavy again as air, so powerful appears to be the agency of plants in decomposing the carbonic acid near the surface of the ground and replacing it by a corresponding amount of oxygen? The solution of carbonic acid and its precipitation upon the ground dissolved in rain likewise assists its removal. During calm weather the atmosphere appears to contain more carbonic acid at night than in the day; but when disturbed by violent winds, causing a down rush from the upper strata, the percentage of oxygen at the earth's surface may temporarily undergo an increase much beyond the average.

One of the principal sources of the increase of carbonic acid in the atmosphere is the process of respiration by animals. If the number of respirations by an adult be reckoned at 15 per minute, and an average amount of 32 cubic inches of air is expired, containing 4 1/2 per cent of carbonic acid, there is thrown into the atmosphere daily by each individual

about 20 cubic feet of this gas. The population of the globe would annually increase the volume of carbonic acid 7,300,000,000,000 cubic feet, and diminish the oxygen by the same amount. This again would at least be doubled by the respiration of the lower animals and by the agencies of decay and combustion. The volume of the atmosphere is 968,870,000 cubic miles; and of this, if four hundredths of one per cent be taken as the average volume of carbonic acid, 387,510 cubic miles consist of the latter. If 20.96 per cent is the mean for oxygen, it amounts to 203,076,600 cubic miles. About 100 cubic miles of carbonic acid are annually added to the atmosphere, at which rate the amount of carbonic acid would be doubled in 3,731 years and all the oxygen consumed in two million years, were not the carbonic acid decomposed by vegetation in an inverse proportion. The weight of a cubic foot of carbonic acid is a little more than one tenth of a pound, and of a cubic mile about eighty and a half million of tons. The total amount of carbonic acid in the atmosphere is three billion tons, containing 27.28 per cent or 851,870 millions of tons of carbon. The computed area of the coal measures on the earth's surface is 260,000 square miles, with a present annual production of 250,000,000 tons of coal. If 75 per cent of this coal is estimated as carbon, the amount of carbonic acid in the atmosphere would be doubled by burning this amount of coal annually for 4,500 years. The total amount of coal is 4.83 billions of tons, which, if burnt, would increase the amount of carbonic acid in the atmosphere four and a half times, or raise its percentage to 0.18. This percentage is smaller than is frequently present in the air of crowded rooms like theaters, and which people endure, at least for some time, without serious consequences. If all the coal of the carbonaceous era were formerly a part of the atmosphere, the earth need not necessarily have been untenable by air-breathing animals. These results appear surprising until we reflect how small a portion of the earth's bulk is made up of carbonaceous deposits. The whole annual production of coal would make a bar 12 feet square passing from east to west through the earth's center. But if spread over the earth, it would amount to 0.015 cubic inch for each square yard of surface, hardly enough, when rubbed over a square yard of drawing paper, to fairly blacken it. The entire bulk of the coal measures, even when estimated at double the available amount of coal now known, probably does not exceed 450 billions of cubic feet, which would form a layer about an inch thick over the earth's surface.

But a vast amount of carbonic acid is locked up in the earth's strata, combined with various bases, more especially lime and magnesia, forming immense deposits of limestone and dolomite. If this carbonic acid at one time formed a portion of the atmosphere, its bulk must have been prodigious. A very thin stratum of carbonate of lime, when deposited, would yield as much carbonic acid as the atmosphere at present contains. It would require but a thin pellicle, a whitewash of 0.136 inch in thickness over the whole surface of the globe. A similar layer of pure limestone, 28.37 feet in depth, would double the weight of the atmosphere.

The thickness of the stratified rocks extending upward from the Potsdam formation probably averages as much as 38,500 feet, of which three eighths or 14,500 feet may be put down as limestone. This is equivalent to 140 millions of cubic miles of limestone rock, weighing 1.55 trillions of tons and containing 682 billions of tons of carbonic acid. This would be to the weight of the earth itself as 1 to 8,652, and would increase the weight of the atmosphere 133 times.

ALBERT R. LEEDS.

The Wonders of the Deep.

In her scientific cruise of three years and a half, the Challenger steamed and sailed 68,930 miles, crossing both the Atlantic and Pacific—the former several times. The deepest soundings were 4,575 fathoms, in the Pacific, between the Admiralty Islands and Japan; and in the Atlantic 3,875 fathoms, ninety miles north of the island of St. Thomas, in the West Indies. We have noticed the principal movements of the expedition from time to time. Its return to England has revived public interest in the work of Professor Wyville Thomson and his associates, and many interesting details concerning it have appeared in the English journals. Many curious crabs were brought home. One very odd specimen, which came to the surface only at night, is described as having a head which is nearly all eye, and a body so transparent as to render visible all the nerves, muscles, and internal organs, while another more lobster-like creature had no eyes at all. Near Amsterdam Island, in the South Indian Ocean, the ship encountered a belt of gigantic seaweed, of which single plants are said to attain a length of a thousand feet and a thickness equal to that of a man's body. A gale of snow, to which the vessel was exposed in the Antarctic Ocean, consisted of exquisite star-like crystals which burned the skin as if they were red hot. The history of the expedition abounds with similar unique experiences.

Indelible Ink without Silver.

Mr. A. J. Foote, of Del Norte, Colorado, sends us the following formula for an indelible ink without the use of nitrate of silver, which, he maintains, is thoroughly efficient and capable of resisting the action of freezing and thawing. No. 1. Extract of logwood, 1 lb.; water, 1 gallon. No. 2. Sulph. prot. of iron, 4 ozs.; water, 4 ozs. No. 3. Sulphuret of potassium, 1/2 oz.; water, 2 ozs. After dissolving the logwood by boiling, add No. 3 to No. 2, until the iron assumes a black color; then add this compound to No. 1, and boil a few minutes. Add cyanuret of potassium, 1/2 oz., which fixes the color. For ink, add gum and alcohol; for dyes, add grease.

* In general the constitution of the atmosphere is regarded as constant, because, after the removal of its carbonic acid and water, the proportion between the oxygen and nitrogen is almost invariable.

PRACTICAL MECHANISM.

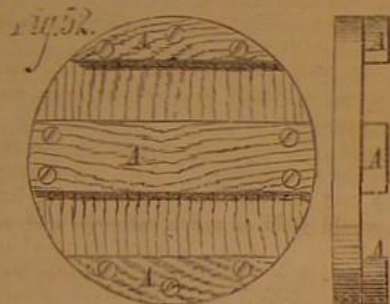
BY JOSHUA ROSE.

SECOND SERIES—Number VII

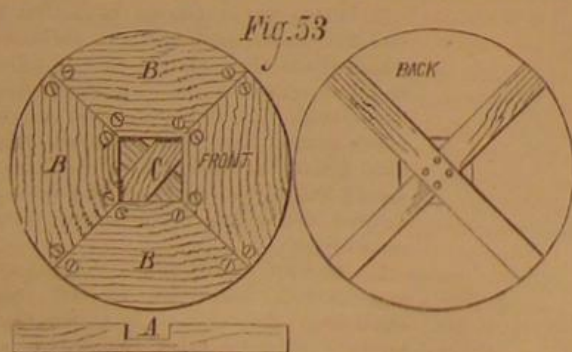
PATTERN MAKING.

From the appliances for turning work between the centers, we pass to those for holding work independent of the back center of the lathe by means of chucks, the name by which such appliances are generally known. Fig. 51 is a back view of a face plate, to which work may be held by screws; the usual method, however, is to screw to the face plate a disk of wood, and then to true the wood across the face and on the diameter. The work is then fixed to the new surface thus obtained. Many good purposes are served by the intervention of the disk of wood (or chuck, as it is usually termed) between the metal plate and the work. For instance, it is a guard which effectually prevents the turning tools from touching the metal of the face plate. It supports the work (being nearly of the same size) when required, and obviates the necessity

of having more than three or four face plates of metal. Its surface is readily made to conform to the shape of the work, and furthermore it is very readily trued up. When we have to deal with large sizes, a mere disk of wood will not serve, as it will be too weak across the grain; and here it may be remarked that the work often supports the chuck, and therefore we should always, in fixing, make the grain of the work cross that of the chuck, because the centrifugal force due to the high velocity is so great that both the chuck and the work have before now been rent asunder by reason of the non-observance of this apparently small matter. When it is considered that the chuck has not sufficient strength across the grain, battens should be screwed on at the back; but a chuck so strengthened will require truing frequently on account of the strains to which its fibers will be subjected from the unequal expansion or contraction of its component parts. Fig. 52 shows the back of a chuck strengthened by the battens, A A A

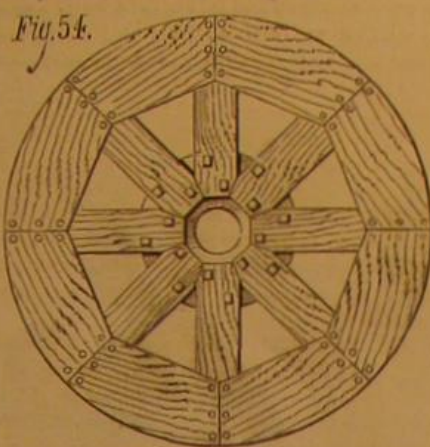


Another method of making a chuck is shown in Fig. 53. It is considered superior to the former from its greater ability to resist outward strains in every direction, while the strains to which it must necessarily be subject, from variations of temperature and humidity, are less than in the former. It will also be found that it can be trued with greater facility, especially on the diameter, as the turning tool will not be exposed to the end grain of the wood. To make one of these chucks about 2 feet in diameter, we proceed as follows: Procuring two bars for the back, say 4x2 inches and 2 feet long, we plane them all over; then in the middle of each we cut out the recess (shown at A in Fig. 53) to a depth equal to half the thickness, the width of the recess being equal to that of the bar; this process is termed half check-

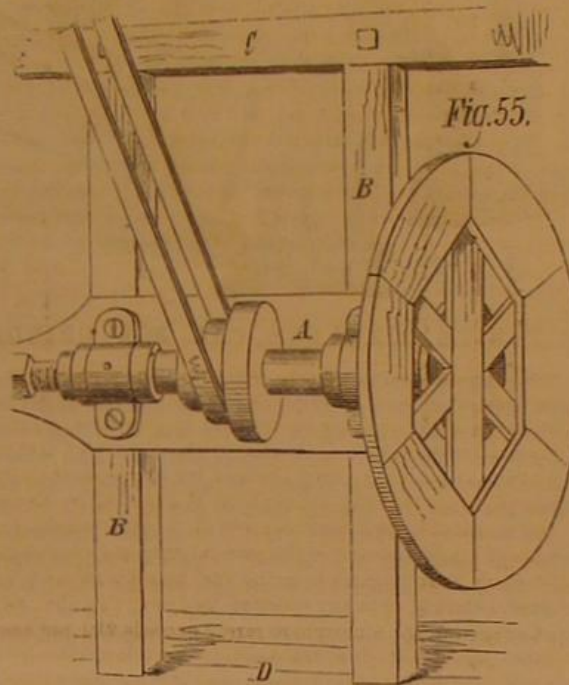


ing. We next fasten these bars together by gluing and screwing them at the center, driving the screws tightly home while the glue is warm. Upon the cross thus formed, we superpose the segments shown in the front view of Fig. 53, at B B B; these may be of almost any thickness, say from $\frac{1}{4}$ to $1\frac{1}{2}$ inches. They should be planed on the back and should not extend to the center, but leave an open space (as shown in Fig. 53, at C) of about 4 or 5 inches. This opening can be filled, if desired, by screwing on a square piece. If the segments were carried to the center, they would be too weak to bear a screw near that point; and again in large chucks, we very seldom require to use the part about the center. Chucks of very large size, that is to say, from 4 feet upwards, will require more support than is afforded by the four arms of the cross. Three bars can be put together, so as to give six arms, which will answer probably for a 6 or 7 feet chuck. For still larger sizes, it is necessary to cast a strong circular plate to form the middle of the chuck, and to then bolt the requisite number of arms to it. This strength of the chuck will of course depend upon the number of arms and their depths; and unless the chuck is very substantial, a difficul-

ty will be experienced in turning, on account of the tremor. A chuck having the middle of iron and the outside of wood, supported by arms, is shown in Fig. 54



In shops where the size of the work necessitates the employment of chucks of so large a diameter, a special lathe is of great advantage, because a lathe having an elevated bed is so tremulous and shaky; while those having large solid heads are too cumbersome, and are not belted to run at a sufficiently high rate of speed. In such cases, the arrangement shown in Fig. 55 is an excellent one. A represents a lathe head bolted firmly to two uprights, B B, which are



firmly fixed to the joists, C, and to the flooring at D, right over and upon the joists supporting the flooring, or else upon beams provided for the purpose. By this means the work may, if the lathe head is fixed midway upon the posts, B B, be as large as the space between the ceiling and the flooring will admit, a movable tripod rest, such as shown in Fig. 47, being employed for a tool rest.

Proportions of Bolts and Nuts.

In reply to several of our correspondents, we give below a table of the standard sizes for the heads of bolts and of nuts, including the pitches of the threads and size of tapping holes:

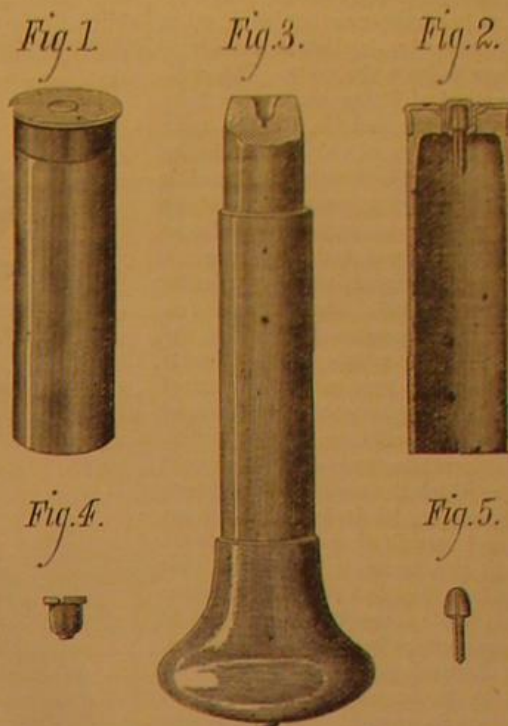
Diameter of bolt.	Threads per inch.	Size of tapping hole.	Size across facets of head or nut.	Depth of head or nut.
$\frac{1}{8}$	20	0.185	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{3}{16}$	18	0.240	$\frac{3}{16}$	$\frac{5}{16}$
$\frac{1}{4}$	16	0.294	$\frac{1}{4}$	$\frac{3}{8}$
$\frac{5}{16}$	14	0.344	$\frac{5}{16}$	$\frac{7}{16}$
$\frac{3}{8}$	13	0.400	$\frac{3}{8}$	$\frac{1}{2}$
$\frac{7}{16}$	12	0.454	$\frac{7}{16}$	$\frac{9}{16}$
$\frac{1}{2}$	11	0.507	$\frac{1}{2}$	$\frac{5}{8}$
$\frac{9}{16}$	10	0.620	$\frac{9}{16}$	$\frac{3}{4}$
$\frac{5}{8}$	9	0.731	$\frac{5}{8}$	$\frac{7}{8}$
$\frac{3}{4}$	8	0.837	$\frac{3}{4}$	1
$1\frac{1}{8}$	7	0.940	$1\frac{1}{8}$	$1\frac{1}{8}$
$1\frac{1}{4}$	7	1.065	$1\frac{1}{4}$	$1\frac{1}{4}$
$1\frac{3}{8}$	6	1.160	$1\frac{3}{8}$	$1\frac{3}{8}$
$1\frac{1}{2}$	6	1.284	$1\frac{1}{2}$	$1\frac{1}{2}$
$1\frac{3}{4}$	5 $\frac{1}{2}$	1.389	$1\frac{3}{4}$	$1\frac{3}{4}$
2	5	1.490	2	$1\frac{3}{4}$
$2\frac{1}{8}$	5	1.615	$2\frac{1}{8}$	$1\frac{3}{4}$
$2\frac{1}{4}$	4 $\frac{1}{2}$	1.712	$2\frac{1}{4}$	2
$2\frac{3}{8}$	4 $\frac{1}{2}$	1.962	$2\frac{3}{8}$	$2\frac{1}{4}$
$2\frac{1}{2}$	4	2.175	$2\frac{1}{2}$	$2\frac{1}{2}$
$2\frac{3}{4}$	4	2.425	$2\frac{3}{4}$	$2\frac{3}{4}$
3	3 $\frac{1}{2}$	2.628	3	3
$3\frac{1}{8}$	3 $\frac{1}{2}$	2.878	$3\frac{1}{8}$	$3\frac{1}{8}$
$3\frac{1}{4}$	3 $\frac{1}{2}$	3.100	$3\frac{1}{4}$	$3\frac{1}{4}$
$3\frac{3}{8}$	3	3.317	$3\frac{3}{8}$	$3\frac{3}{8}$
4	3	3.566	4	4

For cast iron work, the tapping holes may, for sizes of 1 inch and less, be drilled to well clear the given sizes.

THE two thousandth locomotive was recently completed at the London & Northwestern Railway Company's works at Crewe, England. The occasion was celebrated by giving a holiday and a day's pay to all the workmen, some 6,000 in number, and a banquet, which was attended by the directors of the company, at which were exhibited specimens of the different classes of engines used on the road.

IMPROVED ANVIL FOR PAPER CARTRIDGE SHELLS.

The invention herewith illustrated is a new anvil for paper cartridge shells, by means of which it appears that a



large number of charges may be fired from one and the same shell without injury thereto. We are informed that a single shell has been used in firing forty-two shots, and that one hundred and four caps exploded on a shell have not caused any deterioration. Each cartridge case, therefore, lasting for so many charges, the sportsman can, with a limited number of them, change his charges to suit different kinds of game, and thus be relieved from transporting a large number of cartridges of varying sizes. Fig. 1 is a perspective view of the ordinary paper shell. Fig. 2 is a sectional view of the same with the improved anvil attached. Fig. 3 is a device for disengaging old caps. Fig. 4 is the cup or socket of the shell in which the anvil and firing cup is held, and Fig. 5 is a detached view of the anvil. The anvil is of brass, iron, or steel, in a single piece. Its head is somewhat larger than its stem, and is made slightly conical in form, to receive thereupon the cap for the explosion of the charge contained in the shell. There is a narrow groove made across the head of the anvil and continued down one side and to the end of the stem. Through this groove the fire is conveyed in a straight line to the charge, causing the same to explode without injuring the case. The groove, it will be observed, extends entirely across the top of the anvil head, so that a large surface for the passage of the flame is afforded. The device shown in Fig. 3 may be made of wood or any other suitable material. Its stem is small enough to be inserted readily in the paper shell, and at the end there is a socket, the bottom of which receives the point of the anvil, keeping it in a central position while it is being pushed outward from the shell. This disengages the old cap and leaves the anvil ready for a new one.

From a certificate submitted by the inventor and signed by several well known professional sportsmen, the statement of the inventor is confirmed that forty-two shots have been fired from two cartridge cases, and that the latter are still intact, also that one hundred and four caps have been exploded on the shell without causing any deterioration.

Patented March 14, 1876. The patent is for sale. For further particulars, apply to the patentee, Mr. J. Saget, 198 Chartres street, New Orleans, La.

American University Boat Races.

The first university race ever rowed in America in eight-oared shells took place between representative crews from Yale and Harvard on the Connecticut river, at Springfield, Mass. June 30, 1876. Length of course, 4 miles. Won by the Yale crew in 22 minutes and 2 seconds, Harvard coming in 31 seconds, or 13 lengths, astern. The number of strokes made per minute of the respective crews is given by the New York Herald as follows:

Minutes.	Yale.	Harvard.	Minutes.	Yale.	Harvard.
1.....	34	35	12.....	33	37
2.....	34	35 $\frac{1}{2}$	13.....	33	—
3.....	34	35	14.....	33	40
4.....	33	35	15.....	33	36
5.....	33	35	16.....	33	37
6.....	33	—	17.....	32	40
7.....	33	—	18.....	33	—
8.....	33	35	19.....	33	—
9.....	33	—	20.....	33	35 $\frac{1}{2}$
10.....	34	36	21.....	33	—
11.....	32	—	22.....	—	—

The average age of the Yale crew was 23.7 years, height 69.3 inches, chest 40.2 inches, weight 158.8 lbs. The average age of the Harvard crew was 21.2 years, height 68.8 inches, chest 39.7 inches, weight 159.14 lbs.

MESSES. OGDEN & CARPENTER, of 400 East 33d street, New York city, state that the steam jet plan, to assist combustion, described by us on page 18, current volume, has been in use at their establishment for more than four years with success.

IMPROVED CAR BOX GRINDER.

The use of car brasses, entirely unfitted and rough from the sand, results in great wear of axles and of the brasses, in hot brasses, and the delays and accidents entailed thereby, in an immense consumption of oil and cotton waste, and in such excessive friction as greatly to increase the power necessary to draw the train. The ordinary method of fitting car brasses is by the use of lathe and file, and the work requires the labor of a skilled mechanic.

The machine herewith illustrated is not only expected to supersede the above named tools for the purpose, but also to render the accurate fitting of brasses a cheap process, requiring no particular experience or skill. The principal feature of the apparatus is found in the emery wheels, which are originally turned and then kept true by a patented diamond tool, the latter being so arranged that it is impossible to turn by it anything except the geometrically correct circle to which the master mechanic sets it. Wheels of 20 inches diameter are used; and though they should be worn down to the flange, it is claimed that they will still grind the full diameter desired, while a speed of from 1,080 to 1,800 revolutions is all that is required.

The diamond tool, A, is shown in its frame, in the engraving, detached from the apparatus proper. The tool, it will be observed, swings on a center in its frame, and can be adjusted to any arc. Once set, it can only turn the prescribed arc with accuracy. In order to avoid the necessity of the foreman having to set the tool, a gage is also furnished. This consists of a spindle adjustable with a nut in such a way that its two points rest in the centers on which the diamond tool revolves. It is only necessary for a disk, B, turned accurately to the diameter of the bearing, to be prepared, and this the apprentice can place on the spindle, adjust the latter, and screw down the diamond tool until it touches the periphery of the disk. A nut is then fastened on the diamond tool, and the frame is lifted on the ways beneath the wheel, when the moving of the handle turns the face of the wheel to the exact circle desired.

To adjust the brass in the chuck, C, it is first set on the axle, D. The chuck is then placed on frame, E, in such a way that the V's fit. Handle, F, then moves a cam that clamps the brass between the jaws, G, one set of which swing on a pivot at H. The brass is thus adjusted in such a manner that, despite the imperfections in molding, it is ground accurately with the least removal of metal. The chuck, C, fits into planed guides on the table, I, and is thus brought in exact line with the motion of the wheel. The crank, J, serves to move the table to and fro on the rods, K, and the table also rises and falls on planed ways, being pressed up by springs. The hand wheel gives vertical adjustment to the whole bed by means of a chain beneath it. There is a pulley by which a suction fan, to remove dust, etc., may be driven. The machine is claimed to be capable of fitting from 150 to 500 car brasses per day.

For further information, address the Tanite Company, Stroudsburg, Pa.

IMPROVED SAW GUMMING MACHINE.

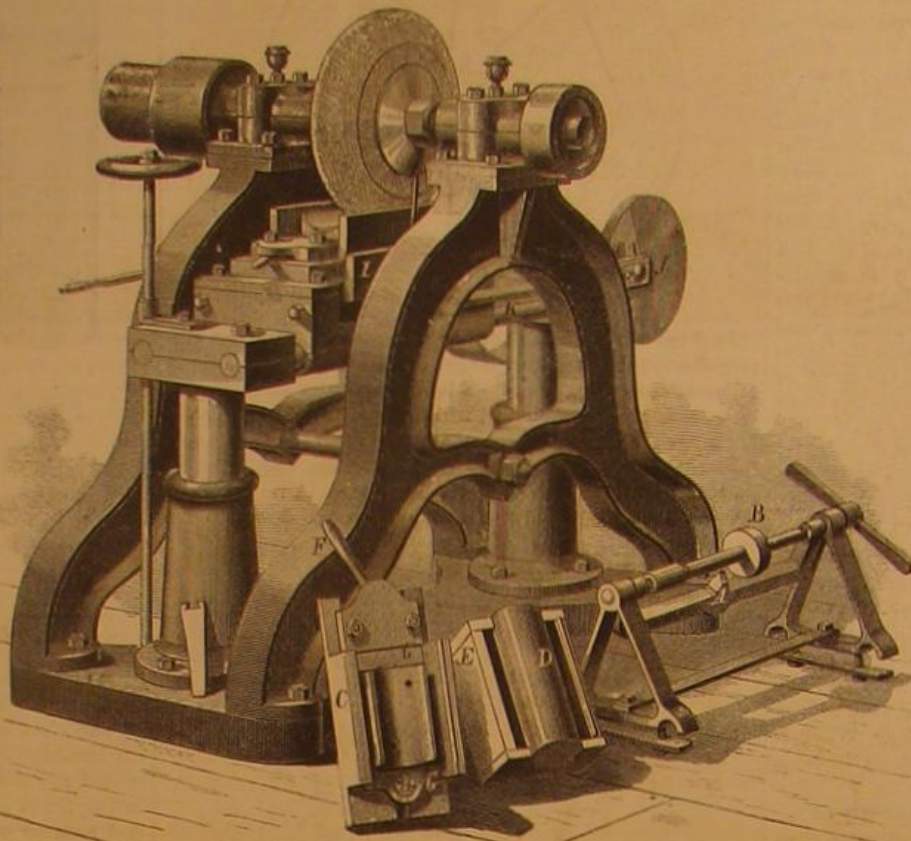
In the accompanying engraving we illustrate a new application of that universally useful invention, the emery wheel, to the purposes of a saw gummer. The apparatus embodies novel devices, whereby the wheel may be set to any angle and rendered suitable either for gumming saws or for grinding the edges of planer or other knives. The working parts are supported on the crosshead of the strong upright column, as shown. At A are the driving pulleys, journaled between arms on a lower cross piece, in which is also socketed the lower extremity of the elevating screw, B. On the upper crosshead is swiveled a yoke, to which is journaled a shaft, C, carrying pulleys, D. These, as is clear from the engraving, transmit motion from the driving pulleys, A, to the pulley, E, on the emery wheel shaft. The shaft, C, passes through a metallic block, F, which fits loosely upon it, and which is ground off to a point on its under side, to form a bearing for an adjusting screw, not shown. Said block is also bored to receive the arm, G, which supports the grinding wheel. This arm is movable in the block and can be fastened in any desired position by the set screw, H. I is a counterbalance for the wheel. J is a stock, secured in place, as desired, by a set screw not shown, and

supported from below by the hand wheel by which it can be elevated and depressed. Said stock has ways for a saw bar or a carriage with clamps for the blade.

The saw disk, in case a circular saw is to be gummed, is attached to the end, K, of the saw bar, and the latter is properly adjusted and fastened to the stock, in such position as

Planer blades are mounted similarly to saw blades, and arm and carriage are so adjusted that the knife edge can be traversed continually along the side of the wheel. The latter can be set by rotating the arm at any angle, in regard to said edge, between a perpendicular and a horizontal position.

Patented by Randolph Densmore, April 4, 1876. For further particulars, address the Tanite Company, Stroudsburg, Pa.



THE TANITE COMPANY'S CAR BOX GRINDER.

to bring the saw teeth properly under the emery wheel. The stock is then adjusted so as to bring it to a proper height by means of the elevating screw, and the arm, G, is depressed in front until the wheel is in proper position. The wheel, it should be stated, is previously adjusted to the proper angle to the tooth by rotating the arm partially in the block, F, and securing it when the wheel is at suitable inclination. When the apparatus is to be used to gum a straight-edged saw, the blade is confined in a carriage, and the wheel is set in relation thereto, as already described. The saw is gradually carried forward by the carriage as each tooth is gummed.

the soap mine, traveled only by the safe pack mule and hardy miner. The rock resembles chalk or lime. At the southern extremity is an extensive deposit, veined, marbled, and particolored, resembling Castile soap. The ledge at its opening is fifteen to twenty feet wide, and crops out for 2,000 feet, to an unknown depth. The lode is well defined, with wall rocks of hard slate stone, and has, in common with the slate and sandstone strata about it, been thrown up from the depths and turned completely on edge. In its vicinity is a mountain of gypsum, also turned up on edge; indeed, the whole country bears evidence of fearful convulsions, also of some time having lain peacefully at the bottom of the ocean; for on the highest mountain tops can be found nearly perfect sea shells and various specimens of marine matter.—*San Benito (Cal.) Reporter.*

Prizes for Temperance Investigations.

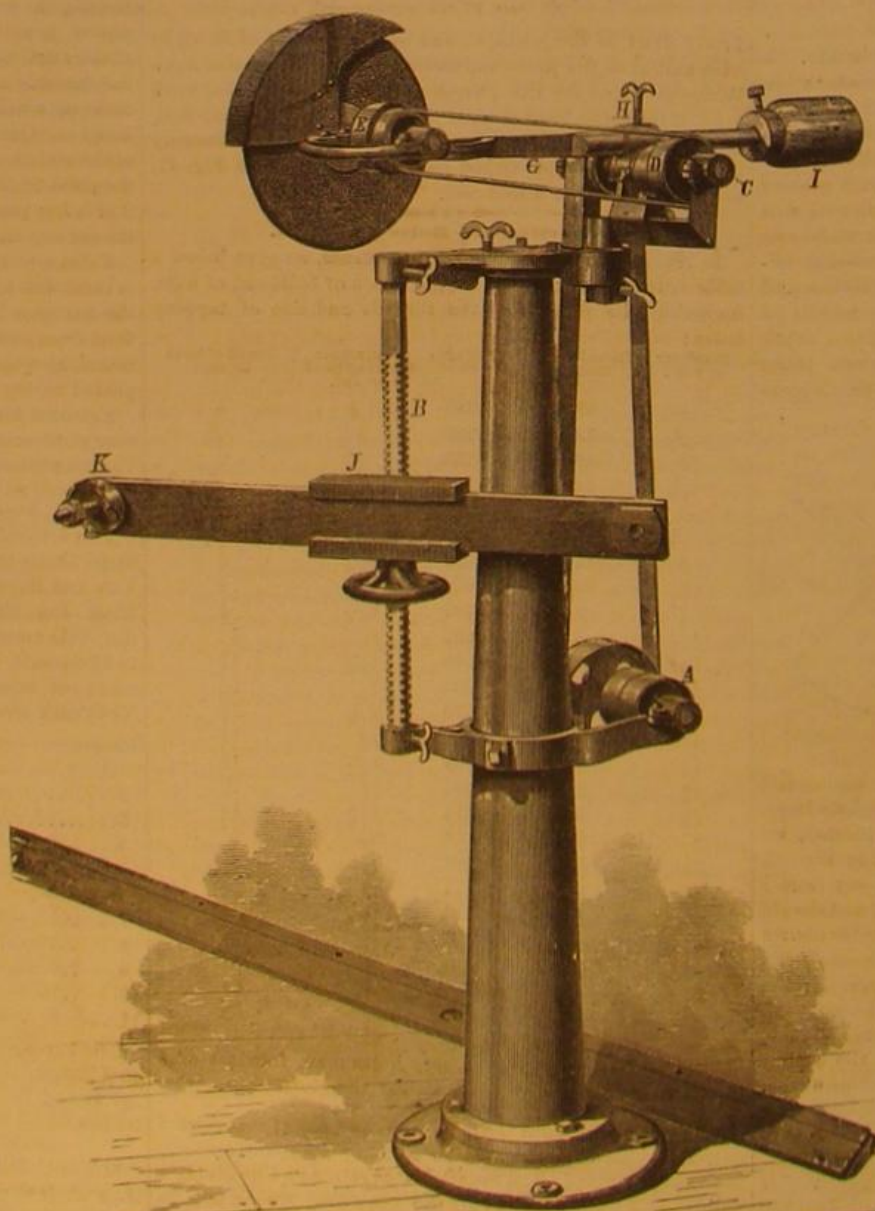
The French Temperance Society submits the following questions, to be answered before January 1, 1878. For the best and most complete reply to the first a prize of \$400 is offered, to the second, \$200. Articles must be written in French, and sent with author's name sealed in a packet, with distinctive device, addressed to Dr. Lunier, secretary of the society, 6 Rue de l'Université, Paris.

1. Determine, by the aid of clinical observation and experiment, the differences which (from the point of view of effects on the organization, the two being administered with equal alcoholic doses) exist between natural wines and brandies on one hand, and on the other wines fabricated or simply treated with alcohols of purely industrial derivation, and brandies of the same origin.

2. Discover by the aid of clinical and experimental observation whether (with equal doses) the addition to alcohol of an aromatic principle other than that of absinthe, such as the essence of aniseed, fennel, tansy, and analogous plants, augments the toxic properties.

Painting Glass for the Magic Lantern.

Draw on paper the size of the glass the subject you mean to paint. Fasten this at each end of the glass with paste, or cement, to prevent it from slipping. Then reverse the glass so as to have the paper underneath, and with some very black paint, mixed with varnish, draw with a fine camel hair pencil very lightly the outlines sketched on the paper which are reflected on the glass. It would add to the resemblance if the outlines were drawn in the colors of the object; but in this respect the artist must please his fancy. When the outlines are dry, color and shade the figures; but observe to temper the colors with strong white varnish.



DENSMORE'S SAW-GUMMING MACHINE.

INFLUENCE OF CHEMICAL FERTILIZERS ON POTATOES AND GRAPES.

A second volume on this subject has recently appeared in France, written by Professor Ville, whose early experiments on the effect of various artificial manures attracted so much attention among agriculturists some years ago. In his first book, M. Ville gave a large number of engravings of plants, reproduced from photographs, exhibiting the influence of his so-called complete fertilizer, composed of nitrogenized matter, phosphate of lime, potassa, and lime, and noting the facts that, by the use of this compound, the yield of wheat per acre was more than double that obtained when nitrogenized manure alone was furnished, the ratio being about 46 to 20. When mineral manure alone was employed, the crop fell to 16, and finally, in earth without manure, the yield was represented by 11.

Applying these experiments to the potato and the vine, Professor Ville, in his recent volume, shows the astonishing effects of potassa. On the potato (see Fig. 1), his complete fertilizer, when used, gave a yield of 35,200 lbs. per 2.5 acres (A, Fig. 1); a like area yielded 25,960 lbs. (B), nitrogenized matter being absent; and with phosphate absent, the yield was 32,780 lbs. (C). When the potassa was removed, these figures fell to 16,590 lbs. (D). With lime absent, the yield determined was 29,700 lbs. (E), and with no manure at all (F), 7,700 lbs.

On the vine (see Fig. 2) the influence of potassa was still more evident. Complete fertilizer (two figures on the left of Fig. 2) caused a yield of 26,400 lbs. per 2.5 acres, or 2,534 gallons of juice; without nitrogen, 13,640 lbs. and 1,320 gallons; without phosphate, 16,000 and 1,531 gallons; without lime, 17,160 lbs. and 1,636 gallons; without potassa and without any manure (remaining diagrams, Fig. 2), no crop.

M. Ville affirms that, potassa being dominant in the potato, the absence of that base coincides with the appearance of the disease, and that vegetables deprived of it become the prey of inferior organisms, fungi, lice, etc.

WATER PLANTS.

An American gentleman recently took some plants of the bog bean (*menyanthes trifoliata*) to England, rightly thinking such a pretty plant worthy of cultivation, and not knowing that it was a native of British as well as American bogs. The bog bean and bog arum, like a number of other plants, had common possession of the two worlds long before the white man had crossed the Atlantic. Both these plants have something more in common, namely, they are both perfectly hardy, and thrive in boggy and muddy places, margins of lakes, mud banks, etc.; both are dwarf in stature, both have creeping stems that root as they creep, both have distinct and graceful foliage, especially when growing freely in rich ground, and both have beautiful flowers. They are plants which every one who cares for ornamental marsh and aquatic plants should possess.

MULTIPLYING PLANTS.

The simple method of propagation by layering is usually adopted for all low-growing or slender plants, those which cannot readily be multiplied either by division, cuttings, or seed. The operation is one of the simplest: A branch or stem of the plant is bent down, and pegged or otherwise fastened below the surface of the soil, while its growing extremity remains above the ground. The carnation is easily propagated in this way. Select the outward, strongest, and lowest shoots for the purpose. Trim off a few of the under leaves, and shorten the top ones even, with a knife; then cut a slit in a slanting direction on the under side of the shoot. This slit should be about an inch long, in an upward direction towards the next joint. Loosen the earth and make a small oblong hole one or two inches deep. Lay that part of the stem where the slit is made in the earth, keeping the cut open and placing the head of the layer upright and one or two inches out of the earth. Hold the layer in position by pegging it down with a little forked twig. Now cover to the depth of one inch, pressing the earth over it gently. Water immediately, and in dry weather give light watering every evening. This is best done in a cloudy day. In about two months the layer will be well rooted. Carnations and all kinds of pinks should be layered in June or July.

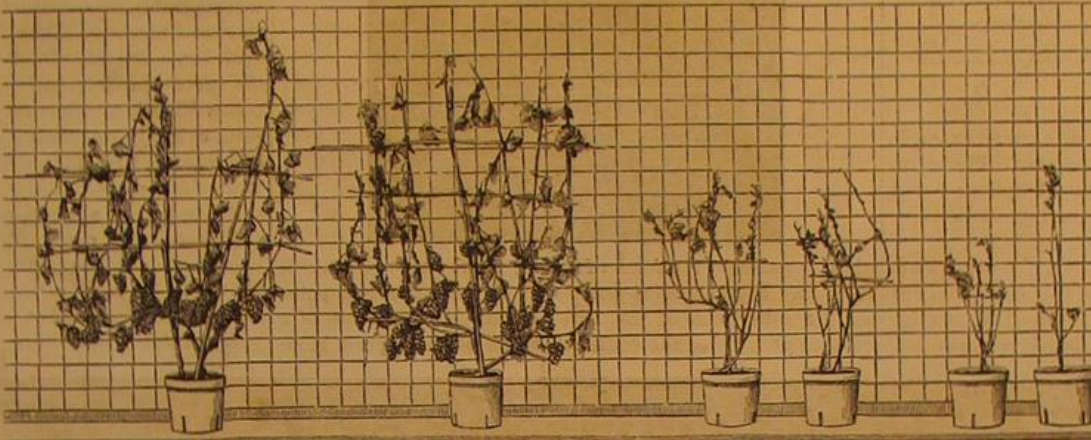
Propagation by cuttings is a very popular and expeditious mode, and one which, like division and layering, exactly re-

produces the parent plant. Nearly all soft wooded plants—such as fuchsias, lobelias, and pelargoniums—are best multiplied from cuttings of the stem; while thick leaved begonias and gloxinias are readily multiplied by leaf cuttings, the fully developed leaf being inserted in a sandy compost. A cutting may vary in size, but it is generally from one to four inches long. It consists of a young shoot taken off the plant with a sharp knife, and afterwards cut off at an acute angle below a joint. This fresh-cut end is to be inserted in the earth if hardy, or in a pot of sandy soil if tender. Lobelias and fuchsias will root freely if severed between the

Fig. 1.



Fig. 2.



joints, anywhere in fact; while geraniums will frequently rot off unless trimmed below a joint.—*The American Gardener.*

The Grand Canal Du Midi.

M. A. Manier has proposed the formation of a maritime canal through France, from the Atlantic Ocean at Bordeaux to the Mediterranean. According to the description which has been published, the Grand Canal is intended to be 300 feet wide at the bottom, 30 feet deep throughout, to flow through Bordeaux, Agen, Toulouse, Carcassonne, Narbonne, and not Cette, but either La Nouvelle or some point still nearer Nar-



THE BOG BEAN.

THE BOG ARUM.

bonne, which is the shorter course by about 40 miles. This canal will enable English ships, bound for the Mediterranean or the East, to save from 800 to 900 miles—in fact, it will complement the Suez Canal, and be, with regard to England, the missing link in the great waterway to India. Even when cut between the two nearest practical points, the Grand Canal must still be a very costly undertaking; but the capital and engineering skill are in Paris and London waiting for employment. All that is needed is to show the



MULTIPLYING BY LAYERING.



MULTIPLYING BY CUTTINGS.

public that a good return may be expected. The French government will readily enough grant a concession if no guarantee or subvention is asked for. The Grand Canal du Midi will free for ever the South of France from all inundations; it will receive above 12,000,000 tons of shipping a year; it will enable the owners to dispose of an average of

21,000,000,000 cubic yards of water a year, for irrigation or motive power. If the whole of this water were used for the wants of industry alone, it would give, in the valley of the Garonne alone, four times the power required for the cotton mills of the whole world. Very slight tariffs would procure from these two sources an income which would justify the outlay of a far larger sum than the projected canal is likely to cost.

On Salicin.

There is accumulating evidence for believing that salicin is a most efficient and unjustly neglected remedy. Dr. MacLagan, in the *Lancet*, and Dr. Senator, in the *Berlin Centralblatt*, speak of it as more desirable, in all respects, than salicylic acid, as an internal remedy in the treatment of acute rheumatism, typhus, parametritis, and febrile affections generally. Its anti-malarial powers have long been known, and the Confederate surgeons employed it largely during the war. It is cheap, being quoted, at present, at fifty cents an ounce. To reduce the temperature in fever, the dose should be about two scruples. It does not cause any of the unpleasant itching, headache, or gastric troubles that occasionally follow salicylic acid.

Dr. Pavesi, of Mortara, Italy, highly extols the following mixture as an efficient anti-zymotic, and believes it will supplant quinine: Common salt 12 parts, iron in powder 5 parts. Mix and add: Muriatic acid 5 parts, salicin 1 part. He obtains a soluble, odorless crystalline substance, somewhat styptic and bitter to the taste, to which he gives the name *natrium muraticum ferruginosum salicinatum*, a cheap and efficient tonic, anti-zymotic, and febrifuge.—*Medical and Surgical Reporter*

The Franklin Institute at the Centennial Exhibition.

The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, through the kindness of the Centennial commissioners, has opened a reception room at the northwestern end of Machinery Hall, for the use of its members and visitors from abroad, interested in the mechanic arts. The Institute cordially invites all who desire to do so, to visit their room, in which will be found files of the "Journal of the Institute" and other periodicals devoted to industrial sciences. The room is in charge of a committee of thirty members of the Institute, one or more of whom is in attendance to receive visitors and give any information they may desire in reference to the Exhibition. The following objects, of great historical interest, have been placed in the room: 1. Franklin's electrical machine. This instrument is doubtless the one used by the great philosopher in making his wonderful experiments in the science of electricity. Presented to the Institute by Dr. John R. Cox. 2. Oliver Evans' steam locomotive engine. This interesting model is among the earliest known, having been built about 1804. 3. Oliver Evans' high pressure steam engine. This is the model of an engine built by O. Evans, about 1804, and is described in Galloway's work on the steam engine, page 101, London, 1827. 4. Working model of a steam engine built by M. W. Baldwin, and presented by him to the Institute, about 1832.

Oil Pipe Lines.

The total mileage of iron pipe used in the oil region is placed by good authority at not far from 1,500 miles, some asserting 2,000 miles to be nearer the truth. This is owned by the following pipe line companies: Atlantic, Union, Keystone, Antwerp, Relief, Sandy & Milton, United, Grant, Pennsylvania Transportation, American Transfer & Conduit. The principal area of these pipes lies in Butler county, Pa., where the producing districts are far apart, and the farms in some places are covered as by huge spider webs. The Conduit Company has over 100 miles in use, including 48 miles of main pipe, 3 inches in diameter, and 48 miles of connections, of 2 inch pipe. Before a gallon of oil was pumped, this line cost \$400,000. Taking 1,500 miles as the quantity of pipe in use, and the cost and laying to be 30 cents per foot, it appears that \$2,682,000 is invested in pipes alone. The cost of pumps, tanks, etc., will swell this to double the

amount.

METROPOLITAN UNDERGROUND RAILWAY, LONDON.—The total number of passengers carried over the Metropolitan, the St. John's Wood, and Hammersmith and City Railways on Whit Monday last, was 243,077.

THE OPTICS OF PHOTOGRAPHY.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY
PRESIDENT HENRY MORTON.

The material Universe forms one vast system, a whole, in which no part can exist in a state of isolation from the rest. It is impossible to bring any influence to bear upon one of them without affecting everything else. When Newton saw the apple fall, the train of thought suggested to his mind began its effect upon the thought of all succeeding time; while the change produced in the earth's center of gravity by the change of the apple's position affected not only the planets on the very outskirts of our system but even the remotest of the fixed stars. So also every branch of physical science necessarily affects every other branch, inasmuch that it is impossible to study one and exclude the rest. We cannot become proficient in physics without a knowledge of chemistry, nor in chemistry without a knowledge of physics. All sciences are mutually indebted to each other, and all profit by discoveries in any one of them.

Fig. 1.

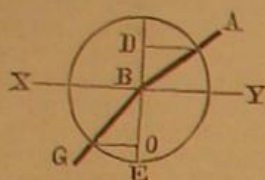
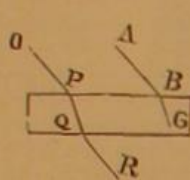


Fig. 2.

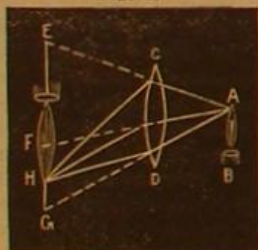


In the subject of the present lecture, we have an example of the interdependence of optics and chemistry. Photography owes perhaps its origin to the science of optics; but it soon made good its indebtedness by originating, in its turn, considerable advances in practical optics.

In the latter half of the fifteenth century, the camera obscura was invented by Baptista Porta, and certainly no one who ever beheld the image produced in this well known instrument could help a feeling of regret that it was not permanent, and a desire to make it so. Thus did the invention of this optical instrument give the first impulse in the direction of photography.

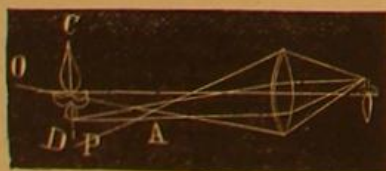
When Daguerre had solved the problem of fixing the image of the camera obscura, his chemical discovery immediately reacted upon optical science. Chemistry called upon optics for the means of producing an image so accurate and perfect in all respects as to be worthy of that permanence, of that immortality which she could confer. This was the great problem in practical optics of the day, as will be readily conceded after an explanation of what was required, what were the difficulties, and how thoroughly they have been vanquished. This problem and its solution originated and now constitutes the science of photographic optics or the optics of photography.

Fig. 3.

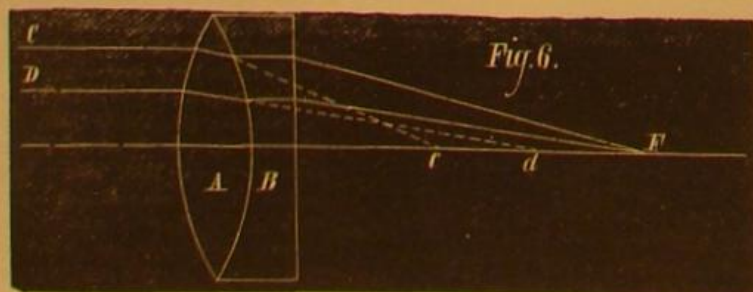


To obtain a proper appreciation of the question, it will be well to begin at the very beginning. When a ray of light passes from a rarer to a denser medium, as for example from

Fig. 5.



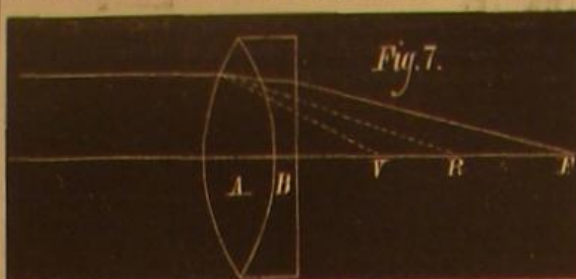
air into glass, its course is changed by being bent towards the line perpendicular to the entering surface. On passing from



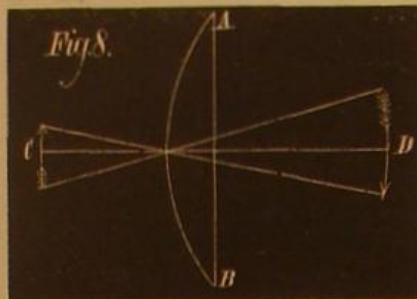
glass into air, it is bent in the opposite direction. In Fig. 1 the upper half of the circle, above XY, is a rarer and the lower half a denser medium. The ray, AB, is bent in the direction, BG. The amount of this bending or refraction varies with the nature of the substances employed, and is found by dividing the sine of the angle of incidence by the sine of the angle of refraction. In Fig. 2, let QG be a bar of glass; then the ray, OP, will be deflected on entering the prism by

being bent towards the perpendicular; while on leaving it again and passing into the air, it will be bent as much away from the perpendicular, and will consequently emerge parallel to its original direction.

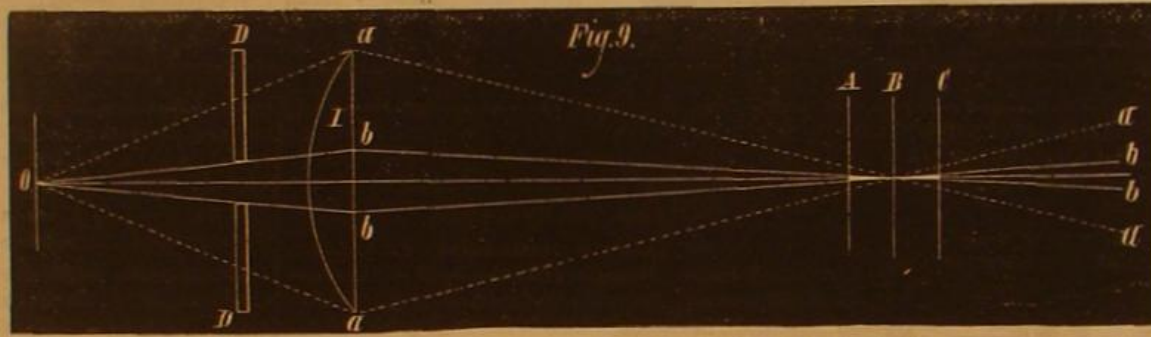
This principle was beautifully shown by projecting an arrow on the screen and then interposing a bar of glass between a part of it and the rays. The result was that, where the rays were intercepted by the glass, the arrow was broken and the broken piece stood either above or below the rest, according to the inclination of the glass. Now if the intercepting



glass is made in the form of a lens, all the rays striking it from any one luminous point will be refracted to a point on the other side of the lens, because it is made up of a number of prisms, the angles of whose surfaces grow more



acute as we pass from the center to the ends, C and D, Fig. 3. In this figure we have three out of many rays striking the lens from A; by carefully constructing the passage of these rays, it is found that they will all meet in the point, H. The same can be shown with any other point of the candle, AB; so that if a screen were placed at EG, we would obtain a reversed image of the candle.



will pass to one, and the violet to the other, end of a band called the spectrum, in which the other colors occupy intermediate positions. Now, as these different rays possess different photographic power, we would obtain an image of varying intensity. This is called chromatic aberration. To correct this defect, a similar arrangement is employed as in the case of spherical aberration. It has been found that

only to F'. Conversely, rays starting from F' will emerge parallel. Now, if we put the other half of the lens on again, rays starting from F' will converge at F', just as far on the other side of the lens. It is evident, moreover, that, the further the source of rays is removed from F', in the direction F'Y, the less their divergence, and the easier it is for the lens to make them converge on the other side. Hence the further we put the source of light from the lens on one side, the nearer the lens will its rays be brought to a focus on the other side. Thus the point, F'', corresponds to F'. Conversely, rays proceeding from F'' will diverge so much that the lens can bring them to a focus only at F'. Two points having such relations to each other are called conjugate foci.

To illustrate this, the lecturer had a lens and a burning candle on the stage. Placing the candle at a proper distance from the lens, an image of it was produced on the screen. When the candle was then brought nearer the lens, it was found necessary to move the lens further from the screen to get an image; and when the candle was further removed from the lens, the latter had to be placed near the screen. It was also observed that, the nearer the candle was to the lens, the larger the image produced.

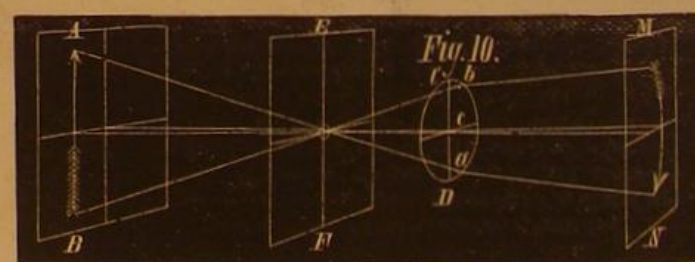
Unfortunately it is impossible, even with the most skillful workmanship, to construct spherical lenses, which bring objects to a perfectly sharp focus. This is especially the case with large lenses. Thus rays coming from the bottom of the inverted object, in Fig. 5, will not all meet in the same point. Those passing through points near the center will meet at D; those passing through the ends will come to A; and intermediate rays will assume positions between these two points, so that a blurred image results. This error is called spherical aberration.

This defect is corrected by joining to our double convex lens another having one surface concave and the other plane, as in Fig. 6. The refraction is greatest near the points of the lens, A, because the angle between its two surfaces is greatest there; on adding the lens, B, however, which acts

in the contrary direction, the rays are lifted up most near the ends of the lens, just where they need it most, and a compensation is thus effected. By the use of the lens, A, alone, the ray, C, would pass to c, and the ray, D, to d; on adding the lens, B, however, both will converge at F.

Another source of error lies in the fact that the rays of light are of different refrangibility; so that the red rays

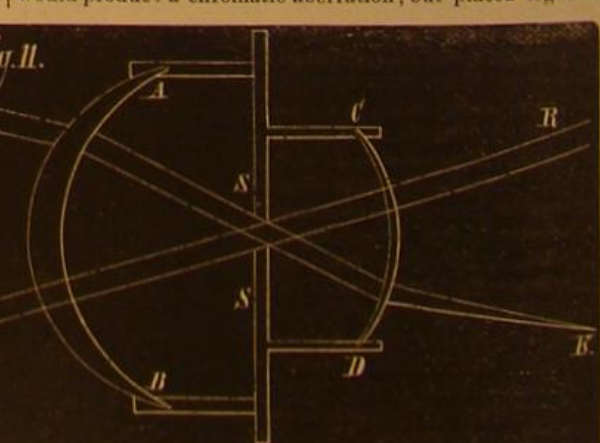
some kinds of glass possess a greater power of dispersion, that is, of separating the rays of different colors, than others. Taking advantage of this property, the lens, B, Fig. 7, is made of heavy lead glass, having a high dispersing power. With the lens, A, alone, the ray, S, would have been separated into a series of colors stretching from V to R; but on passing through B, they undergo a reversing process, and are brought to a focus at F. Either lens alone would produce a chromatic aberration; but placed together



Passing now from this general statement to the principles involved, we find that parallel rays, falling on an ordinary glass lens having both surfaces of the same curvature, will meet in the center of curvature on the other side of the lens. Thus, in Fig. 4, the rays, HA, KB, will be refracted to the point, F. The same would be true for any other parallel rays not drawn in the figure, because they would be acted on equally by the opposite surfaces of the lens; and they would be bent less and less the more we approached the mid-

dle of the lens, because the angle decreases more and more. The point, F, is called the focus, a word meaning fireplace. Conversely all rays, starting from F, would emerge parallel on the other side of the lens.

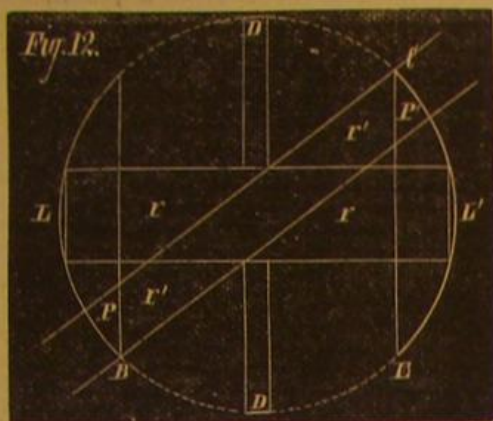
If now we suppose the lens split in half in the direction, AOB, and one half removed, its converging power would evidently be reduced one half; in other words, the focus will be twice as far off, and the rays, HA, KB, will now be bent



they correct each other because they act in opposite directions.

A third source of error is what is known as the curvature of the field. It is evident, on inspecting Fig. 8, that rays of the same length, passing from an object, C, through the optical center of the lens, AB, will not form a flat, but a curved, image. If, therefore, a flat screen is placed at D, the top and bottom of the arrow will be out of focus; and

if the screen is properly placed for the top and bottom of the arrow, the middle will be out of focus. The different parts of the image evidently do not lie in the same plane; and to correct this error, the same device will have to be employed as in photographing at the same time objects lying in several different planes more or less distant from each other. In other words, we must produce what is known as



"depth of focus." This is necessary even in taking a portrait, where the nose and the ears of the sitter, for example, would come to a focus at different distances from the lens.

The depth of focus is increased by means of the diaphragm or stop, an ingenious contrivance, shown at D D, in Fig. 9, by which all rays coming from an object at O are cut off, with the exception of those passing through the opening. Without the stop, the outer rays, O a, would diverge considerably on both sides of the focal point cut by the screen, B; and if this screen were moved to the position, A or C, the curvature of the resulting image would become very appreciable. With the stop, however, the screen could be moved anywhere between A and C, and a tolerably sharp image produced.

It is not possible, however, by the use of the diaphragm alone to correct the curvature of the field entirely. The effect of the diaphragm is really to divide the lens into as many little lenses as there are pencils of light passing through it. Some of these pass through the ends of the lens where there is greater converging power, and are consequently brought to a nearer focus than those passing through the middle. This circumstance of itself would tend to produce a distortion. This is shown in Fig. 10, where the parts of the arrow, A B, not lying in the axis of the lens, C D (and consequently obliged by the diaphragm, E F, to pass through the ends of the lens, at a and b), are brought to a focus nearer the lens than the middle points.

It has been found by experience that a convergent meniscus lens provided with a stop and placed with its concave side toward the object to be photographed, will produce the least amount of curvature of the field. When the convex side is turned towards the object, a greater curve is produced in the opposite direction. Hence, by combining two such meniscuses, and placing a diaphragm between them at the proper relative distance from the lenses, this fault is entirely overcome. These and other considerations, which would take us too far, led Mr. Zentmayer, of Philadelphia, to invent his celebrated lens, a representation of which is given in Fig. 11. Here we have two meniscuses, A B and C D, with a stop, S S, nearer the smaller one. The lenses are made of the same kind of glass, and yet counteract each other's errors so well as to produce a very perfect instrument. The leading principles will be better understood from the following drawings: In Fig. 12, let A B represent two plano-convex lenses, exactly alike, and so placed that their outer surfaces form parts of an imaginary sphere, A B C D. Then, neglecting refraction for a moment, it is evident that a bundle of rays, r r, which the aperture of the diaphragm, D D, allows to pass through both lenses, will be affected only by the little lenses, L, L', and two blocks of glass having parallel surfaces. Hence, we will get only the insignificant amount of spherical and chromatic aberration due to two minute lenses. The rays, r' r', passing through the edges of the lenses, A B and C D, will be affected only by the two prisms, P and P', which will counteract each other, being exactly equal and opposite. For the reason already stated, and on account of the refraction of the rays, the diaphragm is not placed in the center, but a little to one side. This instrument has a most remarkable depth of focus, and produces most excellent results.

To show that any refracting medium, water for example, could become a lens when made into the proper shape, the lecturer placed a watch glass in the path of the rays coming from a vertical lantern containing a slide of a fine piece of statuary. Nothing was visible on the screen, until he poured water into the watch glass, when the image came out with surprising distinctness. The applause which followed this

striking experiment sufficed to agitate the water, disturbing the shape of the lens and destroying the image, which did not perfectly reappear until the water came to rest.

One of the most astonishing effects that a lens is capable of producing was shown by the aid of an instrument called the megascope, represented in Fig. 13. This is nothing more than a dark box, having a lens in front and illuminated inside with an oxyacetylene light falling on a sheet of white paper in the rear of the box. When the hand is held as close to the light as it can be without burning it, an immense image in natural colors and startling relief is produced on the screen. The huge proportions of this mammoth hand produced a ludicrous effect when compared with the hand of an assistant standing near the screen. Other objects, such as a plaster cast, a mother of pearl shell, an apple cut in half, and the works of a watch, were then shown with splendid effect. The images of these objects are so large that it is difficult to keep them in focus in all their parts. The lecturer concluded by exhibiting a number of photographs upon the screen, pointing out their artistic excellence and defects in accordance with the principles laid down.

Facts and Simple Formulas for Mechanics, Farmers, and Engineers.

[We are constantly receiving letters, asking for simple rules for various engineering and mechanical operations. Frequently the writers send us merely the problem, requesting us to apply the rule and publish the solution. In order to avoid repetition, it is our custom to refer correspondents, presenting analogous cases, to those already published in

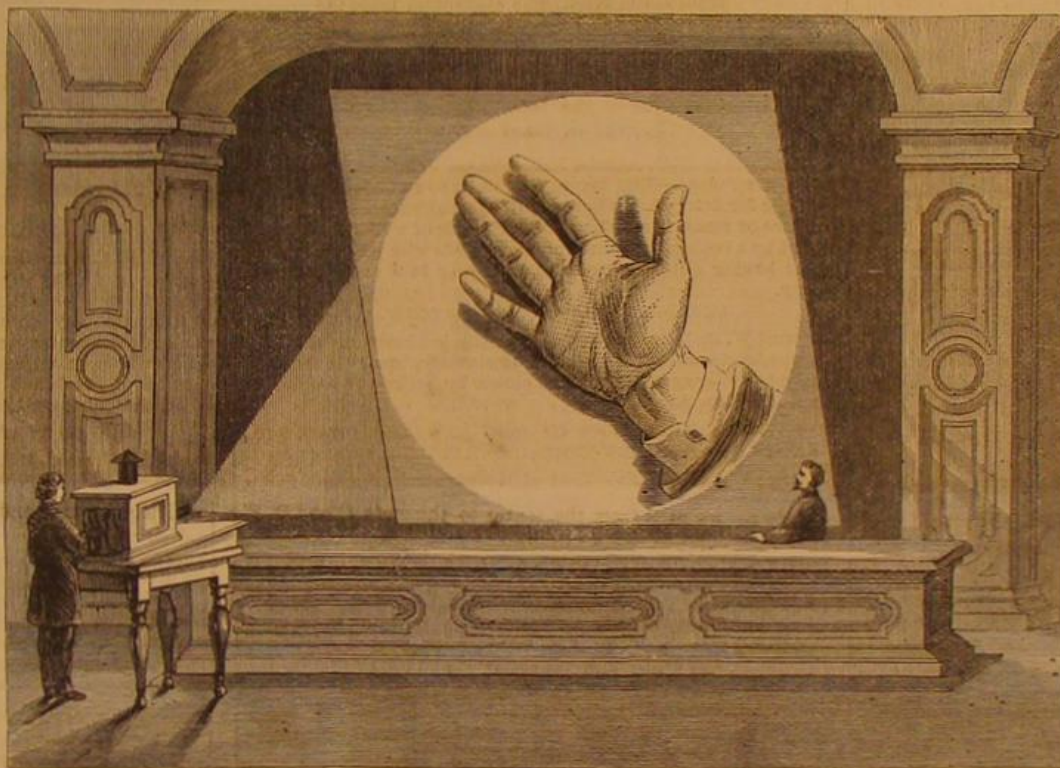


Fig. 13.—THE MEGASCOPE.

these columns, leaving them to apply the information there given to their own wants. In deference to the demand for the rules abstractly stated, and believing that in many instances a reference to the rule itself rather than to any application of it will serve our correspondents' purpose better and at the same time relieve our already crowded query columns, we shall from time to time present a series of useful facts and formulae taken from the works of Molesworth, Haswell, Nystrom, "Wrinkles and Recipes," and other reliable sources, in place of our usual collection of recipes. Brief and simple rules, which are the results of the experience of any of our readers, we shall be glad to receive for publication in this connection; and correspondents sending us queries on any mechanical or engineering subject, answerable by rules or formulae, will generally here find the information needed.—EDS.]

Shrinkage of castings, in locomotive cylinders $\frac{1}{16}$ inch in a foot; in pipes $\frac{1}{8}$ inch in a foot; girders, beams, etc., $\frac{1}{8}$ inch in 15 inches; engine beams, connecting rods, etc., $\frac{1}{8}$ inch in 16; thin brass $\frac{1}{8}$ inch in 9; thick brass $\frac{1}{8}$ inch in 10; in zinc $\frac{1}{8}$ inch in a foot; in lead, same; in copper $\frac{3}{8}$ inch in a foot; in bismuth $\frac{3}{8}$ inch in a foot; in tin $\frac{1}{8}$ inch in a foot.

To test iron and steel: Nitric acid will produce a black spot on steel; the darker the spot, the harder the steel. Iron, on the contrary, remains bright if touched with nitric acid. Good steel in its soft state has a curved fracture and a uniform gray luster; in its hard state, a dull silvery uniform white. Cracks, threads, or sparkling particles denote bad quality. Good steel will not bear a white heat without falling to pieces, and will crumble under the hammer at a bright red heat; while at a middling heat it may be drawn out under the hammer to a fine point. To test the toughness, place the fragment on a block of cast iron; if good, it may be driven by a blow of a hammer into the iron; if poor, it will be crushed under the blow.

Main shafting in woodworking shops should run at 300 revolutions per minute. Mortising machines, 250 to 300 strokes per minute; adzing soft wood across the grain, 30°; ordinary soft wood planing machines, 35°; gouges and plowing machines, 40°; hard wood tool cutters, 50° to 55°.

The hide of a steer weighs about the eighteenth part, and the tallow the twelfth part, of the living animal.

The buoyancy of a cask in lbs. = 10 times the capacity in gallons minus the weight of the cask itself.

A square of slate or slating is 100 superficial feet. The lap of slates varies from 2 to 4 inches. The pitch of a slate roof should not be less than 1 inch in height to 4 inches in length.

Wood Ashes.

On another page we publish illustrations of the effects of potassa and other chemical fertilizers on potato and grape vines. The most accessible and cheapest form in which potassa is obtainable is wood ashes, which every country house-keeper should carefully collect from the hearth. Mr. Austin P. Nichols, of the Boston Journal of Chemistry, has recently made some analyses of ashes taken from the hearth, with the following potassa results:

	No. 1.	No. 2.	Mean.
Potassa.....	12.55	12.64	12.59
Carbonate of potassa.....	18.38	18.55	18.48

The wood from which the ashes came consisted of a mixture of hickory and beech. The results show the amount of pure potassa and carbonate of potassa which the ashes contained; but the absolute alkali power and value as represented are best shown in the amount of crude or commercial potassa held in the ashes. One hundred lbs. held 19.85 lbs. of alkaline salts, soluble in water, and consequently, if we estimate the value of commercial potassa at eight cents per pound, we have a cash potassa value in these ashes of \$8.60 in each 100 lbs. A bushel of dry ashes weighs about

34 lbs.; this would give a potassa value to each bushel of fifty-three cents. The ordinary ashes, such as are collected in the country by soap boilers, are usually not so rich in alkaline constituents. The mean potassa value of these ashes, estimated upon the value here adopted, we have found to be about forty-two cents per bushel. From these results it is clear that the farmer had better retain his ashes for farm use than to sell them at the price usually obtained from soap peddlers. Besides the potassa salts, ashes contain important amounts of phosphoric acid, soluble silica, etc., which add greatly to their value as fertilizing material. It is safe to say that every bushel of true wood ashes which a farmer produces upon his hearth is worth to him, for farm use, forty cents in gold. It is, therefore, very poor husbandry to sell them for twenty cents the bushel, as many do. We value ashes so highly that offers for them are rejected, no matter what they may be.

"In the mixture of raw bone meal and ashes, recommended by us ten years ago, we get quite all the valuable constituents of plant

food, and at cheaper rates than in any other mixtures. We have used this combination for many successive seasons, with most satisfactory results. We confidently expect that the German potassa products will before long stop the consumption of wood ashes in the manufacture of American potassas, and it will be a happy day for our agricultural industry, if the products of our wood fires are turned in the direction of the farm."

RED INK.—The following recipe for a beautiful red ink is given by Metra, of Paris: Dissolve 25 parts, by weight, of saffranin in 500 parts warm glycerin, then stir in carefully 500 parts alcohol and an equal quantity of acetic acid. It is then diluted with 9,000 parts water, in which is dissolved a little gum arabic.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From May 24 to June 7, 1876, inclusive.

AIR GUN.—I. Johnson et al., Worcester, Mass.
ATMOSPHERIC HAMMER.—J. C. Butterfield, Chicago, Ill.
BANK CHECK, ETC.—J. B. Johnston, New York city.
BEER TAP.—G. C. Driner et al., Brooklyn, N. Y.
BILLIARD BALL.—W. H. Lippincott, Pittsburgh, Pa.
BOILER.—I. Barton, Williamsport, Pa.
BOMB LANCE.—P. Cunningham, Newark, N. J.
BOOT HEEL TRIMMER.—L. Graf, Newark, N. J.
CIGAR LIGHTER.—D. W. Boyden, Newark, N. J., et al.
CURTAIN FIXTURE.—C. Buckley et al., Meriden, Conn.
DESK.—W. S. Wooten, Indianapolis, Ind.
ENVELOPE.—H. Burnett, San Francisco, Cal.
FARE REGISTER.—A. Hance et al., New York city.
FIRE DRAWING BOARD.—J. Good, Brooklyn, N. Y.
HARVESTING.—B. F. Jackson, Pittsfield, Ill.
HUCKLING HEMP, ETC.—J. Good, Brooklyn, N. Y.
LOOM.—G. Crompton, Worcester, Mass.
MAKING GAS.—T. S. Stewart, Philadelphia, Pa.
MAKING WOOD SCOWS.—T. J. Sloan, New York city.
MOTIVE ENGINE, ETC.—J. T. Gallup, Greenport, N. Y.
PANTALOON.—G. R. Eager, Boston, Mass.
PIPE-CUTTING TOOL.—A. Saunders, Yorkers, N. Y.
POLISHING BUTT.—G. P. Warner, Leeds, Mass.
ROCK DRILL.—J. B. Waring, New York city.
ROCK DRILL.—W. W. Dunn (of San Francisco, Cal.), London, England.
SWIMMING APPARATUS.—R. B. Humphrey, Baltimore, Md.
TREATING REFUSE OIL, ETC.—W. P. Jenney, New York city.
WASHING FABRICS.—J. Brown, Monticello, N. Y.
WASHING WOOL, ETC.—F. G. Sargent, Granville, Mass.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Rhode Island.
THE ATTORNEY GENERAL, UPON THE RELATION OF GEORGE V. HECKER VS
THE HUMFORD CHEMICAL WORKS *et al.*

[In Equity.—Before Shepley and Knowles, JJ.:—Decided May 15, 1876.]
This was a proceeding in equity in the name of "George V. Hecker as the Attorney General, upon relation of Hecker vs. The Humford Chemical Works *et al.*," the prayer of the bill being to declare void and to cancel and annul certain released letters patent, and to enjoin defendants from prosecuting any suit at law or equity for alleged infringements of the same.

A patent for a useful invention is not, under the laws of the United States, a monopoly, in the old sense of the common law.
It more nearly resembles a contract which, under the authority conferred by the constitution, Congress authorizes to be entered into between the Government and the inventor, securing to him, for a limited time, the exclusive enjoyment of the practice of his invention in consideration of the disclosure of his secret to the public, and his relinquishment of his invention to the public at the end of the term.

The practice that obtains in England as to the mode or forms of procedure for the cancellation and annulling letters patent by *scire facies* does not obtain in this country.

No statute of the United States confers or recognizes the existence of any such right, nor any precedent for the suing out of a writ of *scire facies*, or the bringing of a bill in equity to repeal or cancel the patent, by the Attorney General, in the name and behalf of the United States, either with or without a relator.

The jurisdiction conferred by the acts of 1790 and 1793, upon the Federal courts to repeal a patent, and which without express grant it is believed did not inhere in these courts, is nowhere conferred by the acts of 1836 or 1870, or in the Revised Statutes of 1874.

The decisions in the Federal courts sustaining proceedings in equity to vacate letters patent granting lands obtained by fraud, furnish no precedent in case of letters patent for inventions.

"The Attorney General of the United States, as he is Attorney General," has no authority to sue and in his own name to file an information, or commence proceedings by bill in equity.

If the court has jurisdiction in cases of this character, the information should be in the name and behalf of the United States, and should be filed by the attorney of the United States, in the district in which the information is filed.

Any other mode of procedure (unless authority is expressly conferred by statute) is neither authorized by law, sanctioned by any precedent, nor supported by the authority of any judicial decision.

(*Creston, Brown and Charles F. Blake* for the informant.
William M. Everts, Clarence A. Seaward, and Charles S. Bradley for the defendants.)

Supreme Court of the District of Columbia.

HENRIETTA B. COLE VS. JOHN W. KENNEDY AND JOHN E. KENDALL.

[In Equity, No. 4,635. Docket 15.—Before Wylie, J.]

WYLIE, J.:
The released letters patent No. 4,519, dated April 25, 1871, declared good and valid, said patent being for improvements in fluting machines granted to H. H. Cole.

The "Knox," "Pee-less," and "Crown" fluting machines are infringements of the Cole patent, as released.

(*Charles S. Whitman*, for complainant.
R. Ross Perry, for defendant.)

United States Circuit Court—Northern District of New York.

GEORGE S. NEWELL *et al.* VS. GEORGE WEST *et al.*

Where an inventor and patentee entered into a written contract with one of the part owners of the patent, to procure, if possible, an extension of the same, and, under such contract, received a valuable consideration, and, after his death, his wife, as executrix, procured such extension, and conveyed by assignment, duly recorded, such extended patent to the assignees of said part owner, who was a party to the original contract with the inventor and patentee, it was held by Wallace, J., that, upon the resignation of the trust as executrix, and the appointment of an administrator with the will annexed, such administrator could not make a legal assignment of such extended patent so as to vest the same in another and different party than the assignees of the executrix.

The complainants having filed their bill for a perpetual injunction, and for an account, alleging the infringement by defendant of extended letters patent, in which complainants own the exclusive right for the State of New York, the defendants plead thereto that the Union Paper Bag Machine Company is the owner of the patent in exclusion of the complainants. Complainants having taken issue by replication to the plea, the cause now comes to be heard upon the pleadings and proofs.

(*Marcus P. Norton*, for complainants.
Horace Binney, for defendants.)

United States Circuit Court—Southern District of New York.

HENRY L. DALTON *et al.* VS. CHARLES NELSON *et al.*—IN EQUITY.—JANUARY 25, 1876.

Letters patent for an improved steam gage cock were issued to Albert Bisbee, September 18, 1855, were extended for seven years from September 18, 1864, and were reissued on June 14, 1870, to Oscar T. Earle, assignee of Bisbee.

SUTHERMAN, J.:
This is a bill in equity, in favor of the owners of the released letters patent, to restrain the defendants from an alleged infringement, and for an account. Infringement and the novelty of the invention are denied by the answer.

The alleged invention, which is a compression steam gage cock, was made by Mr. Bisbee in 1853, and consisted, in the language of the specification:

"First, in making one of the surfaces that meet to close the water way or steam passage of a piece of galvanized rubber, which is protected from spreading or confined in metal in such manner that but little more than its bearing or acting surface is exposed; and secondly, in making the other surface, which is of metal, in the form of a ring, so that the rubber may be compressed, by the same power, more forcibly than if the metal surface were equal in area to that of the rubber."

Prior to this invention, the opposing surfaces of steam gage cocks had been made of brass or other metal, which was speedily roughened or worn by the dirt or grit in the water. To remedy this difficulty, one of the surfaces was sometimes faced with leather or lead; but the steam soon destroyed the leather, and corroded or cut away the surface of the lead. The joints leaked, and the cocks soon needed repair, whatever material was employed. The use of vulcanized rubber as one of the bearing surfaces overcame these difficulties. Its advantages are briefly explained, by one of the defendants' witnesses, to have been that, "being a rubber or elastic substance, it would not wear and grind, as metal surfaces would; by its elasticity it pressed upon the seat and easily made a tight joint; it has always answered just as well in hot water as cold, while metal surfaces and ground joints in stopcocks will not stand at all in hot water." The Bisbee cock has proved to be of great value. It has superseded the use of pre-existing devices, has met with large sales, and "has answered its purposes perfectly."

The main question in the case is as to the validity of the patent. The defendants have introduced a number of devices, which are claimed to have anticipated the plaintiff's patent. Of these, the valve patented by Albert Fuller was clearly antedated by the Bisbee invention. In neither one of the other prior inventions or prior publications was vulcanized rubber used as one of the surfaces to close the steam passage. This fact raises the question which was considered by counsel to be the principal one in the case, namely: Is the substitution of vulcanized rubber for cork, leather, or soft metal, by which substitution a substantially perfect gage cock was first produced, the subject matter of a valid patent?

The difficulty which was to be overcome by the patentee was to make a steam gage cock which would not readily leak, and which would resist the action of steam. The result which he attained was the invention of a durable gage cock, which remained tight under various pressures and different degrees of heat, and which did not get out of repair. This result was accomplished by the discovery of the fact that highly vulcanized rubber, in consequence of its elasticity, would not be ground and changed by water containing dirt or grit, and in consequence of its durability and non-corrosible properties, would successfully endure and withstand the power of steam. In the year 1853, the peculiar adaptability of hard rubber to the varied mechanical purposes to which it has since been applied was much less understood than it is at the present time. The invention consisted in the practical application of the discovery by such mechanical means that an efficient gage cock was produced.

An attempt was made to show that this invention had been anticipated by the application of sheets of vulcanized rubber to the edges of the door or gates; but the analogy between the edge of a gate, upon the plate of a compression steam gage cock, which is necessarily opened and closed at frequently recurring intervals, and which should be so constructed as not to become leaky from the constant use to which it is subjected, is so remote that a rubber gasket cannot with propriety be considered an anticipation of Bisbee's invention. The remark of Judge Coltman in *Walton vs. Potter* (4 Scott's N. C. 31), seems to be applicable to this branch of the case.

It appears to me that if the plaintiff's invention is a very useful application for the purpose, had never been known before, and, therefore, that it was properly the subject of a patent.

Again, the Bisbee invention comes within the principle which was enunciated in *Hicks vs. Kelly* (15 Wall., 673):

"The use of one material instead of another in constructing a known machine is, in most cases, so obviously a matter of mere mechanical judgment, and not of invention, that it cannot be called an invention, unless some new, and useful result, an increase of efficiency, or a decided saving in the operation, is clearly attained."

Here the substitution does not merely produce the same result in the same way, but produces a new result, differing from the former one so materially that it is almost to be said that the difference is one of kind, and not of degree. The improvement was of such marked character that the inference is drawn, and skill, rather than the result of mere mechanical judgment.

The defendants' device is an imitation of the plaintiff's gage cock, except that, in lieu of the vulcanized rubber, the defendants use the material which was patented by released letters patent issued to Nathaniel Jenkins, August 8, 1864; the claim of the patent is for an elastic packing composed of at least four tenths of fine wire pulverized refractory earthy or stony material intimately mingled with and held together by rubber, prepared for vulcanizing and then vulcanized, "as and for the purpose described."

The defendants have taken the principle or idea of the Bisbee invention, which was the production of a tight steam gage cock, by the use of vulcanized rubber as one of the bearing surfaces, and the same material is used in the same form and shape, in which it appears in the Bisbee invention. It is true that other materials are intermingled with the vulcanized rubber, for making one compound but the vulcanized rubber of Bisbee is none the less

used because other materials are fused with it. The infringement is manifest. Let there be a decree for an injunction and an account.

(*S. J. Gordon* for plaintiffs.
Thomas W. Clarke, for defendants.)

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PRINTER'S GALLEY.

Henry E. Hanna, Pittsfield, Ill.—This invention is a galley, by which the type may be locked in an instant without sidesticks, quoins, and chase, for taking proofs, and unlocked for making corrections without scaling off type. It consists of an adjustable cross bar that is applied by hinged or buckle joints to the side of the galley, to be readily folded out of the way or locked to the type. When it is desired to lock the type for taking a proof, the locking bar is brought against the type, and the knuckle or hinged frame lowered and extended to its full width, giving a firm and complete locking of the type at a saving of time and labor. As the lower part of the locking bar is first withdrawn from the bottom of the types, while the bar still holds the upper part of the type, the locking bar may be easily released without producing any scaling off of types, which forms an objectionable feature of the locking attachment of galleys heretofore in use.

IMPROVED STOVE PIPE JOINT.

James L. Loring, Dallas center, Iowa, assignor to himself, Fortunatus Hubbard, and Judson Purinton, of same place.—This is an improved stove pipe joint that forms a solid and firm connection of the pipes, so that they cannot be pulled apart or pushed together, while being readily disconnected when required. It consists of recesses at the end of one pipe, in connection with rivets of the other pipe end, the rivets having broad interior heads, and shanks nearly of the width of the slots.

IMPROVED BALANCED SLIDE VALVE.

John Edward Watson, Louisville, Ky.—This invention consists in the improvement of balanced slide valves, by combining a piston, diaphragm, and valve with a seat having port, passages, and channels leading from steam inlet. The diaphragm takes the upward pressure of the steam, and has sufficient movement to allow the valve to be pressed by the down pressure in said chamber steam-tight on the seat. The area of the chamber is sufficiently larger than that on the under side of the valve subject to lifting pressure to keep the valve tight.

IMPROVED WEIGH SCALE.

Alanson Carpenter, Angola, Ind., assignor to himself and Joseph Smith, same place.—This invention relates to an improved weighing scale for determining the weights of substances, and also the pressure of steam in a boiler; and it consists of a sliding post connected by a bottom crosshead and lever rods with weighted elbow levers having outer index arms, swinging in a suitable casing or box.

IMPROVED SELF-CLOSING HATCHWAY.

Samuel W. Bell, Burgettstown, Pa.—This is a hatchway door. It is opened automatically by a tapering elevator, made in sections, hinged together and folding, and closed by springs or weights, in the manner specified.

IMPROVED MANUFACTURE OF BOOT AND SHOE SOLES, ETC., AND IMPROVED SCREW-THREADED RAWHIDE SHOE PEGS.

George V. Sheffield, New York city, assignor to Sheffield Screw Driving Machine Company, same place.—The first invention consists in the method of uniting the soles of boots and shoes, or the parts to be joined together, by means of threaded screws made of petrified rawhide, or other analogous fibrous material, which said screws are screwed into corresponding screw-tapped holes in the parts to be united. The second invention relates to the manufacture of the threaded pegs, in which the skins or hides, as they come from the animals, are spread on boards placed over a bed of common salt in a retort, and subjected them to the action of the salt heated to about 90° for a sufficient length of time to petrify and harden them. Practicable screws are made from the strings cut from the hides, the width being about the same as the thickness of the skin, so as to make them square.

IMPROVED CAR COUPLING.

George W. Johnson, Princeton, assignor of one half his right to Francis W. Hauss, Gibson county, Ind.—This consists of a hook and a catch on each bar, so contrived as to form a double coupler, which connects self-acting, and is disconnected by a chain or cord from above, or from the side, in such manner as to avoid going between the cars.

IMPROVED COMPENSATING PENDULUM.

Fritz Willman, La Salle, Ill.—The pendulum ball is suspended by two rods of metal, of different powers of expansion and contraction, and a lever, the lever being fixed in the rod of least expansion for a fulcrum, and having the more expandible rod connected to one end, and the ball to the other end, so that when the rods expand the ball will be raised, and it will be lowered when they contract. The amount of variation or compensation is varied by shifting the lever along the rod in which it is suspended.

IMPROVED FIRE SHIELD.

William Murray, Vicksburg, Miss.—This invention consists of coupling joints and pipes for quickly erecting frames for scaffolds, and for supporting plates to protect firemen from the heat of a burning building, the object being to enable them to approach closer to a burning building, and to afford protection to other buildings by being set up between them and the buildings on fire.

IMPROVED LOCK AND KEY.

John J. Portuquez, New York city.—This is an improved lock for safes, doors, and other places where two parts are to be secured together, so constructed that it cannot be opened by any other instrument than the key made expressly for it. The mechanism, which embodies several novel and ingenious devices, cannot be explained without the aid of drawings.

IMPROVED SMOKE JACK.

John B. Deeds and David A. Bridwell, Terre Haute, Ind.—This consists of a flue or jack with movable and balanced hood and outside ventilators. The movable hood adjusts itself automatically by a surrounding conical rim, with drip holes, to the top of the locomotive smoke stack.

IMPROVED HOSE PIPE COUPLING.

Thomas Loftus, Sacramento, Cal., assignor of one half his right to Benjamin Bullard, Jr., same place.—The coupling is formed by an exteriorly threaded and flanged tube, and two interiorly threaded tubes, which screw on the former and clamp the hose.

IMPROVED EARTH AUGER.

Datus N. Root, Parkersburg, Iowa, assignor to Chancy F. Owen, same place.—This consists of a bucket and bits contrived in three equal sections, by which the auger works faster; and by taking out one of the boring bits and bucket sections and substituting a pronged bit of peculiar form, with a shorter bucket section, bowlders of larger size may be taken out than can be with other augers.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED FIRE ALARM AND EXTINGUISHER.

Thomas F. Nevins and John W. Smith, Brooklyn, N. Y.—This invention consists in making water flow through a water wheel whose movement acts upon a bell, whereby an alarm is sounded automatically the moment the water commences to flow. As soon as a fire breaks out and the flame licks a cord, the latter burns and breaks, and a spring throws back the bolt and lets a weight fall. The said weight, being attached by a chain to the end of the stopcock arm, opens the stopcock and allows the water to pass to the water wheel.

IMPROVED MICROSCOPE.

George Wale, Fairview, N. J.—This is an improved microscope stand, by which the object glass may be adjusted to greater or less distance from the object without being disturbed in the least, or thrown out of its accurate vertical position, and by which the greater or lesser intensity of the light may be regulated and set to various conditions of the object. The invention consists, first, of the mechanism for the minute vertical adjustment of the object glass; secondly, of the adjustable ring frame and socket; and lastly, of the variable light-admitting aperture of the same.

IMPROVED PHOTOGRAPHIC PLATE.

Frederick H. Powell and Philip Lehen, Auburn, N. Y.—This consists in an improved plate for photographs or signs made of waterproof paper, having a coat of paint on the back, and one or more coats of baking japan or varnish on the face, and hardened. The process of preparing the paper for photograph and sign plates consists in first waterproofing the paper, then coating the back with a paint, and baking it in an oven till hard, then coating the face with one or more layers of baking japan or varnish, and then baking such final coat to hardness to obtain the required finish.

IMPROVED BURIAL APPARATUS.

Lewis H. Shular, Crawfordsville, Ind.—A deep, strong box, with closed top, open side, and dumping bottom, is mounted on truck wheels to move sidewise. The bottom may be opened and closed by a crank shaft. Cranes are provided for lowering the coffin by chains and a crank shaft, and are pivoted to the ends of the box inside of the opening to swing out on the grave, and to close in for protection when the box is shut up. The shaft has a ratchet and pawl for holding the coffin when required. After the coffin is lowered, the box is moved along over it on the track for dumping the earth in.

IMPROVED VOLTAIC BELT.

Alexander M. Dye, Elkhart City, Ill.—The plates are secured to a felt band by clinching them over the edges and also by a band bottom fastening.

IMPROVED WEIGH SCALES.

Robert H. C. Rhea, Uniontown, Ky.—These scales are adapted for being carried by physicians and druggists in portable folded state, in the pocket. They are made of a longer weighing beam and a shorter tray beam, hinged together and working on a fulcrum or flange bent down from the tray or scale beam. The weighing beam is longitudinally slotted for the sliding weight, having lateral index hands and a guide pin, and provided with pronged ends for attaching smaller weights.

IMPROVED COMBINED MEASURE AND FUNNEL.

Frank H. Winston, Evansville, Wis.—This invention consists in a crooked stopper rod, by which the stopper may be held while the liquid is running from the measure.

IMPROVED BREECH-LOADING FIRE ARM.

John A. Heckenbach, Kenosha, Wis.—This consists of a movable plate in front of the breech block, with a device for tightening it up in a simple way, by means of which the plate can be readily taken off for making smooth and bright with emery paper, and can be tightened up when the parts become loose from wear, without expense, and also without tools. The plate also allows of using stronger pins on which the hammer strikes.

IMPROVED BATH FOR TREATING IRON.

Christian Ziegenheim, Allegheny, Pa.—This is a compound for treating iron preparatory to uniting it with steel by casting the steel on the iron, consisting of sal soda, caustic soda, borax, lime, and water.

IMPROVED ICE CREAM FREEZER.

Edward G. Wheeler, Mobile, Ala.—This consists of an ice can surrounding the cream basket, both of which are inside of an outer can, and suspended from the handles of the beater shaft, so as to revolve with it, being supported on its pivot so as to turn easily. The device is so connected to the beater shaft that, although only partially filled with ice, it can be made to freeze a full can of cream by shifting it up along the cream bucket, after freezing the lower portion.

IMPROVED PROJECTILE FOR ORDNANCE.

John G. Butler, New York city.—By means of this invention the sabot of a projectile may be applied in the shape of a comparatively delicate flanged ring, whereby the weight is not only greatly reduced, but much strength is added, since the sabot is secured to the projectile so much nearer to its periphery. A reduction of the distorting effects of the discharge upon the sabot, whereby it is frequently broken, by presenting a greatly reduced area for the operation of these forces, is also gained.

IMPROVED FOUNTAIN PEN.

Henry H. Perkins, Utica, N. Y.—This invention consists of a fountain attachment, bent of one piece of sheet metal, and attached by elongated wings and spring clasps to the pen, the ink reservoir being at the under side of the elongated wings.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED SASH BALANCE.

James Waddell, Mamaroneck, N. Y.—This is an improved sash holder, by which the upper sash may be readily opened and closed and retained in any position for ventilation, and by which also both sashes may be secured in closed position. The cords are connected with the top and front of the upper sash, and then passed over pulleys arranged on the top of the lower sash.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FENCE POST.

Frederick Suiter, De Witt, Iowa.—This consists of a slotted metallic tube with a wooden core, to which the wire-supporting staples are fastened. A top staple and wire retain a protecting cap, and a bottom staple and wire the inner wooden section.

IMPROVED HARROW.

William Taylor, St. Louisville, Ohio.—This harrow is so constructed that it will readily adjust itself to irregularities in the surface of the ground, and will allow either side to be raised to pass obstructions, and to clear it of rubbish. It has longitudinally hinged sections.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

Wanted—A second hand Ferris & Miles Hammer, about 1,000 lbs. ram. John R. Cameron, Halifax, N. S.

Celebrated John Scott Scroll and Jig Saws made to order, of Jessup's superior cast steel, by J. Roberts, 108 Hester Street, New York. Send for circular.

Split-Pulleys and Split-Collars of same price, strength, and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

Gear Cutter—Baldwin's for Sale. Cheap for Cash. Address W. E. Lewis, Cleveland, Ohio.

Foot Lathe, \$14; Scroll Saw attachment, \$3. Samuel Harris, Lind Block, Chicago, Ill.

For Sale—No. 3 Fowler Punch, with large assortment dies and punches. Cost \$800. Price \$275. Heavy iron shears, capable of cutting 3 in. square iron. Cost \$300. Price \$100. Forsyth & Co., Manchester, N. H.

Now Ready—New and enlarged edition of the Catechism of the Steam Engine. Free by mail for \$2. Send stamp for descriptive Circular. F. Kipp, Bridgeport, Ct.

To Inventors—Owners of Practical Patents can find buyers through us. Penn. Pat. Agency, Philadelphia.

Centennial Pumps for Hand Power—All sizes, for exhausting or compressing air. H. Weindel, 463 Dillwyn St., Philadelphia, Pa.

Scientific American—The early Volumes for Sale—very cheap—either bound or in numbers. Address A. F. R., Box 773, New York City.

Hydrant Hose, Pipes, and Couplings. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

Snyder's Little Giant One Horse Power Steam Engine, complete with Tubular Boiler, only \$150. Ward B. Snyder, Manufacturer, 84 Fulton St., New York.

For 2d Hand Portable and Stationary Boilers and Engines, address Junius Harris, Titusville, Pa.

Centennial Exhibition, Philadelphia.—Examine the Allen Governors, Machinery Hall, D. 9, Par. 71.

Machine-cut brass gear wheels, for models, &c. List free. D. Gilbert & Son, 212 Chester St., Phila., Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N. J., & C. 27, Michy, Hall, Cent. 1.

The French Files of Limet & Co. have the endorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, French Department, Centennial Exposition. Homer Foot & Co., Sole Agents, 22 Platt St., New York.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

See Boulton's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 2-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Deafness Relieved—No Medicine. Book free. G. J. Wood, Madison, Ind.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

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

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

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

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

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Boring Metals. E. Lyon, 49 Grand Street, New York.

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

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y. Temples and Oilcans. Draper, Hopedale, Mass.



C. C. P. will find on p. 203, vol. 34, recipes for colored fires.—H. J. C. should line his vinegar casks with the material described on p. 11, vol. 24.—G. W. S. and other pisciculturists should address Seth Green, Esq., Rochester, N. Y.—S. H. D. will find a recipe for removing warts on p. 97, vol. 32.—R. G. B. will find directions for bronzing iron castings on p. 283, vol. 31.—C. W., Jr., can proportion the change wheels of his compound gears by the rule given on p. 167, vol. 31.—W. B. can paste paper labels on tin if he mixes a tablespoonful of coarse sugar with a quart of flour paste.—E. F., G. M. C. & B., J. M., C. C., J. H. G., and many others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) F. M. J. says: I want to convey water 1,000 feet from a hydrant before it can be used. Which is the most practicable way, to lay 1,000 feet of pipe and connect an engine to the end, or connect the engine close to the hydrant, and the hose to the end of the pipe and play through the pipe and hose? A. The first method would be best, if you wish to throw a stream.

(2) A. S. asks: How are photographs put upon glass and made transparent, so as to be colored on the back with oil colors? A. The face of the picture is covered liberally with starch paste and laid upon clean glass. Then, with a smooth, hard edge, the paper is rubbed upon the back from the center to the edge until all of the starch is pressed out from between the picture and glass that can be. After it is dry, castor oil is applied to make it transparent.

(3) E. V. J. asks: What is the difference between sweet oil and olive oil? A. They are different names for the same thing.

(4) A. F. I. asks: How high can water be raised with an ordinary well pump by using check valves, say 10 or 12 feet apart? A. If, as we understand you, you mean to force the water up, the height is only limited by the power applied, and the strength of the apparatus.

(5) W. L. P. asks: 1. In what proportion should the best Portland cement be mixed with clean sharp sand, for coating the outside of a stone or brick building? A. One measure of cement powder to three measures of dry sand. 2. How many square feet will a barrel of cement mixed with sand cover? A. One barrel of cement and three of sand will make $3\frac{1}{2}$ barrels of mortar, which will cover about 4,000 square feet of brick wall, or about 40 squares, to a thickness of $\frac{3}{4}$ of an inch. 3. Should it be put on in one or two coats? A. Use one primary coat and a finishing coat put on immediately after it, before the first coat has set. The permanence of stucco on the exterior walls of a building depends generally more upon the stability of the surface that receives it than upon the stucco itself. The latter can absorb water and give it off without injury; but if the water finds its way through the stucco into the brick, it is apt to freeze in winter and fracture the face of the wall. To harden and fill the pores of the brick, spread a thin wash of cement over the wall and scrape it off first, before putting on the principal coat. 4. Could an ordinary house plasterer put it on satisfactorily? A. Yes, if an intelligent man.

(6) E. M. B. asks: Will a pump do work as easily with a 12 inch column as with a 5 inch, the size of water valve being the same in both cases? The lift is 150 feet. A. Other things being similar, the pump should force water more easily through the 12 inch pipe.

(7) J. V. N. asks: The following is a 2 x 4 inches engine, large enough to drive a boat 20 feet long and 40 inches beam, with a propeller? A. A somewhat larger cylinder would be advisable.

(8) R. B. H. says: I have a small iron cylinder, that will hold, compressed, 100 gallons nitrous oxide gas. I have also a regular dental gasometer that will hold a similar quantity. How can I compress this nitrous oxide gas into the iron cylinder, taking it from the gasometer? A. You will need a compressing pump. Considerable apparatus is required for producing such a high degree of compression.

(9) J. R. McC. says: 1. I saw in the SCIENTIFIC AMERICAN a recipe to make a wash of cement and oil to put on a brick wall, to keep out the moisture. Would water do as well as oil to mix with the cement, or would the brick being previously painted be a detriment to the cement adhering to the brick wall? A. A wash of cement and oil is simply a paint, and you can apply it like any other paint, with a brush; if your wall has been already painted, you should use oil and not water. 2. After the cement is applied, can I paint over the wall with any ordinary paint? A. Yes.

(10) J. T. C. asks: A. and B. have an argument about names of floors in a building two or more stories high. A. says the floor on a level with the street is the ground floor, and not the first floor, but the floor up one flight of stairs from this ground floor is the first floor, and up two flights the second. B. contends that the floor level with street is the first floor, and may also be called the ground floor, but the floor up one flight is the second floor, and so on. Which is right? A. B. is right, according to the practice followed in this country; but A. would be right in Europe. The ground floor in London and the *rez de chaussée* in Paris correspond to our first floor; and the first story in London and *premier étage* in Paris are equivalent to our second floor. In London they sometimes say "up one pair," that is, one pair of stairs, and in Paris *au premier*, which means the same thing.

(11) J. J. asks: A. says that glue can be dissolved in alcohol without applying heat, providing the spirit be of the proper strength? B. says it cannot be done with alcohol alone. A. B. is right.

(12) G. H. W. asks: Is carbonic acid beneficial to the stomach? A. In many cases it is.

(13) C. E. R. says: I have seen articles made from some composition pressed in molds, to represent carved wood, and intended for ornamentation on furniture. Can you tell me how they are made? A. The composition you mention is probably that made from sawdust and glue.

You state that paper pulp can be hardened by treatment with chloride of zinc. Can you give me fuller directions? A. We believe the anhydrous chloride of zinc is employed, together with the alumina salt, in the slaking.

(14) J. H. S. asks: How much zinc, used as a preventive of scale, is required for a 30 horse power boiler? A. A piece weighing 2 or 3 lbs. will be sufficient to experiment with.

(15) C. W. N. asks: Why is it that gunners are afraid to depress their guns below a certain angle in firing from a height? A. For fear that the gun may become unmanageable, and more disastrous to friend than to foe.

(16) A. A. H. asks: How is the material used by dentists for filling teeth prepared? A. Gold leaf is principally employed for this purpose, also other foils. An amalgam of copper and mercury has also been used with good results. You should have stated more explicitly what particular variety of cement you had reference to. Plaster of Paris is not used for this purpose.

(17) T. P. H. asks: Can marsh grass be utilized in the manufacture of paper? A. The material, we believe, has been used for this purpose before. If it can be economically harvested, dried, and freighted, and occurs in sufficiently large quantities, it might prove of some value.

(18) C. W. J. asks: The statement that, in the case of mill rocks, the upper stone may be more easily raised when in motion than at rest (the upper stone being the runner) by the regulating screw, is not credited. Can you explain? A. A simple test could be made by attaching a spring balance to the wheel or lever by which the stone is raised.

Of what material must a barometer be made in order to be entirely reliable? A. Mercury barometers are regarded as the most accurate.

The circumference and area being given, how do you find the diameter of a ring? A. Divide 4 times the area by the circumference.

(19) W. M. says: I have a gummy fluid which contains by the test considerable iron in solution. The density is about 15 Baumé. Can I get rid of the iron so as to avoid the color it gives? A. Iron in solution may be precipitated by heating it with nitric acid, and then adding ammonia.

(20) L. H. E. asks: How can I make a dressing that will keep a leather buggy top soft and pliable? A. A good mixture for making and keeping leather flexible consists of 1 pint boiled linseed oil, 2 ozs. beeswax, 1 oz. Burgundy pitch, and 2 ozs. turpentine, melted together over a slow fire.

(21) H. C. S. asks: How can I make gold size? A. For use on oil colors, take boiled oil and thicken with calcined red ochre, and reduce to the utmost smoothness by grinding. Thin with oil of turpentine. On water color or distemper work, use isinglass size, mixed with finely ground yellow ochre.

(22) H. B. asks: If a bottle be partly filled with water and an air pump applied to the top (the pump not reaching the water), can the water be pumped out, leaving a perfect vacuum in the bottle? It is understood that the bottle shall be closed airtight. A. No.

(23) C. S. says: When I drop a large stone into a stream of water, it will sink to the bottom; but if I break that stone into small particles and drop it into the current, it will move down the stream. My friend says it is because the particles are lighter. I say it is because the particles have a larger surface in proportion to their weight, to be acted upon by the water. Which is right? A. You are.

(24) U. H. asks: 1. Would an engine with two oscillating cylinders, $\frac{5}{8}$ inch in diameter and of 14 inch stroke, be powerful enough to run a scroll sawing machine to saw pine 1 inch thick? A. The engines will answer. 2. Of what size should the boiler be, to run with spirit lamp, and at what pressure should I run it? A. You might use a boiler 10 or 12 inches in diameter, and 18 or 20 inches high. You will find alcohol a very expensive form of fuel, even if you succeed in using it at all.

(25) C. J. L. asks: Is it possible for a gas meter to register more gas than really goes through it? A. It would be very easy to make a meter that would do this.

(26) F. C. R. Jr. asks: 1. If a ball is thrown into the air vertically, will it, on coming down, strike the hand with the same force that it left it with? A. No. 2. Why not? A. On account of the resistance of the air.

(27) S. G. asks: How many feet of water per second is required when passing over an over-shot water wheel 24 feet in diameter, utilizing 70 per cent of its effective force, to produce 100 horse power? A. Find how many horse power would be developed, if there were no losses, multiply this by 550, and divide the product by the product of the velocity of the water in feet per second multiplied by the weight of a cubic foot in lbs.

(28) F. O. R. says: I have steel springs from No. 18 to No. 0 in thickness in a vessel containing steam, sometimes up to 100 lbs. pressure. For what length of time do you think the springs will maintain their elasticity? Do you think that the heat of the steam will injure the temper? Will it corrode them? A. If the springs are kept bright, they will prove quite durable. To prevent their corrosion, they might be plated with nickel or silver.

(29) J. W. N. asks: Which wheel, of a pair of ordinary carriage wheels, would lift from the ground in rounding a curve, with nothing on the axle, the wheels being drawn rapidly? A. We are not sure that either would, if the ground were level.

(30) J. J. asks: 1. What power is gained on every additional inch on the face of an 18 inches diameter pulley, say from 6 inches to 7, 8, etc.? A. As we understand your question, if you double the face, you can expect to transmit about double the power. 2. What is the best thing to put on a rubber belt to keep it from slipping? A. If it is tightly stretched, it would be advisable to use a wider belt. 3. Is a six ply belt as liable to slip as a four ply? A. Yes, other things being the same.

(31) D. P. A. asks: What weight will a 2 inch jack screw raise and sustain? The screw has 2 threads to the inch, single thread, and length of nut is 4 inches. A. If you do not take friction into account, the weight raised will be to the pressure applied, as the distance passed over in a given time by the point of application of the pressure is to the distance passed over in the same time by the point of application of the weight. Practically, this result will be considerably modified by friction; how much can best be ascertained by experiment.

(32) O. R. M. asks: What power would be required to run a fan with 30 blades, each 5 feet long x 1 foot wide, set at an angle of 30°, at a speed of 500 per minute? A. So much depends on form and construction of fan blowers that it is safer to answer such questions by experiment.

Have you ever published any articles on flying machines? A. We think that everything of importance in reference to the subject has at least been noticed in our columns, and on p. 112, vol. 32, you will find a pretty thorough review of the question.

(33) H. M. W. says: I see it stated that anticipating a crowd at a new church, they tested the strength thereof (by piling pig iron on it) to 50 lbs. to the square inch. To what height would they have to pile to accomplish it? A. About 16 feet. We think, however, that you did not read the statement rightly. At all events, we are confident that no such test was applied in the case mentioned.

(34) C. T. V. asks: I have a ram for forcing water to my barn, and it will not run. It has always performed its duty well until this spring. The pipe into flume is tight, and no part broken. The valves are in good order; the shut-off comes up and will not go back. Can you tell what will start it? A. You should endeavor to find out why the waste valve will not shut. It must be obvious that a thorough examination would be more valuable than our opinion.

(35) J. W. C. asks: In No. 13 of the SCIENTIFIC AMERICAN SUPPLEMENT, first page, you give an illustration of the steam yacht Black Hawk, and say that salt water is now substituted to avoid carrying the weight of the fresh water. How is this done, and foaming prevented? A. In changing from fresh to salt water, and vice versa, foaming is apt to take place; and until the water in the boiler is changed, it is well to throttle the steam and check combustion somewhat.

(36) A. H. S. asks: What size of boiler will I need for a $1\frac{1}{2}$ x 3 inches engine? What should be the thickness of iron? With such a boiler, what horse power could I develop, running at a high speed? A. Your questions are rather indefinite, as the size of boiler and thickness of iron will depend upon the number of revolutions, the pressure of steam, and the design and construction of the engine. We have published some general rules on pp. 33, 285, vol. 33.

(37) J. F. S. says: I wish to make a small propeller to draw a small boat to carry 10 persons, on flat water about $1\frac{1}{2}$ feet deep. How can I build it best? A. Build it on the model of a good rowboat that has the required capacity and draft.

(38) F. M. says: I want to make a cast iron gun of $3\frac{3}{4}$ inches bore and 4 feet long. How much metal must I have around the bore at the breech? A. Make the thickness at breech about 4 inches. Make the diameter of vent $\frac{1}{2}$ inch, and bore it so as to enter breech about 1 inch from the bottom. But you will be safer if you buy a gun ready made.

(39) C. W. M. s ys: In your reply to E. L., you say that if, from a point without the ellipse, lines be drawn to the foci, the line bisecting the angle thus formed will be normal to the curve. So it will if the point is on the line of the major or of the minor axis, but not otherwise. In what treatise on the conic sections can be found the method of constructing the normal from a point not on the curve, in the case of either the ellipse, the parabola, or the hyperbola? A. We are obliged to our correspondent for calling attention to this matter. By an oversight, we gave the directions for drawing a normal on the assumption that the given point was on the curve. We have never seen a graphical solution of the problem for a point outside the curve. Nearly all treatises on conic sections, however, give methods by which the equation of the required normal can be obtained, and perhaps some of our mathematical readers will be interested in working out a simple graphical solution.

(40) J. H. H. asks: 1. What is the greatest depth from which a siphon can draw water, from an inclined shaft or a straight shaft, or is there any difference? A. In an inclined shaft, the pipe being longer, there would be more friction in the pipe, and the discharge would not be so great. You will reach the practical limit at a height of 28 or 30 feet. 2. How much longer should the external end be than the internal end? A. A slight difference of level between the two ends will insure working, provided the discharge is the lower, but of course, in practice, it is well to have a considerable difference, if possible.

(41) J. W. B. says: In regard to thickness of iron for a boiler of 14 inches diameter, 30 inches long, you say that iron will stand 35 lbs. to the square inch safely. I have a cylinder of 18 gage, 16 inches in diameter and 30 inches long, that I have had tested to 270 lbs. pressure. A. In our answers to correspondents in relation to the pressure a boiler will stand, we generally give working pressure, with a large factor of safety. In practice, it is usual to find boilers carrying much higher pressures than would be allowed by our proportions; but we think it best to give values which are sanctioned by the highest engineering authorities in this country and Europe.

(42) C. W. J. says: It is contended by some that to clear the foliage from muck beds, so that the sunlight and heat may have free access thereto, the fertilizing properties of the muck are lost by evaporation and absorption of nitrates from the muck. But to allow the shade to remain over the muck, and to haul therefrom as required, is better, and, in fact, the only salvation of the muck bed as a fertilizer; and it is contended that the evaporation and absorption goes on after the muck is deposited on the required lands, and that the plants designed to be improved thereby have to grab, so to speak, for their share, entering into direct conflict or contest with the sun. It is also contended that rain is a deposit of nitrates, previously taken up as vapor, and, therefore, after a shower, the nitrates are then taken up as rapidly as the plant can do it; and up in the reappearance of sunshine and heat, they are reabsorbed.

Are these things so? A. If the muck beds be well covered, there is practically little danger of loss, liable to arise from exposure to direct sunlight. The proportion of nitrates of ammonia in rain water is extremely small, so that in a well manured field the gain or loss to the vegetation from this source would be inappreciable.

(43) W. E. E. says: I have a lot of black rubber chains, and they have all turned to a grayish color. How can I get the color back? A. We could not suggest a remedy without examining the material or learning more precisely under what conditions the change had occurred. It is probable that the articles were not originally of good material.

(44) E. P. B. asks: Is oil made from fresh butter good for oiling farm machinery? Can the salt be taken out of salt butter so as to make an oil fit for oiling harness? A. No. Such oil is not suitable for either purpose.

(45) W. J. R. says: By what means can I take iron rust out of marble? A. It is impossible to do this, without injury to the marble, by purely chemical means. The best method that we can recommend is a uniform abrasion over the stained surface with a stiff steel brush, and, if the work was originally polished, repolishing in the usual manner. Where the stains are too deep for such treatment, it would perhaps be better to cover them with a light coating of a mixture of plaster of Paris in a strong solution of water glass.

(46) C. T. G. says: Please give me a recipe for cleaning baryta crystals and stalactites. A. If the crystals are really sulphate of baryta, try steeping them for some hours in hot muriatic acid, containing a very little nitric acid. If the deposit you wish to remove consists of ferruginous clay (ocher), this treatment will completely remove the iron, leaving behind the pure white clay, which may best be removed by mechanical means.

(47) C. H. W. says: In soldering tinware without a soldering iron, with a candle or lamp, the place to be repaired is first covered with an acid. Can you tell me how that acid is prepared? A. Digest zinc in strong muriatic acid until the acid will dissolve no more of the metal. Decant the clear liquid and bottle for use.

(48) H. M. asks: 1. How many strokes should a fret saw give, to one turn of the crank, to give the best results? A. About 25 or 30. 2. Would a friction wheel covered with india rubber of about 2 inches diameter, to be driven by a larger wheel, have power enough to drive the above saw? The 2 inch wheel is to be connected to the under part of the saw, by a crank pin run in a slot in the lower arm of the saw. A. I think it would, with a good heavy balance wheel, or a driver with a heavy rim. 3. Would it run hard under the above conditions? A. I do not think that it would run hard at all.—J. E. E., of Pa.

(49) E. A. F. says, in reply to J. W. O., who asks whether a horse can draw a vehicle more easily if hitched close to it: Several friends say that the closer a horse is to his load, the easier it is to pull, and vice versa. You say that you cannot see why the draft increases with the distance except by the additional weight of chain or rope and friction on the ground, if the rope touches the ground. My experience is that, in drawing a log or any other dead weight from the ground, the closer you get to the weight or object the easier it will move, for the reason that your power is above, getting rid of part of the friction. You may hitch to the forward end of a log and draw all you can, and then change to the hind part of the log, and let one animal be on each side with the weight between them, and they will move the load more easily. Take, for instance, a pair of trucks for hauling logs, and place the skids on one side of the trucks and a log to be loaded and team on the other. You may hitch a chain or rope to the trucks and under the log, and back over the trucks and to the team, which is close to the trucks, and then roll the log on. But take chain enough to reach from 30 to 60 feet, and they will load it easier with the 60 feet of chain or rope. In the last position your weight is above the backs of the animals or above the line of draft; in the first your weight is below. A. In our answer to J. W. O., we understood him to refer to an ordinary vehicle, in which no lifting effect was desired. What you have so well detailed in your letter is, we believe, generally correct.

(50) D. M. says: As many of your readers seem to take an interest in the baroscope of Babinet, of which I sent you a description which has been published in *Wrinkles and Recipes*, allow me to suggest a change which experience has taught me. The use of water in that instrument is subject to great inconvenience. For, as the water gets foul at the expense of the air confined in the bottle, it is necessary to remove the water pretty often. Now this trouble is almost entirely avoided by using, instead of pure water, a mixture of water and whisky in equal quantities.

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

8.—The powder consists of oxide of zinc together with finely ground resin. It would be necessary to make a quantitative analysis in order to determine the proportions of each ingredient.

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 Calcification of Tubercles. By C. B.
On the Water Grate. By F. G. W.
On a Small Engine. By T. B. R.
On the Vicksburg Cut-Off. By C. G. D.
On Voracious Fishes. By R. L. S.
On an Indolible Ink. By A. J. E.

Also inquiries and answers from the following:
S. & S.—J. J. H.—J. G. S.—I. W. H.—E. L. H.—C. S.
—G. S.—J. D. T.—P. K.—R. E. M.—W. H. E.—C. M.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells electric bells? Who is the best parlor organ? Who makes diving apparatus? Who is the best engine-turning lathe?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

June 20, 1876,

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Alarm, burglar, H. F. Green.....	178,922
Alarm, burglar, A. P. Norman.....	178,875
Alarm, burglar, W. H. Reiff.....	179,063
Atomizer, D. J. Tapley.....	179,079
Bag holder, L. H. Bristol.....	178,903
Bands and ropes, making, L. Blinn.....	178,987
Barrel-making machine, Hodges & Yelton.....	178,928
Basins, valve for, Doyle & Bayles.....	179,303
Bed bottom, spring, G. H. Evans.....	179,007
Bed book support, etc., G. B. Norgrove.....	179,048
Bedstead, cabinet, D. A. Green.....	179,013
Bee hive, H. H. Roush.....	178,929
Blackboard rubber, J. Haggerty.....	178,847
Boiler, agricultural, W. K. Stevens.....	178,974
Boiler, rotary steam, C. W. Pierce (r).....	7,184
Boiler, furnace, G. Morrison.....	179,042
Bolt-heading die, F. Matimer.....	179,244
Boot stiffeners, making, J. R. Moffitt.....	178,929
Boot sole edges, setting, C. A. Lake.....	178,858
Boot sole protector, S. Y. McNair.....	178,942
Boot, rubber, J. A. Bates.....	178,806
Boots, abrasive paper for finishing, J. G. Buzzell.....	178,994
Bracket, ornamental wall, E. A. Hale.....	178,848
Brick, hollow partition, J. Borie.....	178,968
Bridle bit, J. Litchworth.....	178,966
Brush, sponge, H. S. Kerr (r).....	7,181
Bucket ear, J. G. Krichbaum (r).....	7,183
Buggy top, G. Gabriel, Sr.....	178,844
Buoy, automatic signal, J. M. Courtenay.....	178,911
Burner, gas, V. Zels.....	178,984
Burner, lamp, H. A. Chapin.....	178,836
Butter worker, E. M. Pike.....	176,053
Can and box, sheet metal, H. C. Leland.....	179,035
Can jacket, J. G. Low.....	178,865
Can, sheet metal, G. H. Chinnock.....	178,996
Cans, sheet metal, E. A. Leland.....	179,035, 179,034
Car coupling, Bates & Borgersrode.....	178,986
Car starter, F. A. Hall.....	178,833
Cars, tube for propulsion of, A. S. Halliday.....	179,056
Carbureter, J. T. Stewart.....	178,973
Card playing, L. Levy.....	178,863
Carpet rag looper, C. F. Gronquist.....	178,923
Carpet stretcher, S. Thompson.....	179,080
Carriage pole, adjustable, F. W. Bishop.....	178,809
Carriage top setter, W. H. Nogle.....	179,047
Caster, furniture, S. Konz.....	178,837
Chair back, W. W. Marshall.....	179,038
Chandelier, drop, H. Prescott.....	178,953
Coat patterns, laying out, J. H. Nichols.....	179,016
Coffee holder, S. C. Johnson.....	179,025
Colds, etc., remedy for, A. M. De Witt.....	178,840
Cooler, air, W. E. Richardson.....	178,958
Cork extractor, J. L. Hyde.....	178,854
Crib, child's, H. Oeort.....	178,945
Crimping machine, L. P. Lum.....	178,866
Cultivator, J. M. Crabtree.....	178,912
Culivator, J. Glidden.....	178,846
Cup holder, J. Scherer.....	178,963
Curry comb, G. Noll.....	178,874
Curtain fixture, A. H. Knapp (r).....	7,192
Cutter head, P. G. Finn.....	178,918
Cuttle fish holder, A. H. Alverson.....	178,803
Cuttle fish holder, C. H. Bentz.....	178,956
Detonating compound, J. D. & W. C. Schooley.....	179,067
Door check, J. H. Swift.....	178,976
Door sealer, G. M. Lindsey.....	178,864
Dredging apparatus, F. C. Prindle.....	179,065
Dredging machine, J. Howe, Jr.....	178,930
Drilling machine, rock, Clarke & Utter.....	178,900
Dyeing woven fabrics, G. C. Gibbs.....	178,921
Engine, explosive, G. Hardy.....	178,925
Engine, reversible valve, F. Murgatroyd.....	178,870
Eraser and pencil protector, C. B. Sheldon.....	178,862
Excavator, J. P. Bonnell.....	178,901
Faucet, beer, T. C. Perkins.....	179,050
Fence, O. D. Beebe.....	178,897
Fence barb tool, wire, H. W. Prindle.....	178,954
Fever and ague remedy, A. M. De Witt.....	178,839
Filter, liquid, H. Stewart.....	178,972
Fire arms, stock for, G. Smith.....	179,073
Fire escape, H. L. Holmes.....	178,929
Fireproof construction, L. Hornblower.....	178,852
Flower stand, bracket, W. H. Shirley.....	179,071
Fruit, etc., preserving, C. A. Dards.....	178,913
Fruit, etc., drying, W. Brown.....	178,901
Pommel tongue, G. B. Clarke.....	178,907
Furnace-feeding mechanism, T. Henderson.....	178,017
Furnace for steam boilers, G. Morrison.....	178,019
Furnace, heating, J. Reynolds.....	178,892
Furnace, metallurgic, Silvester & Kirk.....	179,072
Furnace, soldering iron, E. G. Adams.....	178,891

Furnace damper regulator, A. C. Norcross.....	178,944
Furnaces, heating air for, C. Thonger.....	178,977
Gas, making, A. Duchesne.....	179,005
Gas, making hydrogen, J. M. Hirsh.....	179,018
Gas tar, separating ammonia, J. J. Thomas.....	178,889
Gasaliers, smoke bell for, J. Fox.....	178,930
Generator, steam, J. A. Miller.....	178,868
Glass panel, J. Budd.....	178,904
Grain binder, J. E. Buxton.....	178,993
Grain binder, Randall & Rayment.....	179,028
Grain sheaves, tie for, R. Richeson.....	179,063
Grinding machine, C. Majer.....	179,037
Harrow tooth, H. B. Fargo (r).....	7,180
Harvester rake, J. Garrard.....	179,010
Heater and filter, feed water, G. F. Jasper.....	178,932
Hog cholera, remedy for, C. B. Lake.....	178,935
Horse protector, W. S. Marsh.....	178,867
Horseshoe, E. Murrain.....	178,871
Horseshoe, Rattray & Robertson.....	178,955
Horseshoe pad, D. W. Horne.....	179,020
Hose coupling, C. L. Martin.....	178,939
Hydraulic drawback, C. Sellers.....	178,965
Indicator, station, J. R. Balseley.....	178,895
Indicator, Goddard & Co.....	179,011
Indicator, station, C. M. Sexton.....	178,968
Iron, holding bars of, W. Sellers.....	178,967
Iron, etc., welding and shaping, G. H. Sellers.....	178,966
Ironing apparatus, Ashton & Metz.....	178,894
Jack, lifting, H. H. Sherwood.....	179,070
Journal bearings, etc., metal for, S. Doubleday.....	178,841
Kiln, charcoal, B. Kane.....	178,835
Kiln for burning brick, gas, Seger & Co.....	179,060
Labeling mineral specimens, C. W. Cannon.....	178,906
Lamp, C. Godfrey.....	179,006
Lamp lighter, F. W. Rentzsch.....	179,061
Lamp-lighting device, R. S. King.....	178,856
Lamp work, G. K. Osborn.....	179,049
Latch, door, S. Oppenheimer.....	178,876
Latch for doors, thumb, H. C. Hill.....	178,926
Latch, reversible knob, W. M. Griscom.....	179,015
Latch, thumb, C. S. Jennings.....	178,933
Leather straps, etc., cutting, C. Gahr.....	178,845
Ledger, mechanical, O. Sallbach.....	174,961
Leech, artificial, F. Klee.....	179,028
Lock, combination, T. M. Seaton.....	178,964
Lock, time and combination, F. McDuffee.....	178,940
Lock, seal, Slack & Fisher.....	179,073
Lock, time, T. W. Spencer.....	179,076
Mail pouch tag holder, Metz & Co.....	179,040
Marquetry, making, W. E. Brock.....	178,989
Mats, etc., protector, G. H. Bliss.....	178,900
Mechanical movement, C. Sandermann.....	178,962
Mechanical movement, R. Swarbrick.....	179,078
Motion, multiplying, Coriell & Co.....	179,000
Nail-plate feeder, J. Newell.....	178,873
Nut lock, A. E. Brown.....	178,834
Oil cloths, printing, Randall & Co.....	179,039
Ovals, cutting, H. McAdams.....	179,039
Oven, domestic, S. P. Whitcomb.....	178,983
Paddle wheel, feathering, J. H. Clow.....	178,999
Paint composition, C. Dubois.....	179,004
Pan, cake, A. Lang.....	179,031
Paper-cutting machine, J. P. Dunwald.....	178,915
Paper binder, temporary, E. W. Stiles.....	178,975
Paper, puncturing, A. N. Lewis.....	178,987
Paving block, S. J. Whiting.....	178,982
Pen, fountain, R. Douglass.....	178,914
Pen holder, C. O. Hart.....	178,849
Pen, writing, H. D. J. Pratt.....	178,951
Piano action, upright, F. Koth.....	179,029
Pipe cutter, Jacob & Jamer.....	179,024
Pipe, waste and overflow, G. E. Waring, Jr.....	179,083
Plow, F. R. Bell.....	178,898
Plow, S. W. Pope.....	178,877
Plow, J. Shickel.....	178,970
Plow and cultivator, sulky, E. W. & J. N. Russell.....	178,960
Plow, shovel, M. Schlessman.....	179,065
Plow, sulky, J. W. Grimes.....	179,014
Plow, tie-laying mole, S. H. Reynolds.....	178,937
Plows, land skimmer for, G. & J. Thomson.....	178,978
Pneumatic switch lock, etc., W. E. Prall.....	178,951
Press, hay and cotton, F. M. Nash.....	179,045
Printer's galley, H. E. Hanna.....	178,924
Printing oil cloths, Randall & Co.....	179,059
Projectile, J. M. Pollard.....	179,004
Propellers, etc., raising screw, E. Ralph.....	178,957
Pump, air, R. H. Holbrook.....	178,851
Pump, double-acting, J. D. Carr.....	178,835
Pump, oil and liquor, W. L. Carlson.....	178,907
Puzzle, picture, Hyatt & Frazer.....	179,023
Radiator, steam, J. T. Kelly.....	179,027
Railway, endless traction, A. S. Halliday.....	179,016
Railway electric signaling, Rousseau & Smith.....	178,880
Rake, horse hay, W. S. Archer (r).....	7,179
Rake, horse hay, E. E. Leach.....	178,862
Rattan veneer, S. H. Penley.....	178,949
Reflector, C. Cothren.....	179,001
Revolver cartridge ejector, R. White.....	179,084
Revolver cartridge extractor, O. Jones.....	179,026
Rolling axle, machine for, G. K. Dearborn.....	178,838
Sad iron, F. Ferrier.....	178,951
Sash fastener, S. Brown.....	178,990
Sash fastener, W. H. Taylor.....	178,885
Saw file and set, combined, E. M. Boynton.....	178,832
Saw filing machine, W. S. Newton.....	178,872
Saw frame, E. C. Atkins.....	188,985
Scraper, earth, E. Atkinson.....	178,831
Scraper, road, W. Patterson.....	178,948
Separator, grain, L. C. Royer.....	179,064
Sewing machine hemmer, E. T. Thomas.....	178,011
Sewing machine ruffler, A. M. Leslie.....	179,096
Sewing machine treadle, W. H. Stewart (r).....	7,185
Sewing machine feed, T. S. Huntington.....	179,022
Shade cord retainer, R. W. Fitzell.....	179,008
Shingle machine, P. T. Burgher.....	178,962
Shingle sawing machine, F. A. Huntington.....	179,021
Shoes, making, C. H. Krippendorf.....	178,909
Shrinks, etc., preserving, G. W. Dunbar & Co.....	178,916
Sign, illuminated, F. McLewee.....	178,941
Sleigh draft bar, J. P. Thompson.....	178,888
Soap holder, J. L. Stackhouse.....	178,893
Soldering iron, W. H. & W. J. Clark.....	178,837
Soldering iron furnace, E. G. Adams.....	178,891
Speed regulator, N. U. Metz.....	178,943
Spice box, G. W. Putnam.....	178,878
Spinning stop motion, O'Donnell & Walker.....	178,846
Spinning wheel, J. W. Mullins.....	179,043
Spool cabinet, S. Schmittner.....	178,987
Stair rod, G. W. Hill.....	178,927
Stalk-cutting machine, E. E. Leach.....	178,860
Staves and laths, sawing, G. W. Herring.....	178,830
Stereotyping machine, S. V. Essick.....	178,843
Stock gallows, W. G. Hyder.....	178,931
Stone and glass, polishing, Purdy & Blue.....	179,056
Stool, camp, W. A. Graham.....	179,012
Stool, camp, L. Sauter.....	178,881
Stove, heating, A. T. Lanphere.....	178,032
Stove or furnace, D. N. Allen.....	178,862
Stove platform, J. W. Elliot.....	178,917
Stud or button, W. B. Duntple.....	178,842
Sugar safe, L. C. Parker.....	178,947

Tag, C. H. Clark.....	178,908
Tanks, constructing wooden, E. M. Morgan.....	179,041
Tannin juices, treating, J. Foley.....	178,919
Tea and coffee pot, E. B. Manning.....	178,907
Telegraph, dial, E. Van Hovenbergh.....	179,062
Thill and pole attachment, E. E. Leach.....	178,861
Top, spinning, C. E. Vetter.....	178,979
Torpedo, oil well, E. E. Sweet.....	179,077
Track clearer, M. Plack.....	178,950
Traction wheel, W. H. Laubach.....	178,859
Truck and bag holder, combined, L. Tandy.....	178,888
Turning handles, Seely & Chilcote.....	178,969
Twine holder, Gardner & Hill.....	179,009
Type casting machine, J. M. Conner.....	178,910
Valve, balanced slide, J. J. De Lancey.....	179,002
Vehicle spring, J. Kauffman.....	178,964
Vehicle wheel, L. Dorman (r).....	7,186
Vehicles, propelling, H. W. F. Carstens.....	178,995
Vessels, swinging berth for, H. C. Smith.....	178,971
Wagon brake, M. Schlessman.....	179,066
Wash board, G. R. Wright.....	179,085
Washing machine, E. J. Robinson.....	178,879
Washing machine, H. L. Vestal.....	178,900
Washing machine, G. S. Walker.....	178,980
Watch cases, calendar for, C. K. Pevey.....	179,052
Watch escapement, J. R. Hopkins.....	179,019
Watches, safety pin for, M. C. Smith.....	179,074
Water wheel, turbine, I. Sherek.....	178,969
Well and clatern top, J. M. Bull.....	178,905
Well torpedo, oil, E. E. Sweet.....	179,077
Windlass, B. D. Thayer.....	178,887
Wire-splicing tool, R. L. Taylor.....	178,894
Wrench, W. Britton.....	178,833
Wrench, pipe, T. Booth.....	178,902
Wringer, G. S. Walker.....	178,981
Zinc from its ores, extracting, F. L. Clerc.....	178,998

DESIGNS PATENTED.

9,345.—MEDAL.—W. Conn, Philadelphia, Pa.
9,346.—STOVE.—J. A. Lawson, Troy, N. Y.
9,347.—STOVES.—A. Richmond, Brooklyn, Conn.

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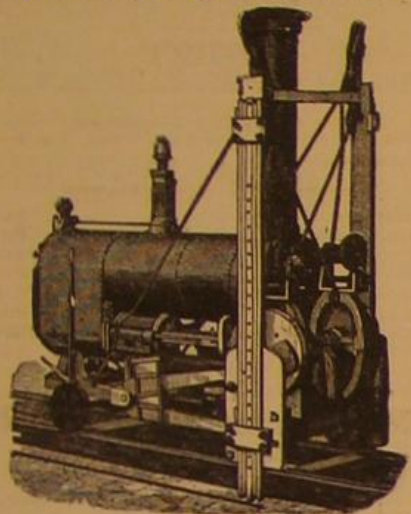
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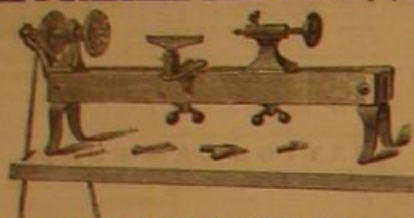
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