SCIENTIFIC AMERICAN

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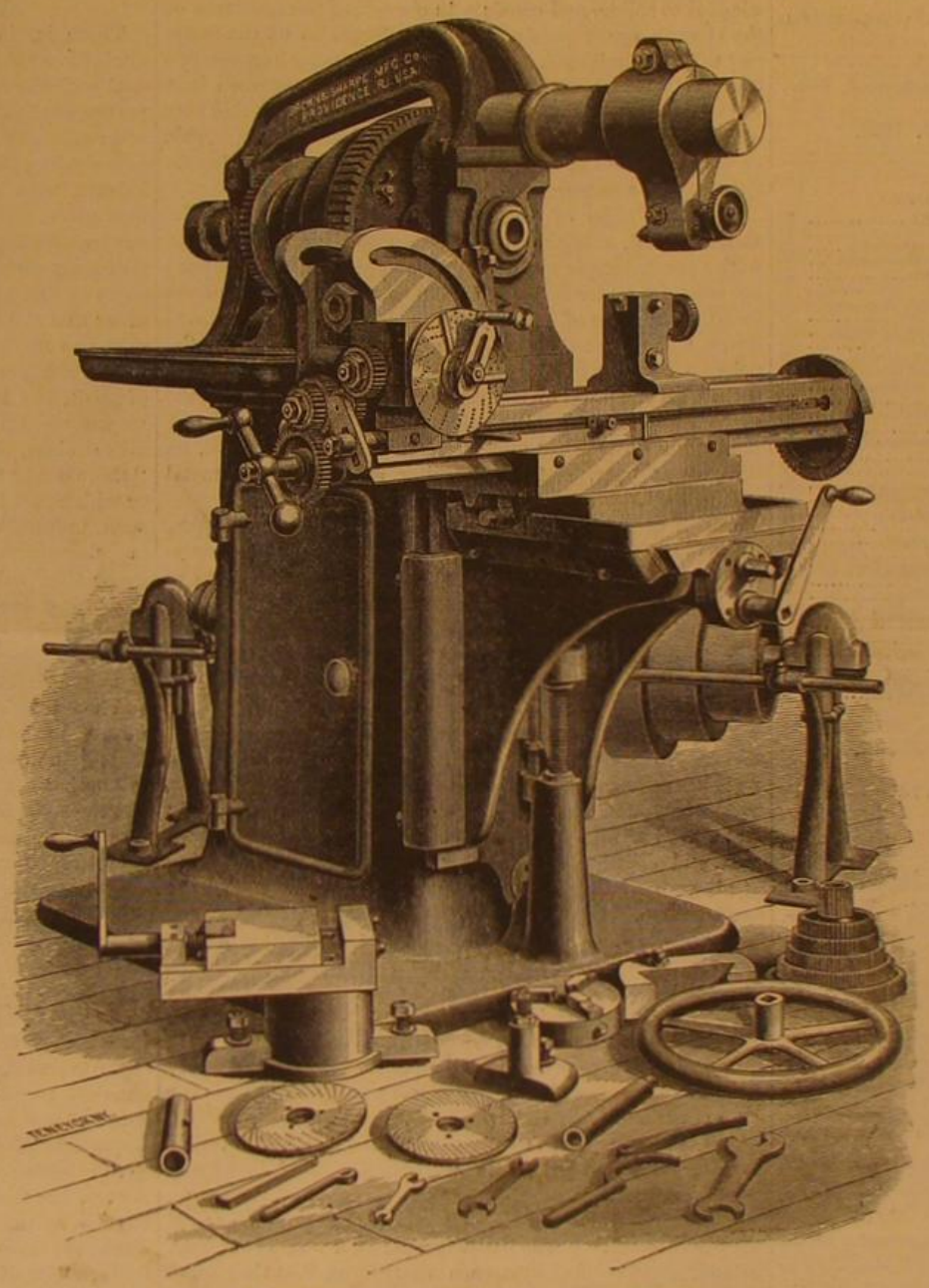
IMPROVED UNIVERSAL MILLING MACHINE.

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 gearing 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.



UNIVERSAL MILLING MACHINE.

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 golf 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, ridiculous 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 an second assistant engineer, nor until he shall have passed a physical and professional examination. The physical examination shall precede the professional; and if a 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.

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(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.
Vol. II., No. 2.
For the Week ending July 8, 1876.

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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 spectro-microscope, 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 Bridgwater 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 hematosed 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 mammifers; 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 oldfashioned 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 exhorbitantly 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.

Dom 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 admittance. 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 Putman 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 icthyological 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 endles 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 kyales 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 foundin 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.

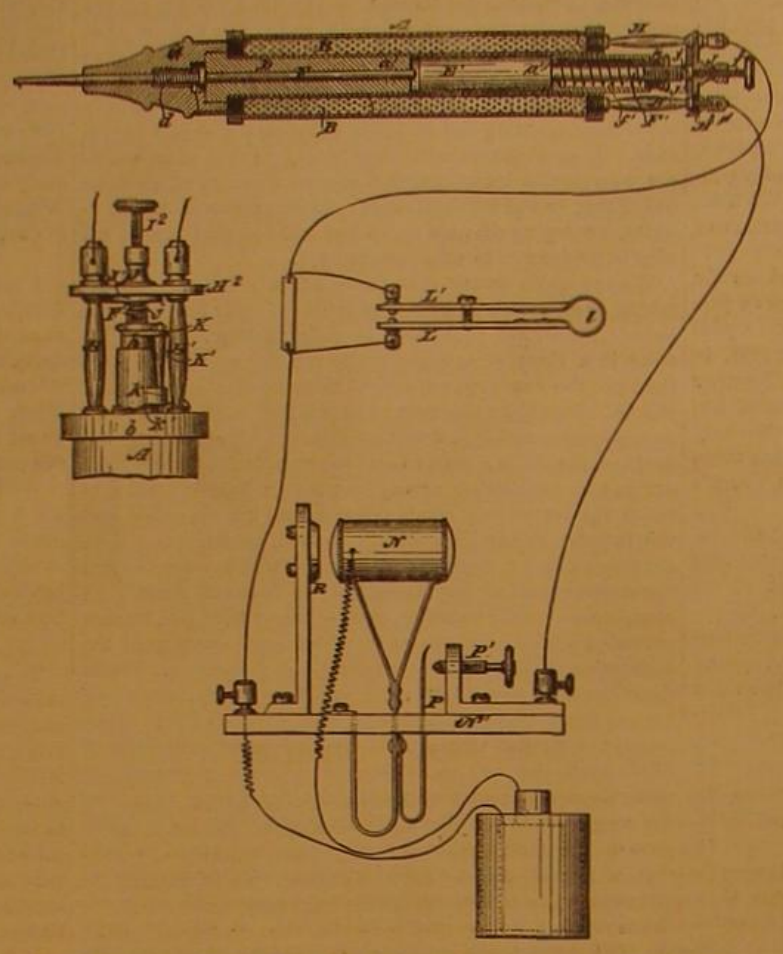
To make aqua regis, distil together 16 ozs. spirit of niter and 4 ozs. common salt. Another way is to mix equal parts nitric acid and muriatic acid, or nitric acid 2 parts and muriatic acid 1 part.

TWO NEW DENTAL INVENTIONS.

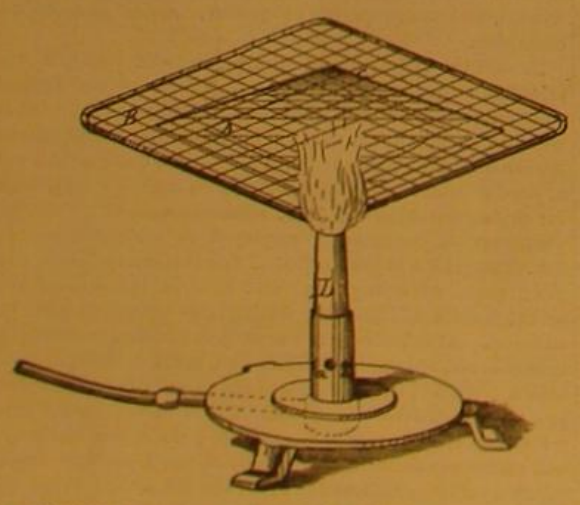
A very ingenious electric plugger, in which the circuit can be established or interrupted at will, has been patented (March 21, 1876) by Dr. Allen Spencer, of Columbus, Ohio. The mallet hand piece, composed of an inner tube, is mounted in a casing. The wire of the helix is confined in the handle, and 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, *j*′. 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 H¹, are screwed into the butt cap, and connected by a crosshead, H². A set screw, I², projects against a disk, *j*, of soft iron, around which, and between the posts, H H¹, 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, H¹. 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 cords, 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, I², of the automatic break, serves merely to regulate the frequency of the blows.



SPENCER'S ELECTRO-MAGNETIC DENTAL MALLET.



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 deposit of carbon, and *vice versâ*. 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 vitæ*, 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, 1¼ 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.

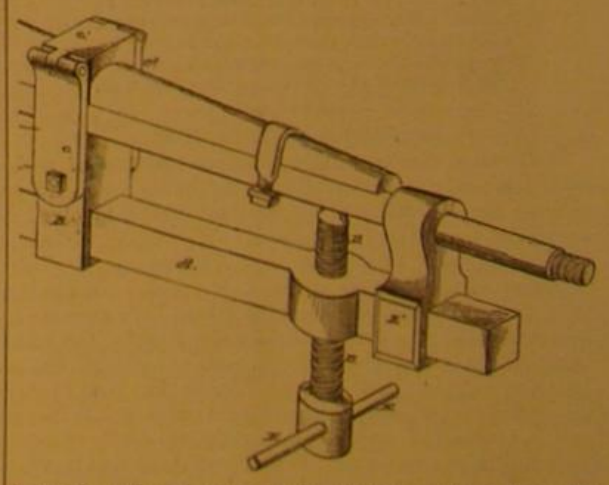
Setting Milk.

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*¹, *c*². 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*¹, 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*¹, is hinged the part, *c*². 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.

Fig. 1

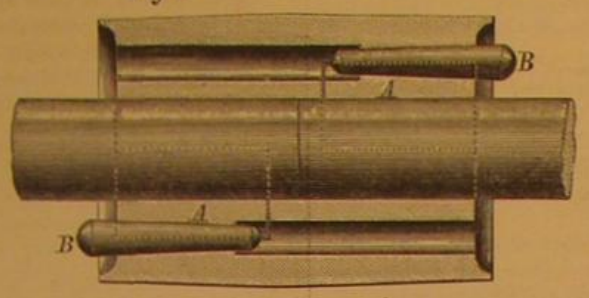


Fig. 2

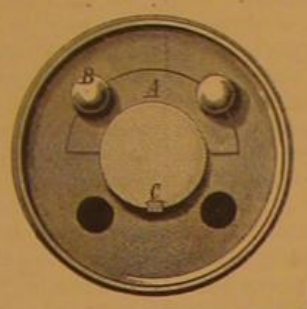
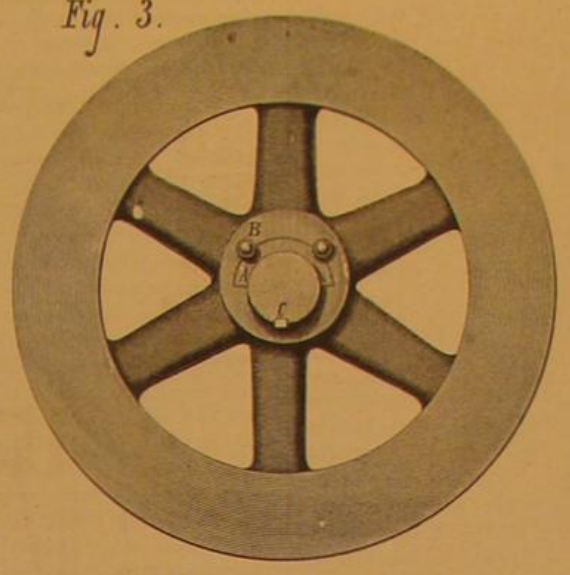


Fig. 3.



GUSS' SHAFT COUPLING.

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 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 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 hight 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 hight 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 $\frac{1}{534}$ that of the surface. Hence, for practical purposes, we may consider the depth of motion below the surface to be commensurate with the hight of the wave above.

The highest waves ever measured occur off the Cape of Good Hope, and reach a total hight, 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

Fig. 1.

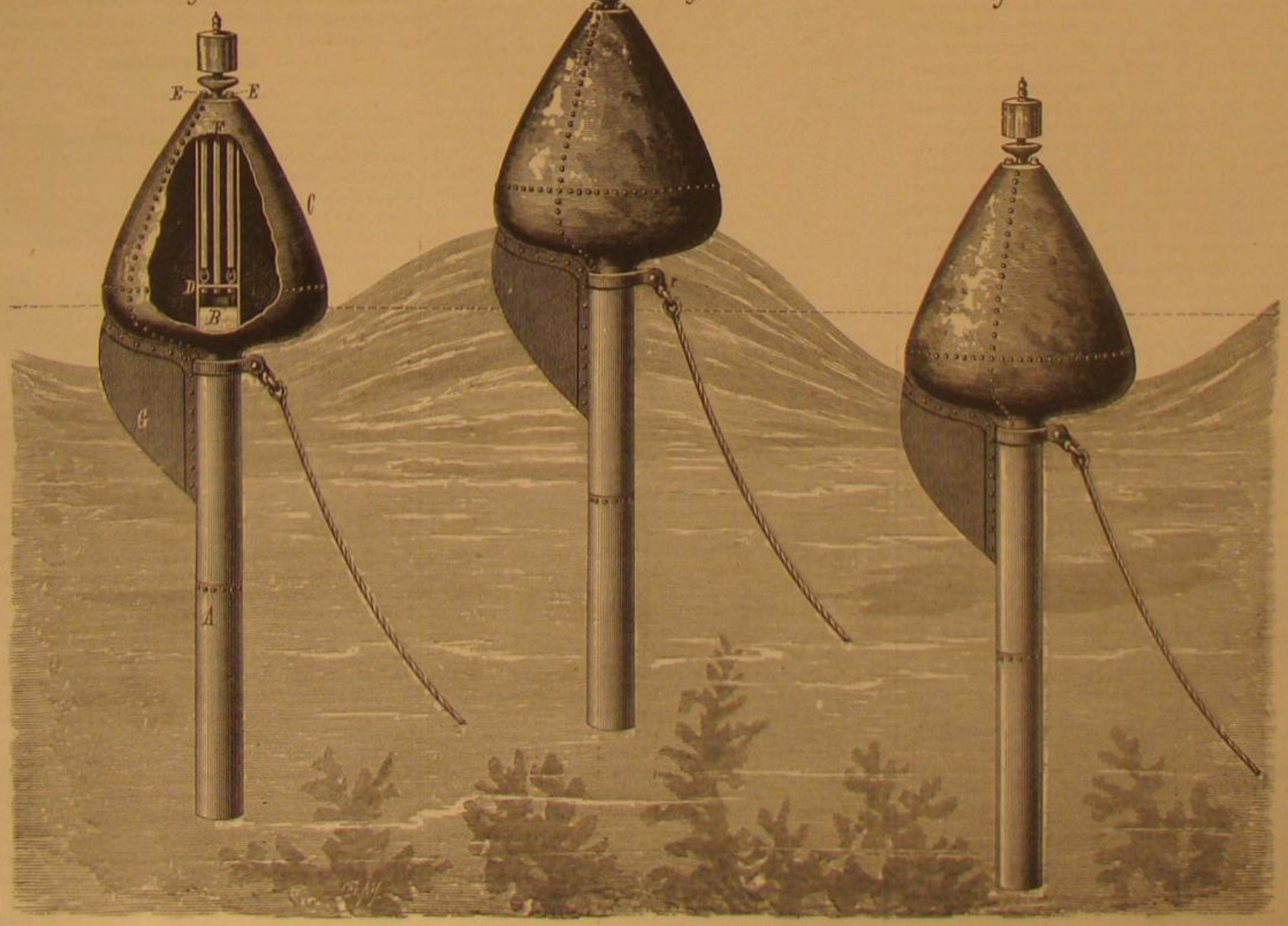


Fig. 2.

Fig. 3.

COURTENAY'S AUTOMATIC SIGNAL BUOY.

shape of prevalent opposing winds and currents, combine on shallow water that rollers of the exceptional hight, 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 hight 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 hight 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 hight 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 hight 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 Oberohe 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 founderies, 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 hights 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 hight 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 adjoined *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.

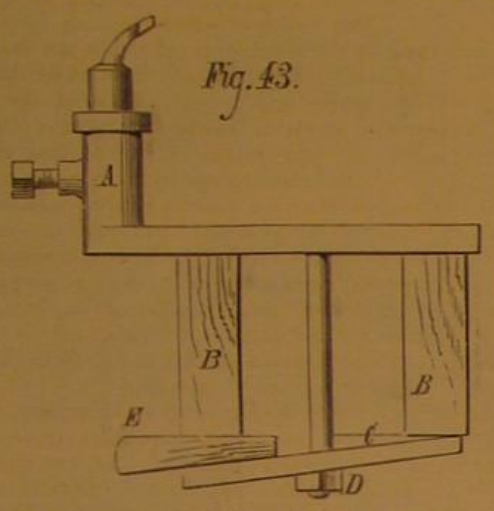
BY JOSHUA ROSE.

SECOND SERIES—Number VI.

PATTERN MAKING.

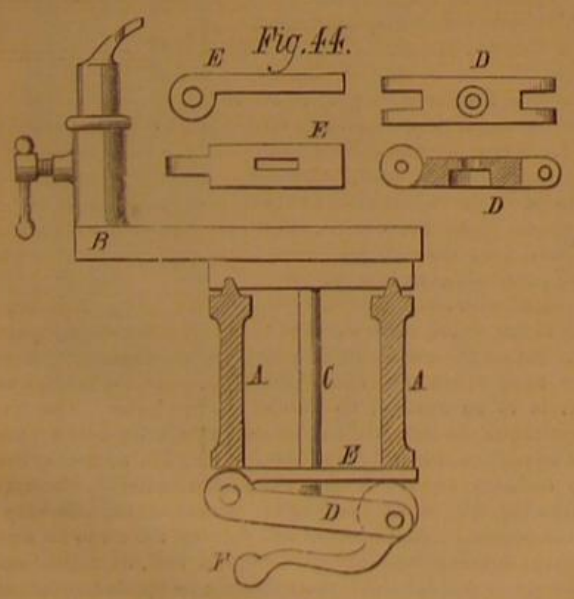
To give the required form to various patterns, recourse must frequently be had to that useful machine, the lathe. The lathe adapted for pattern work is strong and steady in the framework, to avoid the tremor resulting from the high speed at which it is driven. It should be of good and durable workmanship 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

Fig. 43.



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 countersink or recess to receive the nut and prevent it unscrewing. E represents a hinged plate, and F a lever, having a cam at

Fig. 44.



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.

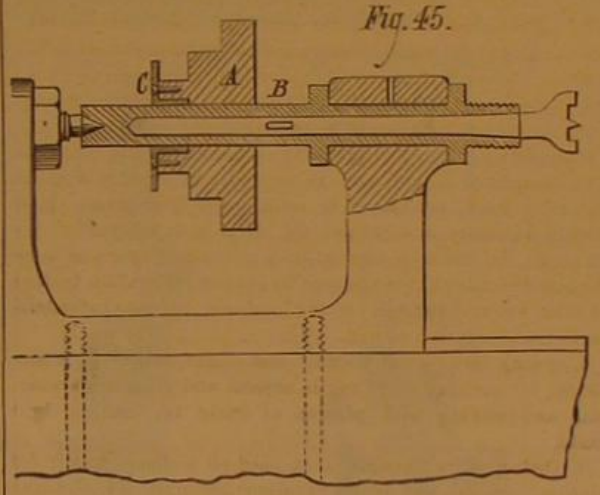
The running head of the lathe requires particular mention. The mandrel should always be of steel, turned true, hardened, and trued by an emery wheel after the hardening process. It should be well fitted to its bearing; for if it is not, an unpleasant jarring noise will be produced when the latter is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

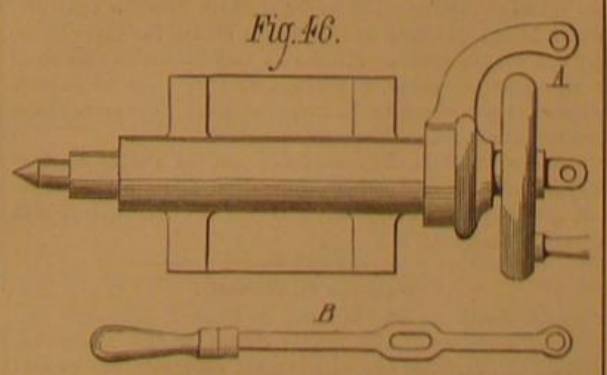
The cone pulleys should be as light as possible for a pow-

Fig. 45.



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 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

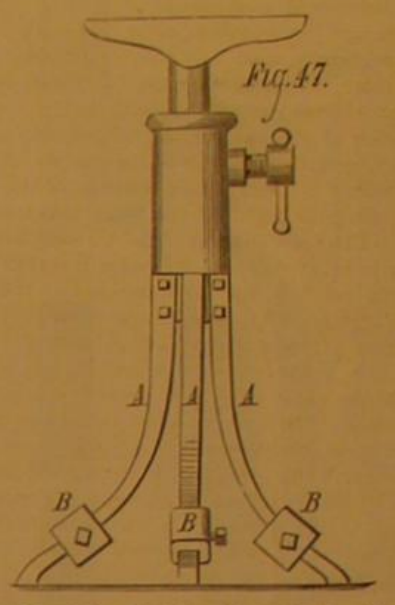
Fig. 46.



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 brdk 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

Fig. 47.



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

Fig. 48.

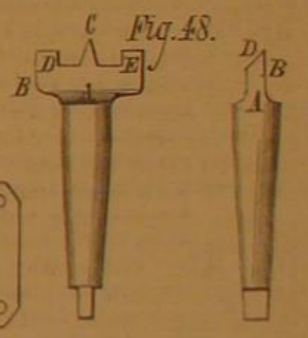
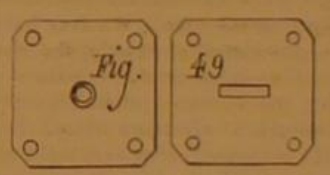
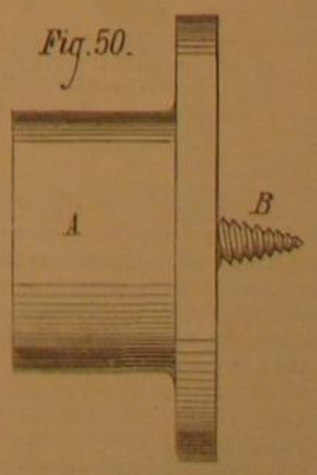


Fig. 49



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 centerplates, 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

Fig. 50.

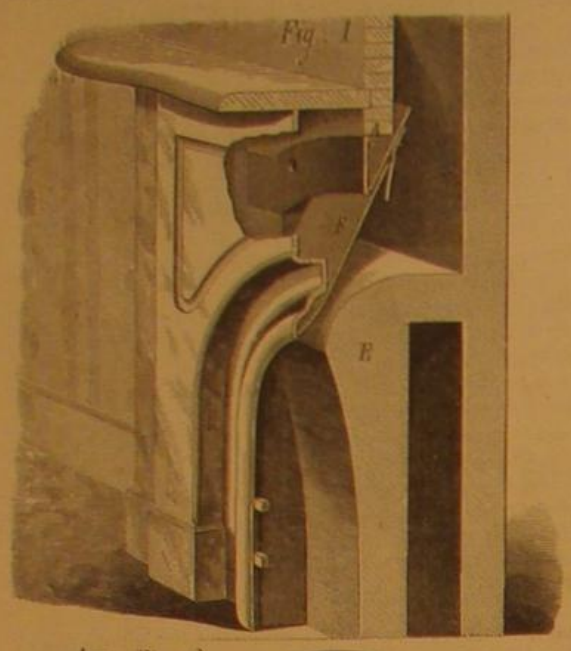


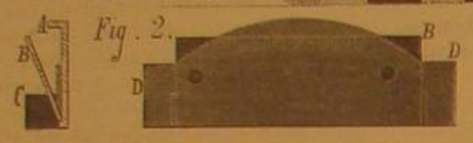
the part, A, having an internal screw to fit the driving screw on the lathe spindle, and the point, B, being a coarse screw intended to screw into the work: which latter should have a small hole bored up it to prevent (especially in the case of hard woods) the pressure of the screw from splitting the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

THE following imitation shellac varnish is used by many furniture manufacturers: Gum sandarac 1¼ lbs.; pale rosin 1¼ lbs.; benzine 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.

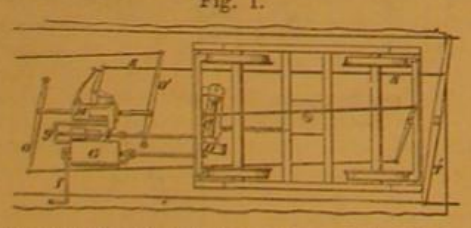
It will be perceived that, by reason of the thin lower edge of the arch bar, and also the inclination of the back plate and the smooth surface of the same, no obstruction is offered to the passage of the products of combustion into the flue. The back plate has also the additional function of turning 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.

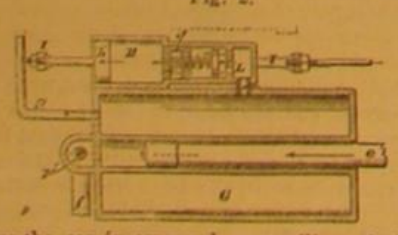
Mr. Alfred James, of Seymour, Jackson county, Ind., has patented (July 6, 1875) an automatic brake for cars, operated

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.

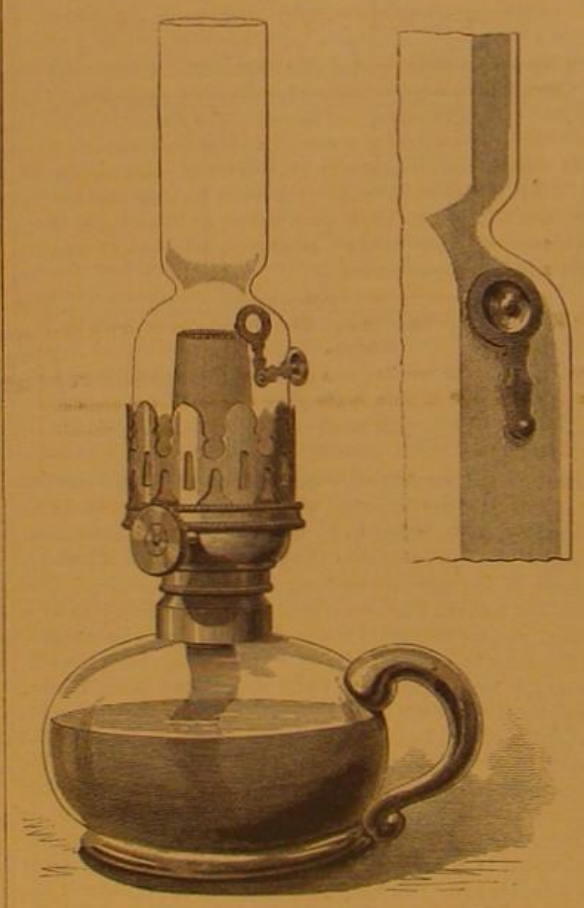


Under the car is arranged an auxiliary shaft, C, Fig. 1, carrying a friction wheel, D, which, by the action of a coiled spring, is drawn against and rotated by the car axle when he vehicle is in motion. A pitman on the wheel, D, connects with the rod, *e*, Fig. 2, which draws in air through the opening, 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, *h*, 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 acted upon by a spring, which valve, when opened, allows access of air from cylinder, G, behind the plunger, *h*. 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, *h*, 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.

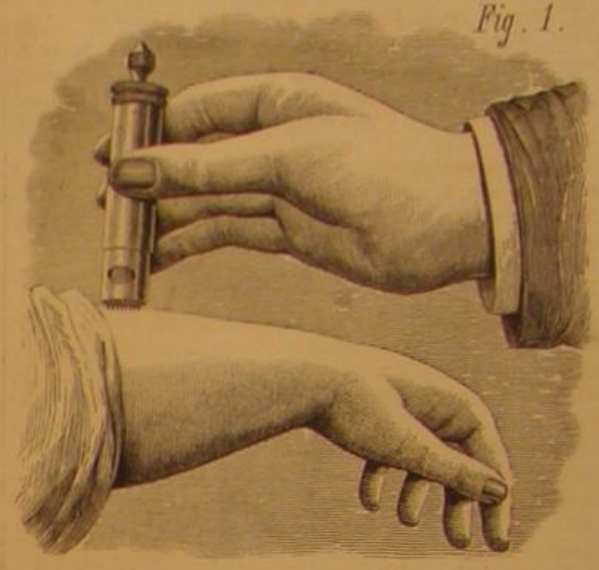
By the death of Mr. William D. Russell, president and business manager of the Baxter Steam Engine Company, Newark, N. J., loses one of her most energetic and prominent citizens. On Friday evening, June 16, Mr. Russell returned to his home from Philadelphia, and at about ten o'clock was taken ill. A physician 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.

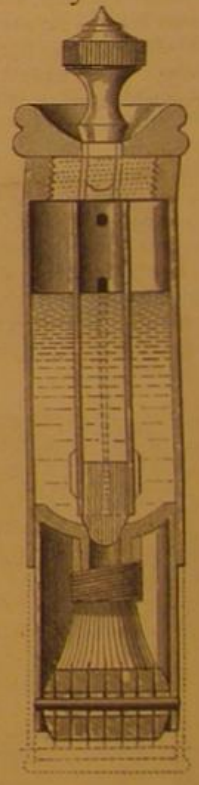
Croton oil and other substances possessing similar qualities are used by physicians as counter irritants to subdue and destroy internal or deeply seated diseases and to induce or substitute therefor a superficial inflammation. The external application of this medicament is attended with very

Fig. 1.



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. Figs. 1 shows the method of its manipulation, and Fig. 2 its internal construction.

Fig. 2.



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.

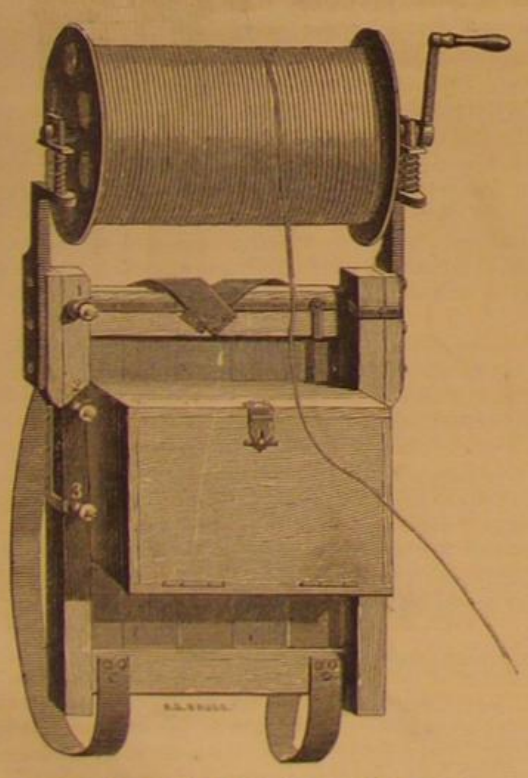
IMPROVED MILITARY TELEGRAPH.

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 cov ered 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 armature 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.

TROUVE'S MILITARY TELEGRAPH.



TROUVE'S MILITARY TELEGRAPH.—Fig. 2.

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 10¼ 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 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

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 consistence 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 8¼ ozs. strong gum arabic solution, to which a solution of 30 grains sulphate of aluminum dissolved in ¼ 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.

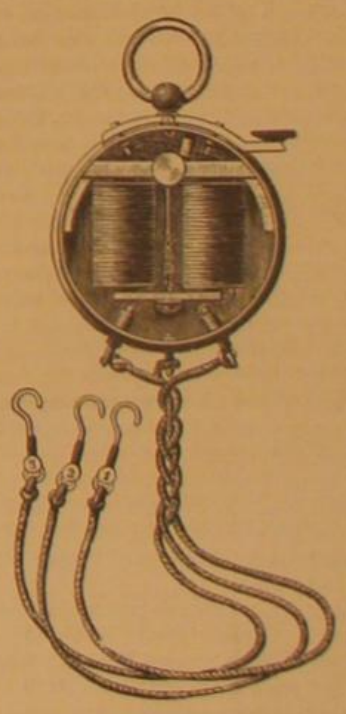
Tobacco leaves for the manufacture of Havana cigars are now being produced in New York, thanks to the industry of some of her citizens, aided by the progress of chemical science. The material used is a kind of brown wrapping paper, made of straw especially for this purpose. The paper, after coming from 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 consistence. 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 alcohol, 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. 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	22
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 n 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 $\frac{4}{1000000}$ 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, equaling 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 tuns per square mile, or nearly 3,000,000,000 tuns 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_3 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_3) 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_3 together with an Ut_3 free reed pipe, the component Ut_3 is perceived unaffected in intensity, while all the higher harmonics are obliterated except Mi_4 and Sol_4, 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 quartetts, 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 fluoreasing substances were then exhibited, producing effects of indescribable beauty.

Fluorescine, 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 fluorescine, 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 p'anet 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 FORMULÆ 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 formulæ 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 about 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.

Authors 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 *et al. 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 reissue 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 shortly come to detect my error, and to uphold or destroy the patent as being for a method of sinking a well pit by puncturing 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 pointed 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 claimed by Green.

The invention consists in the method of putting to a 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 abundant supply of water is afforded to the pump. This conception was 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, then became part of the property of the public, available for the purposes intended, unless it be secured by 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 whether force could be called into operation 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 experiment might, therefore, well be allowed 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 24, 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 reissue, 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 the defendant contends, as he may rightfully do, that 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 Suggett 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 question of prior use may at this place be disposed of. *

It is, of course, true that, 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 right to a patent would not thereby be defeated. A chance operation 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 put to practical use by him in his process, had before that been known and 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 if 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 productiveness 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, 1868. 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 1839, 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 his process at the fair grounds in Cortland, where the Seventy-sixth New York Regiment, of which he was colonel, was then stationed, to be there 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 report 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 method by which that idea 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 pursuance of the directions he had given, at or near his house in Courtland. The first experiment was a success in this, that it proved 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 wherewith to construct 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 1839.

The act of 1839, 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 Suggett were under a 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. (Hascldeu *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 the fact that Suggett had put down wells in Cortland necessarily amounts to notice that the process of Green was being employed by Suggett. The rule of law being that "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 exceeds two years, but in the absence of that and of any other colorable circumstances we know 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.

I 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 controversy in which he had become 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 co clude, 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, B. 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 the patent reissued to them as assignees of Adoniram I. 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 that power at any other point at the will of the operator.

Decree for complainant.

[*George E. Belton,* for complainants.

James E. Maynadier, 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 pasteboard 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 Hights, 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 fleur 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 hasp-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 CAR TRUCK 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 hights, 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 treeing 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 woof 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.

Marciene H. Whitcomb, 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 pulverise 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 Clawater, 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, Rockfort, 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 whey ing 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 (118 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 triturators, 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 hight, 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 aperature 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 staves 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 stave, 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 plated.

Notes & Queries

J. P. H. will find full particulars of the malleable glass on p. 402, vol. 32, and p. 20, vol. 32.—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. 203, vol. 30.—R. A. B. can preserve natural flowers by the process described on p. 204, 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.—F. O. X. will find directions for kalsomining outdoor work on p. 133, vol. 34. For crystallizing with alum, see p. 127, vol. 26.—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. 24.—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. 80, 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. 250, 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. 404, 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. 250, 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 mucilage on p. 202, vol. 31.—W. B. will find a recipe for aquarium cement on p. 80, 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 $\frac{7}{10}$ to ¾ 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 26 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 $= F = c\,R$; the space described is the circumference of shaft $= 2\,\pi\,r$; and the mechanical effect lost by friction is $A = c\,R\,2\,\pi\,r$; now if the shaft makes n revolutions per minute, the mechanical effect expended per second is equal to $L = 2\,\pi\,c\,R\,r\,\frac{n}{60} = \frac{\pi\,n\,c\,R\,r}{30} = 0{\cdot}105\,n\,c\,R\,r$. 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 1¾ 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:

12345679	12345679	12345679
18	27	81
98765432	86419753	12345679
12345679	24691358	98765432
222222222	333333333	999999999

A. It is determined by experiment. Thus, it having been found that 111,111,111÷9=12,345,679, 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 ½ inch long and ½ 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, 5¾, 4¼, and 3¼ 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 Stubs' standard, is no particular part of an inch. Gages from No. 1 to No. 26 vary from $\frac{1}{10}$ to the $\frac{1}{100}$ part of an inch. No. 1 is about $\frac{1}{7}$, No. 3, ¼, No. 10, ⅛, No. 16, $\frac{1}{16}$. 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 1,700 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 potassa, 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 ocher, powdered charcoal, and fine sand; they are to be 5 inches high, 2 inches wide, and ½ 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 feispar. 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. B.
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. B. 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 electrotype molds, etc.? What is the value of magnetite or magnetic iron ore? What is the cost of a yacht of 25 tuns, and of one of 100 tuns, 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.]

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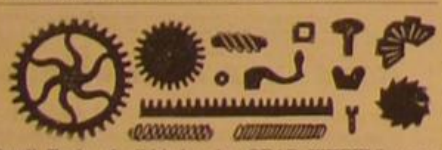

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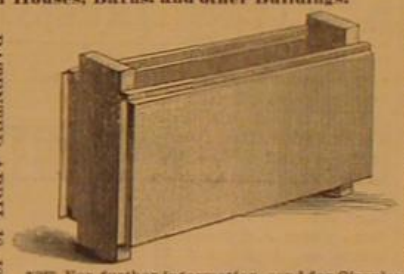

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