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THE TELEPHONE.

We have already laid before our readers accounts of the wonderful performances of Professor Bell's telephone, an instrument remarkable not merely for its phenomenal capabilities but also because of its having been brought to its present stage of development within the period which has elapsed since June last. During that month, Professor Bell exhibited the apparatus at the Centennial, working it over short distances only, and causing it to transmit sound, which reached the opposite terminus very much diminished in intensity. Without undertaking to follow the inventor through his various improvements, it will suffice here to state that the telephone has recently carried the human voice over a distance of 143 miles (from Boston to North Conway, N. H.), so that ordinary conversational tones uttered at one end were distinctly audible at the other. Further even than this, the inventor and his assistant have talked through a wire arranged to give an artificial resistance equal to 40,000 ohms, which is more resistance than the entire length of the Atlantic cable would offer. There are, however, other obstacles than the resistance, which checks the transmission of the voice over such immense distances. These the inventor is now endeavoring to overcome; and at the first favorable opportunity, a practical test of the powers of the instrument over one of the transatlantic cables will be attempted.

In the telephone which we illustrated recently in the SCIENTIFIC AMERICAN SUPPLEMENT, a battery current was directly employed. The most important improvement yet made in the apparatus is the entire abolition of the battery and electro-mag-

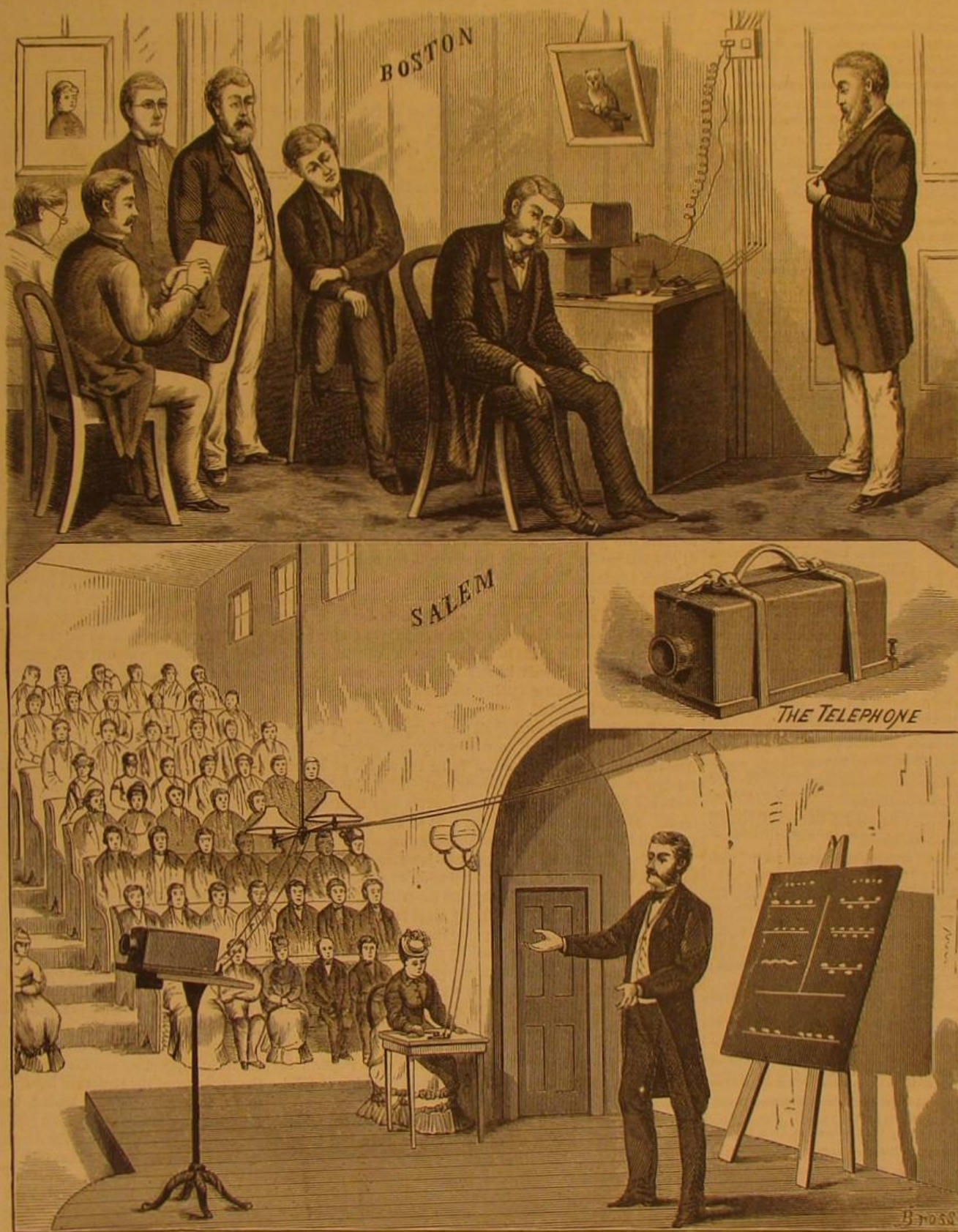
nets, and the substitution of the permanent magnet, the electric wave used in transmitting the sounds being generated by the voice itself. The construction of the instrument will be readily understood from the detailed drawings, Figs.

to or from plate, A. F is a bar of soft iron or magnet; G is a coil of insulated copper wire around the extremity, H, of said bar, and I is an adjusting screw by which the end, H, may be placed as desired in relation to plate, A. Several of these instruments are placed at different stations upon a line as represented in Fig. 3.

When sounds are made at the mouth-piece of the instrument, the plate, A, is set in motion before the poles of F, which may be a permanent compound magnet and arranged as shown in Fig. 2. A current of electricity is thus created in the coils, G, surrounding the poles, and the duration of the current of electricity coincides with the duration of the motion of the plate as it vibrates. When the human voice causes the diaphragm to vibrate, electrical undulations are induced, in the coils around the magnets, precisely similar to the undulations of the air produced by the voice. The coils are connected with the line wire, and the undulations induced in them travel through that wire; and passing through the coils of another instrument of similar construction, they are again resolved into air undulations by the diaphragm, A, of the second instrument. So perfectly is this resolution effected that even a whisper is audible over long distances, and soft tones are even more distinct than loud ones.

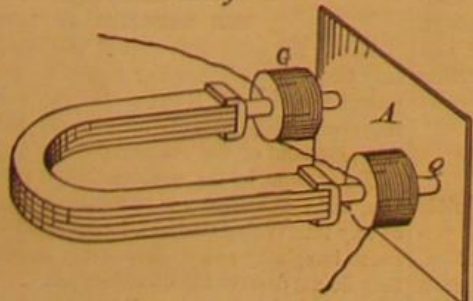
It will be evident that it is possible to send by the telephone multiple telegraphic messages or multiple verbal communications simultaneously. In Fig. 3, we have represented a number of telephones connected together.

each one, for instance, at a different station, the stations being several hundred miles, perhaps, apart. To send multiple telegraphic messages, let it be supposed that a certain musical sound is uttered before the telephone No. 1: then telephones Nos. 2, 3, etc., will all repeat that sound. Now let two musical
[Continued on page 200.]



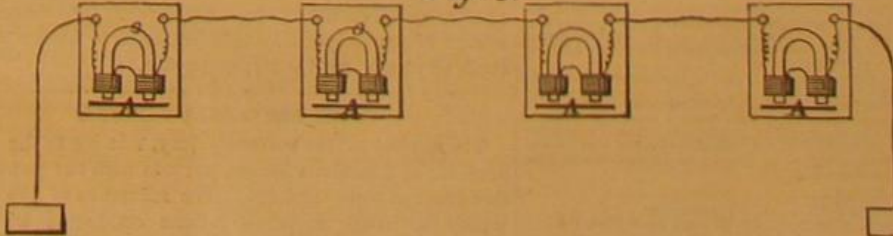
PROFESSOR A. GRAHAM BELL'S TELEPHONE.—Fig. 1.

Fig. 2.



2 and 4. A, Fig. 2, is a plate of iron or steel which is fastened to the sounding box, D, Fig. 4 (see page 200). E is the speaking tube by which sounds are conveyed

Fig. 3.



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OUR NATIONAL TRIAL AND ITS RESULTS.

The four months beginning November 7th, 1876, and ending on the 4th of March, 1877, will long be remembered as a period not only of severe trial to our national institutions, but also to the material interests of the country. The crisis has been passed, and there can be no question but that the new start is taken under better auspices than have obtained for many a year.

We believe that the revival in business activity is one that is going to make itself rapidly felt. Material for manufacturing purposes is comparatively cheap, building can be much more inexpensively carried on necessities of life and wages are down, and altogether conditions are favorable for the undertaking by capitalists of enterprises contemplated, but long delayed, and for the investment of a vast amount of capital which hitherto has been closely guarded.

We are beginning to learn, moreover, that, after all, the hard times have not been destitute of good. As soon as the first effects of the blow had passed, manufacturers began to adjust their business to the new order of things. Cotton fell in value, and old stocks were, as already noted, cleared out under enforced liquidation. Meanwhile in the production of cotton goods we made numerous valuable improvements, and all this tended toward rendering us consumers of fabrics produced at home, rather than purchasers from England, as we had been to a large extent before. The same is true, though in smaller ratio, of woolen and worsted goods. The decline in our imports from England during the five years from 1871 to 1876 is shown in the following figures: Cotton goods from 129,700,000 yards to 55,000,000 yards, woollens from 5,391,000 yards to 1,478,000 yards, and worsted from 86,682,000 yards to 41,079,000 yards. Not only, however, is the market here for English fabrics substantially lost, but our manufacturers are entering into competition with British producers on their own soil. We have already a considerable trade in Manchester (the home of English cotton weaving) in cotton calico cloths. Our cotton mills have large South American orders on hand; and it is well known that we are now making worsted goods of better quality than the foreign fabrics we have hitherto imported.

On the other hand, during all the long period of depression, our exports have been steadily increasing. Fresh American meat, which bids fair to be the staple of a great foreign trade, is now sold throughout Great Britain at 16 cents and less per pound, or one quarter less than English meat. More than forty-four per cent of the foreign wheat required by England to eke out her home supply, we furnish. The shipment abroad of American lobsters and oleo-margarin oil are two new experimental additions recently made to our export list, both of which are promising. Our butter and cheese exports are exceedingly large and still growing. In brief, and without entering into further detail, our export trade (we quote figures obtained by the New York Sun, and embodied in a very carefully prepared article) for December, 1876, was by far larger than ever was known in one month, and the lessons of thrift and frugality which the business stringency has enforced are known by their fruits in the statement that the exports of 1876 exceeded those of 1872 by \$171,000,000, while the excess of exports over imports for 1874, 1875, and 1876 amounts to the grand showing of \$314,884,000.

We have before us a large number of reports from various sections of the country, all of the most encouraging nature. In New England, mill after mill is resuming full work in the iron trade of Pennsylvania, where the greatest stagnation has reigned, there are good signs of improving business; the shoe and leather merchants announce better sales; and altogether, look where we may, either the actual opening of augmented trade or good prospects of activity near at hand are clearly apparent. Even the blue glass mania has contributed its share to the general revival, as it has brought large business to our glass works, and has caused the production of a variety of glass which hitherto we have imported almost wholly from Europe. In fine, we have passed through the fire, not unscathed, it is true, but strengthened and chastened. The future opens hopefully. The characteristic energy of our people may be relied upon to render its years those of plenty, prosperity, and peace.

THE ASHTABULA VERDICT.

The verdict of the coroner's jury, relative to the terrible accident at Ashtabula bridge, accords with the popular verdict reached some time ago. The substance of the finding, which is based on investigations conducted with great thoroughness and by a body of men well versed in the tech-

nical subjects laid before them, is: First, that the bridge fell because of its own inherent defects, and second, that the subsequent burning of the train was owing to neglect to comply with the Ohio State law which provides that railroad cars shall be so heated that the fires shall be extinguished if the cars leave the track. This obviously places the whole responsibility on the shoulders of the railroad company; and it remains to be seen whether the fact of the latter's being a corporation is sufficient to shield it from the punishment deserved.

The bridge was unsafe, it appears, for eleven years. The man who designed it is dead, and the engineer in charge, who ought to have found out the defects, has perished by his own hand. Criticism of the direct agents is therefore silent. As regards the railroad company, the absence of the necessary precautions against fire can only be attributed to that spirit of parsimony which is altogether too prevalent among corporations when the question of using or not using the improved devices, which are constantly being invented, comes before them. It is the same spirit which causes steamship companies to send vessels to sea without proper life-saving apparatus—the same that begrudges the room in public buildings necessary for the construction of broad and ample staircases and other ready means of escape in time of danger. It is a peculiar phase of human nature, doubtless, that prevents the necessary outlay for such purposes; and people will keep on in the same course as long as they think they make money by thus saving, which is questionable policy when life is at stake.

IRON FRONT BUILDINGS.

A fire recently occurred in this city in a magnificent-looking building, which left the edifice a total wreck and resulted in the destruction of over a million dollars' worth of property. The structure was quite lately built, and had an ornate iron front, which gave it an exterior appearance of stability and solidity of construction.

There has been a predilection for exactly this species of building in New York and other cities, of late years, because it affords a great deal of show for little money. We do not doubt but that excellent materials are used by excellent architects in their construction. The difficulty lies not so much in the structures themselves as in the law which permits their existence, for it is not to be expected that while a handsome building can be cheaply erected without infringement of law, and readily insured, landlords will subject themselves to any extra expense in the matter. The question is one for the legislators, and it certainly seems to us that either laws forbidding the construction of any but really fireproof buildings in cities should be enacted, or else that existing statutes should be so modified as to prevent the erection of edifices which are so easily burned as the kind to which we have reference. We can recall over a dozen structures even larger than the one now destroyed, the progress of construction of which we have watched with apprehension lest they might tumble before completed. We have seen the thinnest brick walls erected to support a wilderness of wooden beams and partitions, the whole run up so quickly that the structures, before the façades were in place, reminded one of gigantic birdcages. Then the ornate cast iron fronts were added, bit by bit; and in an incredibly short space of time the birdcages were hidden, and elegant architectural creations, with richly decorated columns and ornamental window caps and cornices, and finally dazzling with gilding and paint in many colors, presented themselves to the admiration of all who did not know how frail was the backing of these gaudy exteriors. To make matters worse, there is a mistaken, though none the less prevalent, idea that an iron building is necessarily fireproof. An edifice wholly of iron of course would not burn; but we doubt if even such a structure would maintain its integrity long with a fire among combustible materials, like cotton and other fabrics common in our drygoods stores, on one of its floors; and this for the reason that iron speedily expands and warps with the heat. But buildings wholly of iron are few; and what is generally understood by an iron building in these days is one with cast iron front and iron columns supporting wooden beams inside. The beams and the contents of the structure burn readily; and the iron columns, as soon as they are heated, bend out of shape, and release the wooden beams, which tumble in a mass and, with the burning goods, increase the conflagration, while the plates on the front curl up like shavings.

We would not make a sweeping condemnation of iron fronts in general, because we believe that they may serve an admirable purpose in spreading good architectural designs at moderate cost; but it is the poor and inadequate material behind these ornamental fronts, which their beauty conceals and renders deceptive, which we condemn. Back an iron front with good and well laid brick and stone, and a substantial structure is accomplished.

THE THEORIES OF LIGHT.

Among the generally received theories of light, there are only two which possess any degree of probability: the corpuscular theory of Newton and the undulatory theory of Huyghens. The idea of the ancients that, in seeing, something goes out of the eye to the object seen, and the theory of Euler (who, by the way, was blind) that we see by induction, and that visibility is transmitted without the necessity of any intervening medium, in the same way as gravitation, are so imaginary and so thoroughly disproved by facts that they do not deserve any consideration.

Newton's theory, as is well known, consists in the assump-

tion that luminous bodies are continually throwing out infinitely small and imponderable corpuscles, which, being propelled in all directions and in straight lines, on reaching an eye make the object visible. When applying this theory to the facts now known, grave difficulties are encountered; and the French philosopher Biot devoted nearly his whole life to the explanation, according to this theory, of the various phenomena of reflection, refraction, polarization, etc. He often had recourse to the most ingenious and intricate mental devices. The fourth volume of his "*Traité sur l'Optique*," an octavo book of 600 pages, entirely devoted to the subject of polarization of light, as far as its phenomena were known in the year 1810, is a lasting monument of wasted ingenuity, as this whole theory was utterly upset by the phenomena of interference, which definitely established the undulatory theory, and this theory is further being confirmed by the details of spectroscopic observations at the present day.

This undulatory theory, as defended by Young, Malus, Fresnel, Brewster, and others, consists in the assumption that light is transmitted by undulations or vibrations in some medium, without the onward progress of anything, in the same way as the transmission of sound takes place: with the difference, however, that in sound the undulations take place by longitudinal compressions and expansions of the air: that means that the sonorous masses have their motion in the direction in which the sound is transmitted, while in light the undulations in the transmitting medium take place transversely to the direction of the ray. Some of our philosophers are dissatisfied with this theory. Thus, for instance, Professor Silliman, in his "*Physics*," says: "It is difficult to explain all the phenomena of light even on this theory;" and further on he closes some paragraphs, under the head of "No Theory of Light entirely Satisfactory," by stating that certain objections to the undulatory theory have as yet not been satisfactorily answered. Other writers express themselves in the same strain; but we may as well object to the undulatory theory of sound (of the correctness of which there cannot possibly be any doubt) on the ground that some difficulties have not yet been satisfactorily answered. In fact, in the case of sound, we have even more complexity than in that of light, as various rates of velocity produce pitch in the first and color in the second, and degrees of amplitude of vibration produce in both various intensities; and in both time is needed for the propagation. It is true that light moves in the planetary space one million times faster than sound travels in air; but both need time, and in neither of them is there such a thing as an instantaneous transmission, as is the case with the transmission of gravitation. In both, the phenomena of reflection, refraction, and interference may be observed; and further, the rays of either propagate and may cross each other in all possible directions without the least mutual interference. Various other similarities may be cited; but then, in sound we have the range of nine or ten octaves, while in light we have only one, or at most three, if we consider the heated and chemical rays at the respective extremities of the spectrum as two octaves. And in sound, we have difference in character, independent of velocity and amplitude, namely, that which the French call *timbre*, a peculiarity which is unknown in light, and is exemplified in the sounds of various musical instruments, voices of singers, etc., which differ from each other so plainly that each may be recognized even in a full orchestra and chorus. The familiar voice of a friend may be identified even among a great number of voices singing together in a choir. If we consider that all these vibrations not only differ in velocity and amplitude, but also in a multitude of other ways, of which the nature is as yet a mystery to us, and reserved for future study, and that all these are transmitted simultaneously without interfering, not alone through air, but may be even transmitted through solid rods, we are startled at the complexity of the nature of the form of all these various sonorous waves; and we may with good authority state that many difficulties in acoustics have not yet been satisfactorily explained by the undulatory theory of sound; but nobody has for that reason ever asserted that the undulatory theory of sound is not satisfactory, because it is established beyond the shadow of a doubt, and any other acoustic theory is absolutely impossible.

We may therefore safely maintain that any remaining difficulty in the explanation of the phenomena of light is due only to our imperfect knowledge of the nature of the various possible kinds of vibrations, which are often of the utmost complexity. Mathematical investigation has already done a great deal in this direction, and promises to do a great deal more. The labors of Lissajous in the determination of various sound curves, and the resulting pendulum apparatus to delineate them, called the *symplozograph*, is a move in the right direction, and the prosecution of such labors will no doubt enable posterity to explain clearly much that is as yet a mystery to us.

In this connection, we ought to mention the modification the undulatory theory proposed by Rankine. He assumes that the particles of the medium which transmit the light (whatever that medium be or may be called) rotate on their axes by the action of a kind of magnetic polarity. This theory is intended to overcome the difficulty of assuming that the light-transmitting medium has the properties of an intensely elastic body, or, as Tyndall expressed it, is, in a certain sense, as dense as a jelly. The beauty of Rankine's hypothesis is that the same mathematical formulae may be employed as for the other form of the undulatory theory, which is a strong argument in its favor.

PHOTOGRAPHS IN THE EYE.

There has long existed a popular superstition that the human eye after death bears the picture of the scene on which it last gazed. Abundant romantic stories are current of how murderers have been recognized through the imprint of their features on the pupils of their victims; and not very long ago many believed that a substantial proof of the supposition had been afforded by the eye of a murdered man, whose body had been found under a hedge, exhibiting a ramified appearance, a likeness between which and that of the tangled branches above the organ some imagined they could trace. It is certainly startling to meet with the grave assurance that the above superstition, although not literally true, possesses a very strong foundation in fact; but the recent wonderful discoveries of Drs. Boll and Kuhne leave no reasonable doubt but that our retinas are sensitive photographic plates, inasmuch as they contain a substance which, under the influence of light, undergoes chemical changes which vary in intensity according to the intensity and character of the luminous rays.

Not very long ago Dr. Boll, Professor of Physiology in Rome, directed the attention of the Berlin Academy to the curious fact that the external layer of the retina, which the microscope shows to be made up of rods and cones, is in all animals of a purple color. This color, he pointed out, is during life being constantly destroyed by the light which enters the eye. Darkness, however, restores the color, which vanishes for ever almost immediately after death.

The very remarkable nature of these statements induced Dr. Kuhne, Professor of Physiology in the Heidelberg University, to undertake a repetition of the experiments; and the results of his researches he has lately communicated in a paper addressed to the Heidelberg *Natur-Historisch-Medicinisches Verein*. Kuhne's observations were made upon the retinae of frogs and rabbits; and by examining as soon as possible after death the retinae of animals which had been kept in darkness, he found "that the beautiful purple color persists after death if the retina be not exposed to light; that the bleaching takes place so slowly in gaslight that by its aid the retina can be prepared and the changes in its tint deliberately watched; and that when illuminated with monochromatic sodium light, the purple color does not disappear in from twenty-four to twenty-eight hours, even though decomposition has set in." These facts, obviously going to disprove one of Boll's important statements, at the same time removed many difficulties of investigation; and Dr. Kuhne, carrying on his researches by the monochromatic light of sodium, proceeded to investigate the conditions necessary to the destruction of the vision purple (*Schpurgel*, as he terms it), as well as some facts relating to its restoration or removal. These observations yielded the discovery: first, that, under yellow light or in the dark, the retina may be dried on a glass plate without its color changing; second, that the color is not destroyed by strong solution of ammonia, saturated solution of common salt, or by maceration in glycerin for 24 hours. On the other hand, it is destroyed by alcohol, glacial acetic acid, strong solution of sodium hydrate, or a temperature of 212° Fah. It was also determined that the more refrangible rays of the spectrum have the greatest influence on the color, while red light is as inoperative as yellow light.

Dr. Kuhne next showed that, even after the living eye had been exposed to daylight, its retina, on being examined in the sodium light room, still showed a fine purple, thus negating another of Boll's assertions; while he further noted that the fading of the purple occurred only after the eye had been exposed for some time to sunlight. The curious result was also reached that, while a retina removed from the eye lost its purple color under diffused daylight, another retina, left in the eye but exposed by an equatorial section, turned a dark red, which bleached when the retina was exposed in naked condition to the daylight. A still more remarkable experiment was that showing how the vision purple is restored. On making an equatorial section through a recently extirpated eye, and lifting a flap of retina from the underlying choroid so as to expose the flap to the light, the purple color of the flap was found to be destroyed, while the color of the rest of the retina persisted. But on replacing the flap, a complete restoration of the vision purple occurred. Dr. Kuhne concludes, therefore, that this restoration is a function of the living choroid, probably of the living retinal epithelium; and it appears to be independent of the black pigment which the retinal epithelium normally contains. Thus, not only does the retina contain a substance capable of being acted upon by light, but connected with it are structures which, so long as they are alive, are able to provide fresh stores of sensitive material.

After concluding this first series of researches, Dr. Kuhne endeavored to obtain, on the retinae of freshly killed animals, images corresponding to objects looked at during life. And he showed that, in order to obtain a permanent photograph or, as he terms it, an *optogramme*, the effect of the light would have to be so prolonged or so intense as to destroy the balance between the destruction of the vision purple and the power of the retinal epithelium to restore it. In order to test the matter thoroughly, he fixed the head of a living rabbit, so that one of the eye balls would be 58.5 inches from an opening 11.7 inches square in a window shutter. The head was covered for five minutes by a black cloth, and then exposed for three minutes to a somewhat cloudy sky. Instant decapitation was then effected, and the eyeball was rapidly extirpated under yellow light and plunged in a five per cent solution of alum. Two minutes after death, the

second eyeball, without removal from the head, was subjected to exactly the same processes as the first, namely, to a similar exposure to the same object, then extirpation, etc. On the following morning, the milk-white and now toughened retinae of both eyes were carefully isolated, separated from the optic nerve, and turned. They then exhibited, on a beautiful rose-red ground, a nearly square image, somewhat larger than 0.0016 square inch in size, with sharply defined edges. The image on the first eye was somewhat roseate in hue, but less sharply defined than that on the second, which was perfectly white. In brief, the hole in the window shutter was photographed on the rabbit's eye. What further investigations into this subject are likely to show, it is difficult to surmise; but it is certain that no results that may be adduced can be more astonishing or unlooked-for than those already reached. They bring out in the strongest relief the fact of how little we really know of our own organization; while they add to the already long catalogue of marvels pertaining to that most wonderful of optical instruments—the human eye.

AN EDITOR'S PERPETUAL MOTION.

Mr. Morgan, the editor of *The Phoenix*, a sprightly newspaper at Columbia, S. C., has invented a perpetual motion, which is to operate as follows: Upon the periphery of a large wheel are arranged a series of rubber bags, one half of which are filled with water. As the wheel rotates, the bags on one side of the wheel become filled with water, while the bags on the opposite side are emptied; a preponderance of weight being thus maintained on one side of the wheel, the latter will continue to rotate until something wears out, or the world comes to an end.

Mr. Robert Tozer, who, Mr. Morgan says, is one of the principal machinists of the place, has given a public certificate setting forth his belief in the practical success of the machine; and on the strength of this certificate Mr. Morgan has issued a very flattering financial prospectus. It is modestly headed "The Morgan Self-Producing Motive Power. No Fire! No Steam! No Explosions! No Engineer! No Expense! Nature's Forces Utilized! The Power that is to Revolutionize the World! There's Millions in it!"

To aid in procuring means to construct a working model, the inventor issues certificates of one hundred dollars each, payable at par as soon as success is insured and the money therefor realized. These certificates he is now ready to sell for one dollar each, or one cent for each dollar of their actual face figures. It is plain that Mr. Morgan is a better inventor than financier, or he would never have put his shares on the market at so low a figure. He evidently needs the assistance of an able person who has had experience in financing similar enterprises: like Mr. Charles B. Collier, for example, the learned agent for the Keely Motor Deception, who at one swoop drew in a hundred thousand dollars from New York merchants in payment for shares in that absurd bubble. Should Mr. Morgan be unable to secure the personal services of Mr. Collier, he may at least derive practical hints from a reading of Collier's own statement of the way he raised the wind for Keely, as published in the *SCIENTIFIC AMERICAN*, July 17, 1875.

THE COMMISSIONER OF PATENTS.

General Ellis Spear, the new Commissioner of Patents, has entered upon the supervision of the Bureau; high subordinate positions in which, he has already ably filled. Either on the principles of civil service reform, whereby long experience in a lower grade is deemed one of the best qualifications for advancement, or through his personal fitness for the office, General Spear's appointment meets approval of the country, while it is also one upon which we think all inventors may be congratulated. An inefficient or poorly informed commissioner has it in his power to impede the efforts of inventors through lack of a proper appreciation of the importance of their work; and thereby he may, however innocently, act adversely to the interests of that great class, and ultimately to those of the public. For this reason, the office should never be regarded in the light of a political emolument, but rather as a high honor bestowed on the possessor of the rare qualifications which should be brought to it.

We are satisfied that the selection of General Spear for the post is in the above respects a wise one; and it is to be hoped that he will regard the position as a trust, to be administered for a longer period than some of his predecessors have found it to their personal interests to do.

Poisonous Peas.

French canned peas are now so commonly sold by grocers that it is not at all pleasant to learn that in England some recent cases of poisoning have been traced to copper put in the cans in order to preserve that beautiful green color of the vegetable. There is not enough of the deleterious metal in any one can probably to do harm; but where the peas are used on the table regularly, an English chemist says, there is sufficient of the poison to affect the health seriously.

CANCELLING POSTAGE STAMPS.—J. C. E. writes to suggest that the government should stimulate inventors to produce an indelible cancelling ink by offering a reward for the invention.

WHAT IS SCIENCE?—"Science to the general public," says a witty contemporary, "is everything you can't comprehend; directly you begin to understand it, it ceases to be Science."

RICE CULTURE IN CHINA.

The *Gardener's Chronicle* gives a series of quaint illustrations from a Japanese work on horticulture and agriculture, recently exhibited at a meeting of the Royal Horticultural Society, London, by Mr. Moseley, one of the naturalists attached to the late Challenger Exhibition. We select one of these engravings for publication, in which the scene depicted represents the thinning out and transplantation of the rice plants in the flooded fields wherein it is cultivated.

The mode of culture of the rice plant varies considerably, according to the climate and local circumstances. The following is the method, says *Land and Water*, employed among the Chinese, who cultivate it to a very great extent in the midland and southern parts of their dominions, the low grounds of which are annually flooded by the Kiang and the Yellow rivers. These extensive inundations are occasioned by the heavy rains which fall near the sources of these rivers, which have their origin in the Himalayan chain of mountains.

When the waters have receded, the earth is covered with a thick coating of slime and mud, which fertilizes the ground as perfectly as the richest manure. As soon as this takes place, the patient Chinese surround portions of this rich soil with clay embankments, always selecting the neighborhood of some running stream. The ground is then carefully harrowed, and the operation is repeated until it works well. In the meantime the rice intended for seed has been soaked in water, in which a quantity of manure has been stirred; this has forwarded its growth so much that the young plants appear above the ground in two days after they have been deposited in the earth. It is necessary to remark that, during all the early stages of its growth, and until the seed is well set, the roots of the plants must be constantly under water; to effect this, different contrivances are resorted to, to keep up an adequate supply of water.

As soon as the young plants have reached the height of six or seven inches, they are pulled up, the tops are cut off, the roots carefully washed, and the whole planted out in rows, as shown in our illustration, about a foot asunder. In the course of its growth, it is sprinkled with lime and water, which is said to destroy insects and assist in enriching the soil; the greatest care is also taken to remove weeds by hand as fast as they spring up. In these tedious operations the English agriculturist can form no idea of the perseverance and attention of the industrious Chinese. The first crop, for they obtain two in the course of the year, is harvested about May or June, and the second in October or November.

The sickle employed by the Chinese for the purpose of reaping the rice is, like the European instrument, bent into the shape of a hook, but the edge, instead of being smooth, is notched like that of a saw. The straw and stubble left after the harvest are burnt on the spot and left to enrich the land.

MUSHROOMS.

To those living in the neighborhood of forests in Europe, especially in France, mushrooms form an important item in domestic economy. Being among the most nitrogenous ar-

Fig. 1.



ticles of diet, they well deserve the name of "vegetable meat," which has been bestowed on them. We publish herewith engravings of three kinds of edible mushrooms, all well known in France, and which might be more generally introduced here to the great satisfaction of American epicures. The first is the *morchella comestible*, the botanical name of which is *morchella esculenta*; the second is the

cep, or bolet comestible (*boletus edulis*); and the third is the chanterelle comestible (*cantharellus cibarius*).

In examining these three specimens, we find, at the base of the stalk, some very thin filaments, which are commonly called the roots of the fungus, but of which the proper name is mycelium. These form the vital organs of the plant, and although the stalk and its burden soon perish when past maturity, the mycelium resists the frosts of winter and the summer's aridity. Recent investigations show that the fibers are not only the roots, but possibly also the flowers, of the



CULTIVATING RICE IN CHINA.

In cultivating mushrooms, it has been found that horse and cattle manure is the best substance for promoting the growth of the mycelium; the earth from the track of a horse power, in which the droppings have been thoroughly beaten into the soil, is excellent material. This should be made into bricks with a hole in each, in which a small piece of the spawn should be inserted; the bricks should then be placed in a hot bed and kept at a temperature of 60° Fah. till the whole mass is permeated by the threads of the mycelium; then further development may be stopped by drying the bricks, and they may be stacked away for use or sale. When the spawn is to be used, make a bed of horse or cattle manure, solid and large enough to maintain a heat of 70°; stick in bits of a brick of spawn at intervals. When the mycelium begins to grow rapidly, cover the whole with about two inches of mould, and place over it straw. The earth should be kept moist, warm water of 70° being used. Mushrooms will appear in six or eight weeks; and they should be twisted off the stalks with the fingers, and not cut off.

As light is not necessary to the success of mushroom culture, they can be raised in cellars or caves, such places being especially suitable because of their generally uniform temperature. Near Paris, France, immense numbers of mushrooms are raised in old stone quarries, two such excavations containing mushroom beds to the length of 16 miles and 21 miles respectively; and one of them sends 3,000 lbs. of mushrooms to market daily.

Scientific Lunacy.

The suicide of George C. Wheeler, a chemist, living in Dundee, Canada, is, says the *New York Tribune*, one of the strangest ever recorded. He was a hard student, 22 years old, who rarely went into society, but lived by himself, working in a small laboratory by day and watching the stars by night through a small telescope. About six months ago he told his friends that he had made a chemical discovery which would carry his renown to the ends of the earth. The hallucination which took possession of him was that he had succeeded in making a preparation which, when scattered on a dead person, would restore life. Neither the arguments nor jeers of his friends changed this belief. He resolved to kill himself in order to have the efficacy of his resurrection powder tested. In a letter which he wrote on March 3, he says: "My physical atomic state, after the ordeal, I desire shall be taken in charge by Professor McLouth of the State Normal School, who, taking a portion of my 'creative, all-changeable material assistance,' will scatter a few particles over the dissectary remains, and then place them in the receptacle of my 'galvanic, magnetic-electrical power,' when the elements will resolve themselves into a new combination, and I will appear a living evidence of the truth of this new discovery." A large bottle, containing a thin fluid, labeled "creative, all-changeable material assistant," was found beside the letter. The machine used by the young man to accomplish his purpose is a marvel of ingenuity. A stout wooden framework supports a large balance wheel, to which are attached knives, portions of scythes, and an ax head. Back of this there is a complex arrangement of small wheels and pulleys, all operated by a powerful steel spring. When set in motion the machine is capable of running at a frightful rate of speed for the space of ten minutes. Close by it is a three-sided trough in which he must have placed himself after setting the devilish arrangement in motion. His head, which he laid under the wheel, was mangled beyond recognition. When his body was found, his brains were oozing out of a deep cut in the back part of his skull.

Ewes' Milk the Richest.

Dr. Stevenson MacAdam, in a paper recently read before the Pharmaceutical Society of Great Britain, shows that ewes' milk is the richest by the following figures: Solids by weight in milk of town dairy cow, 12.27; country dairy cow, 12.77; goat, 13.43; ewe on natural pasture, 17.75, or, with addition of feeding stuffs, 20.11. Taking the fat in the solids in the order above mentioned, the figures are 2.58, 2.88, 4.31, 6.77, and 8.27.

The *London Gardener's Chronicle* advocates the grafting of roses by the insertion of growing eyes in the early spring instead of dormant eyes in the summer. The growing eyes are inserted in the main stem, one on each side, to form symmetrical heads. These make as much growth in the first season as the dormant eyes do in the second season.

Fig. 2.



Fig. 3.



with the flavor of these fungi, and even with their fitness for food. The *agaricus campestris*, the common mushroom of this country and England, is rejected in the markets of Italy as unwholesome; while the chanterelle, a highly prized rarity in England and a favorite species in France, which is

represented in Fig. 3, was not relished when found in North Carolina by Mr. Curtis. This writer states that he ate of 40 different species of fungi gathered within two miles of his house, and that he found 111 kinds in the State.

PRACTICAL MECHANISM.

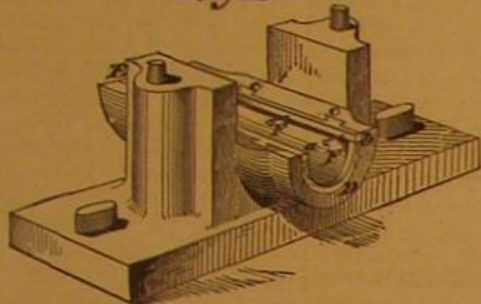
BY JOSHUA ROSE.

NEW SERIES—No. XXIII.

BENCH WORK.

The method to be pursued to make the pattern for the brass is as follows: Take a piece of wood of sufficient size to form the body of the brass, and make it of the necessary size and form, observing the directions above given as to the bevels; and make the flanges by turning the two halves in one, as explained in a previous example, omitting to turn out the inside, as this would effect no saving, and such boring would weaken the flange and render it liable to split in attaching it to the body of the pattern. To fasten the flanges, glue them on; and when dry, insert brads, setting the flanges by lines. Then pare out the flange even with the bore of the brass. In many cases brasses are dispensed with, and Babbitt metal is employed in their stead. The requisite form of casting for this purpose is shown in Fig. 167, the Babbitt metal be-

Fig. 167



ing contained within the thin ridges which extend all around the edges of the half circular bearing. In addition to this, however, the machinist sometimes drills small holes in the cavity for the Babbitt metal. The ridges are cast solid with the box, and the two at the end (D and E in Fig. 167) make no difference to the moulding, since they will leave the sand readily and easily. But the ridges or strips that extend lengthwise of the bearing must be made detachable from the pattern, the strips referred to being held in position by the dovetails shown at C. The recesses to receive the dovetails are first cut out, and the dovetails are made to a neat fit therein. Then we take the strips required to form the ridges; and having just spotted the faces of the dovetails with glue, while they are in their places we press the strips against them for a moment, and adjust the strip and leave it in position, for the glue to dry. By this means the dovetails are fastened to the strips exactly in the required position. When dry, the strip with the attached dovetails may be withdrawn from the pattern, and should then be more securely fastened together by the addition of screws or nails. In many cases wires are employed in place of the dovetails; they are being inserted as shown in Fig. 167, at F; and when they are used, it becomes a consideration whether the moulder can conveniently extract them. If he can, they are preferable to the dovetails, as these latter are sometimes apt to stick.

Bearings of this class (Babbitt metal) are often formed in the framework of a machine, or in other patterns that do not permit of being moulded in the direction suitable for the above example. Fig. 168 represents such an example, which

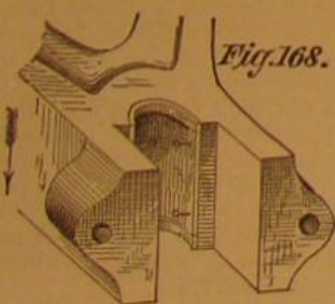


Fig. 168.

case is made as shown in Fig. 169, the space for the bearing being blocked up, and the block extending through, as shown at A, to form a core print. The core box shown be-

neath may be, in the smaller sizes, cut out of the solid wood, the part, B, being made thick because it includes the thickness of the ridge on that end, and also the depth of the print, as shown at A. The reason that the block or core print protrudes, at C, is that a ridge may be formed in the mould to steady the core while inserting it in the mould; and the depth of the core box, at E, must be made to suit it. It will be noted that the core prints, at F F, are carried to the top of the pattern; and it will be readily per-

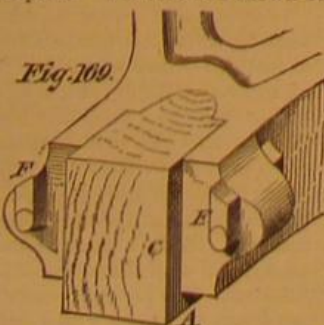
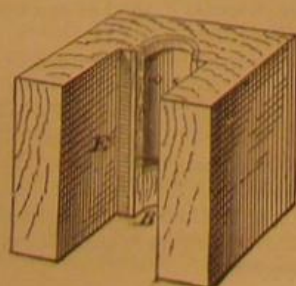


Fig. 169.



ceived that they must be so made in order that the pattern may lift from the sand. Then, after the mould is made, the core for the hole is first inserted, and then a small core is fitted into the recess in the mould, and thus is the top part of the recess (above the core print) stopped off. The circles marked on the faces of the prints, F, are to be painted on the pattern in black varnish, and their purpose is to denote that the core proper is round. If these black circles were not made, the pattern maker would require to make a similar circle and cross marks with chalk or pencil that the moulder may know how the core is to be left.

Fig. 170 is a representation of a pattern for a slide; it has the projections simply set on with pegs, to prevent the pattern being locked in the sand. In moulding this piece, a false core is laid between these projections. After the cope is lifted, the plate, A, may be taken out; and after removing the false core, the pieces, B B, can be withdrawn.

Our next example shall be for a square or rectangular column, which, though very simple in construction, yet necessitates a departure from the ordinary method pursued in pattern making, the object being to save the making of an entirely new pattern for every required column. In view of the thousands of columns of this kind that have been cast, it is not to be wondered at that measures have been taken to cheapen the cost of the pattern, and lessen the labor in preparing the mould; but it is to be remarked that no one has been able to invent a permanent mould for this class of work. In cast iron columns, the strict rules of architecture are not rigidly followed. The slight but graceful curve prescribed for every column and pilaster is frequently neglected, and various parts of the column are modified in their contour: to their detriment, as may be easily seen by comparing the details of a stone building with those of an iron one.

Square iron columns are usually made parallel throughout their lengths; while, on the end view, two of the sides incline towards one another on account of the draft or taper given to the pattern. Round column patterns are not made parallel, but are smaller at the cap than at the base. The curve above mentioned is given to the shaft; but as the pattern is made to serve for all lengths of columns of that diameter, the curve can only, in most cases, be an approximation. In foundries that make a specialty of this class of work, numbers of blocks of various sizes and lengths are kept, and they simply require the addition of such ornaments as the design comprises, which ornaments, such as mouldings, flutings, and the like, are often ready to hand to complete the column pattern. These blocks are, for small columns, made solid; but for large columns they are constructed like boxes or troughs, with pieces filled in at short distances to give strength. (See Fig. 172). Fig. 171 is a

perspective view of a block, mounted with mouldings and other ornamentation so as to form a column pattern ready to go into the sand. The base, B, and its mouldings, a and b, are to be cast solid with the shaft of the column; this, however, as may be inferred from what has been said, is not compulsory. It will be seen that the base forms a guide for the stopping-off blocks, A A, at that end; at the other end of the column the guides, C C, are attached. The distance between the stopping-off blocks, A A, is of course the length of the column, plus shrinkage and plus the amount left for cutting off to square up the ends of the cast column. The wires shown are for the purpose of holding the ornaments in position upon the block. The ornaments on the face are held by loose pegs, except the cabling, D, and the paneling, E, which are made fast on the face by nails or screws.

Let it be required to prepare a pattern for a column 12 feet long, of 13 inches face, and 14 inches deep, to be of the style shown in Fig. 171. Select a block similar to that shown in Fig. 172, in which the top piece is shown removed so that the distance pieces may be seen. We will

suppose our column to require mounting on the face and one side; then $\frac{1}{2}$ inch or $\frac{3}{8}$ inch will be taken up on the face and side by the margins, E, which form, with their mouldings, the paneling; therefore, if $\frac{1}{2}$ inch margins are used, the block

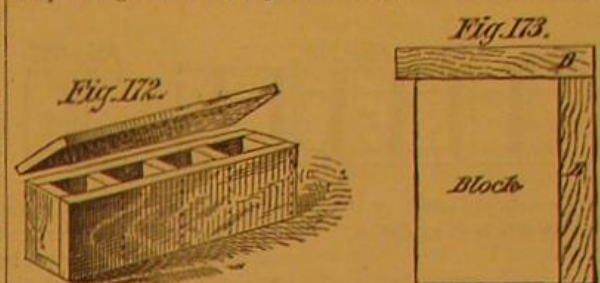
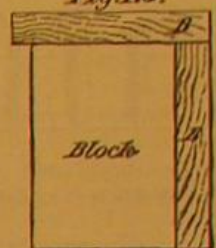


Fig. 172.

Fig. 173.



should measure $11\frac{1}{2}$ by $13\frac{1}{2}$ inches, and $\frac{1}{2}$ less if $\frac{3}{8}$ margins are employed. The length of the block is immaterial, so that it be not less than 20 inches longer than the column: this excess is for core prints at the ends of the pattern. Lay off upon the block the length of the column pattern; this will be 12 feet + $\frac{1}{8}$ inch for shrinkage + $\frac{1}{4}$ or $\frac{3}{8}$ inch at each end for squaring up. Space off upon the block the position of the various members and apply them as directed. It must be noted that the mouldings and base pieces on the face over-run those upon the side, and also extend according to their contour over the side that is not mounted (see Figs. 171 and 173). The reason of this is that by removing these face mouldings and base pieces, except the cabling and paneling (which are fast), the moulder can make a bevel parting. When the parting is made, the pieces are then replaced and will be taken up again by the cope. A rectangular column is invariably moulded with the face up, because of the facility such a position gives for supporting the main core by means of the cores which make the openings always formed at the back of these columns.

For stopping-off the column to the right length, we simply prepare four pieces, as shown at A, Fig. 171, of a length equal to the depth of the column at the ends, not including the base piece, as that will be stopped-off in the cope. In ramming up the column, when in the sand, these pieces are bedded in, in the position shown. Some provision is necessary to prevent them from being rammed out of the perpendicular; this is provided in this case by the base pieces, B; but at the other end of the column temporary strips are braded to the block, as shown at C. To find the place for these guiding strips, add to the length of the column pattern the thickness of the stopping-off piece, square a line at this point down each side of the block, and nail on the guides outside this line but with one edge touching it. Columns are often cast without bases or caps, these latter being cast thin and attached by screws after the columns are set up.

The ornamentation of columns is varied constantly, depending upon the taste of individuals; therefore it is impossible to lay down precise directions in this matter. It is thought, however, that the above remarks will be of service, and I may add that, in place of cabling, fluting is often employed. This is never to be cut out of the block, but formed in extra pieces. The cabling on the side is made by fastening the strips to a piece of board, and this is attached to the block by wires. Fig. 174 shows this arrangement. Baked or dry sand is not used for the main core of square columns, and we proceed to describe the method of making the greensand core now invariably adopted.

Fig. 175 shows a sort of universal core bore, employed for making these cores. A is a cast iron plate, laid upon the floor of the foundry, generally in close proximity to the mould; upon this are set up two stout boards, B, about two

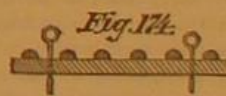


Fig. 174.

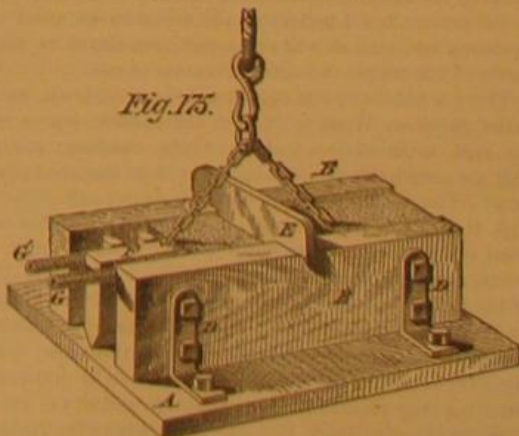


Fig. 175.

inches thick. These boards are adjustable, so as to take in any breadth of face, by the brackets, D, moving along slots in the plate. Nipping screws in the brackets admit of the boards being pressed together on the end pieces, which must be changed for every width of column; the height of the core is regulated by means of the strike, E. On account of the exceedingly fragile nature of a greensand core, it is necessary to imbed within it a strong bar of cast iron, called a core bar, such as is represented at F, Fig. 175. It consists of a strong center bar with pieces cast solid with it, ranged on each side, called wings; the bar itself is made to taper off to a narrow ridge towards the under part, as also are the wings, which taper at the edges. The sand, being rammed between these wings, is able not only to sustain itself, but

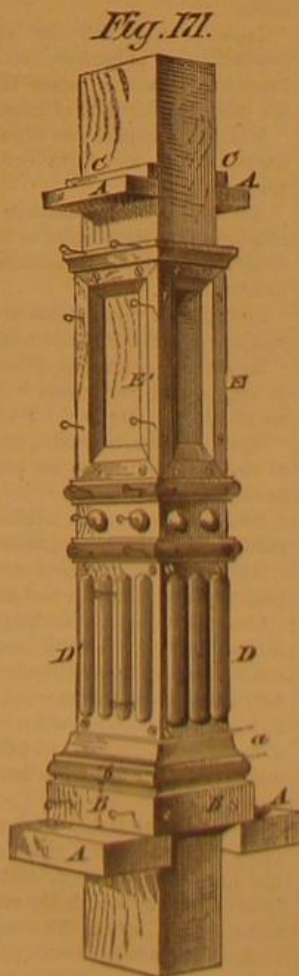
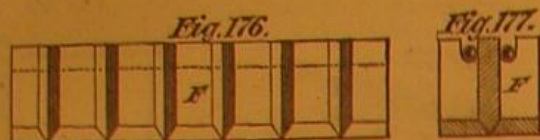
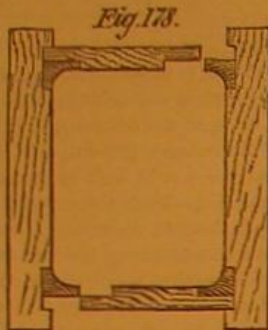


Fig. 171.

also a small portion extending beyond them, namely, to the correct outline of the core. The bar is generally from half an inch to one inch smaller than the core, as will be seen in the sectional end view, Fig. 177. A notch is cut out of



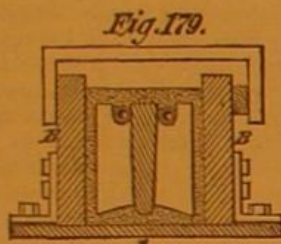
each wing to admit of the insertion of a perforated tube on each side for ventilation. The core bar, F, and the perforated tubes, G G, are shown in Fig. 175, imbedded in the core.



As there are not any core prints required to form the openings at the back of the column, the cores for these openings are made in a box not thicker than the intended thickness of metal in the column. Such a box is shown in Fig. 178, though, for the sake of cheapness, when the columns are not more than half an inch thick, the core

box is sawn out of one piece.

Fig. 179 is an end view of the core box, with core, shown in Fig. 175, but with the addition of the wooden binder, which serves to assist the brackets in holding the sides, B, of the core box together, which is necessary when the core box is very deep.



Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The House bill relating to infringements, referred to in a previous letter, have been postponed to next December; in consequence of so much opposition being made to it, the Committee on Patents have been authorized to sit during the recess to revise and amend the patent laws. This bill will probably receive further consideration, when it is to be hoped that the obnoxious features will be eliminated or the bill dropped altogether. I understand that, among other amendments, the committee will be requested to consider the following: Separation of the Patent Office from the control of the Interior Department. The Commissioner and other officials, down to and including the examining corps, to hold their positions for life, or during good behavior. All the receipts of the office, under proper safeguards, to be used for facilitating its business. All agents, before being admitted to practice in the Office, to pass an examination as to competency. Everything relating to transfers of patents, including licences, to be recorded within sixty days. That owners of reissued patents shall be able to sue for infringements that occurred before the reissues were granted for such points as were covered by the original patents; and that applications and oaths for reissue applications may be made by the assignees of entire interests. These amendments to the present law I believe on the whole to be good sound doctrine, and such as will commend themselves to the majority of the people, whether inventors or not.

There is another point that should be considered, and that is the question: What to do with the models, where to put the vast accumulation (some twenty thousand per year), that are constantly arriving and have to be disposed of somehow? There is yet room for a gallery on one side of the south hall, if Congress would but allow the Patent Office to use some of its own funds to build it; but, even if built, there would not be more than sufficient room to properly dispose of the models now lying around loose on the floors, stacked on the tops of the cases, and piled up one upon another on the shelves of the model cabinets until the under ones become broken from the superincumbent weight, and from the handling they receive in taking them in and out of the cases to make examinations. So many models have been destroyed by this method of storing in times past that there are cartloads of broken pieces stowed away in out-of-the-way corners.

If a little "more light" could be let in through the ceilings of the north and west halls, there is room for an additional gallery in each of them; but even these, if built, would soon be filled at the present rate of increase. In view of this, why not in future dispense with the models in such cases as do not actually require one to illustrate the invention? As the law now stands, the Commissioner can dispense with the model if he chooses, and for a year or so there were many patents issued without models being required; but for four or five years past, models have been required in all cases in which a model could be used. In the majority of applications models are not necessary to show the invention, and the only use for them in such cases is that they may

be placed in the model room in order that inventors and others may see them when making preliminary examinations. As a printed copy of the drawing, suitably mounted on stiff cardboard and placed in the model cases or in adjacent portfolios, would answer quite as well, and not take up one hundredth part of the room, the model in nine cases out of ten might as well be dispensed with as not, and the inventor saved the expense of furnishing and the Office the expense of finding room and taking care of it.

Another point that should be considered by the Patent Commissioner is the necessity of having a complete system of digests published, after the style of the English abridgements. Some of the examiners have prepared partial digests of various subdivisions of their classes for their own use, but these are not accessible to most people; and some three or four such digests have been published, but at such high prices that the majority of inventors cannot purchase them, and they are therefore comparatively useless as compared with the great good that such publication would do if they could be issued at about the cost of printing, to say nothing of the advantage such digests would be to the examiners themselves in making their researches.

In my last, I stated that a bill had been passed appropriating money to build a national museum. I have since found, however, that my information was incorrect, and that it had only passed one House. It therefore failed to become a law, and the immense collection of Centennial exhibits will have to be stored for a year or so longer, and many of the articles be irretrievably ruined, and some of them may be withdrawn altogether. The collection is a very large one, and should be properly displayed and taken care of. The following is a list of the more important donations:

Argentina Republic: Almost the whole of the exhibit in Agricultural Hall, and the most of that in the Main Building, comprising ores, metals, pottery, tiles, stuffed animals, woods, fibers, leather, agricultural and fishery products.

Brazil: Specimens of iron, coal, hides, leather, tiles, pottery, woods, vegetable fibers, food substances, gums, resins, etc.

Chili: A collection of minerals, artificial stones, tiles, terra cotta, and an extensive variety of grains, seeds, and other vegetable products.

China: The entire collection made by the Commissioner of Customs, including a complete representation of the manners and customs of the Chinese, having numerous full-sized figures beautifully executed and suitably dressed. Many hundreds of clay figures about one foot high representing the different classes and races of the empire, with specimens of their food, medicines, domestic utensils, musical instruments, samples of their manufactures, buildings, etc.

Egypt: Collection of minerals, tiles, pottery, garden products, woods, and a large collection of objects illustrating the manners and customs of the natives of Soudan, Nubia, and Abyssinia.

France: Messrs. Havilland, of Limoges, presented a pair of Centennial memorial vases valued at \$17,000.

Germany: Tiles, cements, asphalt work, and manufactures in metals. Krupp, the great iron manufacturer, presented an extensive display, illustrating the mineralogy and metallurgy of Germany, with samples of his different manufactures.

Japan: Pottery and tiles, and a large exhibit of fishery products and apparatus, skins and hides of animals, food preparations, and a series illustrating the manufacture of tea, silk, and bamboo articles.

Mexico: Minerals, ores of gold and silver, obsidian, woods, fibers, pottery, and terra cotta, an iron meteorite weighing 4,000 lbs., etc.

Norway: A large collection of ores and other specimens exhibiting the metallurgy of iron, copper, nickel, etc., and a collection of the eatable fishes of Northern Europe, food preparations, etc.

Portugal: A very extensive exhibit of ores, minerals, etc., samples of industrial and vegetable products.

Russia: An enormous collection exhibiting the metallurgy of copper and iron, a very valuable collection of the minerals of Siberia, samples of pottery, tiles, cements, etc.

Spain: A large collection illustrating the mines and mining of the kingdom, also its manufacturing and agricultural products.

Sweden: The entire exhibit of this country in the Agricultural Hall and photographs of arctic scenery.

Turkey: Illustrations of its metal work, mines, minerals, tiles, pottery, domestic and household utensils, etc.

Great Britain: A very large collection of the private exhibits of tiles, terra cotta, pottery, mosaic work, from Minton & Hollins, Doulton, and others. Among these are some very large vases, a terra cotta pulpit, and a group showing an allegorical representation of America, embracing several colossal figures, valued at \$15,000. A complete collection, embracing over 300 varieties of wool from all parts of the world.

In addition to these, smaller collections from nearly all the other countries in the world that had exhibits in the Centennial have been received, making a most complete series of illustrations by which the manners, customs, manufactures, minerals, etc., of the different peoples of the world can be studied, the whole of which it is estimated to be worth over a million of dollars, and comprising a considerable section of the Centennial Exposition which may be examined by ourselves, our children, or children's children at leisure and without cost.

Congress, before adjourning, passed several acts authorizing

the extensions of patents, but I have been unable to get a list of them yet, although I have made many attempts to obtain them. There is no accessible list of the bills that are passed, and no way of finding out until all the bills are printed.

The new Secretary of the Interior is fairly—or unfairly—besieged by applicants for office, but, as far as I can find out, with very poor success, and it is believed that very few changes will be made in the Patent Office. The present Commissioner, it is generally considered, is "the right man in the right place," and is likely to stay unless the President ignores the civil service reform altogether in his case.

The patent attorneys of this city have organized an association under the general incorporation act, known as the "Patent Office Bar Association of the District of Columbia." The objects of the association, as set forth in its constitution, are "to maintain the honor and dignity of our profession and increase its usefulness, promote the proper administration of the patent laws, and the protection of the rights and interests of inventors and patentees, and to secure a proper standard of character and qualification, and a prompt responsibility to public judgment among the practitioners before the Patent Office." Qualification for membership consists in being of lawful age and good moral character, and qualified by education, training, and experience to pursue properly the business of patent solicitors or attorneys. One of the objects of this association is believed to be the preventing from practicing of the large number of irresponsible shysters who abound in Washington, who know nothing of patent law or practice, but who have the effrontery to advertise themselves as patent attorneys, and by offering to "put cases through" for very low fees, or on the "no patent, no pay" system, defraud their trusting clients and bring disgrace on a respectable body of gentlemen who have to suffer the obloquy of the wrong-doings of these miscreants. Several of these fellows have been debarred from practicing for defrauding their clients, and it is probable the others will be shortly.

Washington, D. C.

OCCASIONAL.

Lightning Rods—How the Centennial Buildings were Protected.

To the Editor of the Scientific American:

Your recent articles upon lightning rods supply much-needed information relative to the most important requisites for protection. The following system, as applied to the Centennial Machinery Hall, combines great economy with the most perfect protection and security, and may frequently be adopted with advantage for large buildings.

The tin roof of Machinery Hall has an area of 14½ acres, and this is utilized as a lightning conductor in this manner: Rising above the roof are 100 wood terminals (used as flag poles), to each of which is attached a copper wire rope ½ inch in diameter, its upper end rising a few inches above the top of the pole; at its lower end the wires are spread out, and 8 inches of its length is firmly soldered to the tin roof. Earth connections from this massive roof conductor are made at ten different places by soldering one end of copper ropes to the tin roof, the other end being firmly attached to 8 inch city water pipes in the ground. Thus it will be seen that every square foot of this huge building is covered and thoroughly protected by an ample conductor; and it is believed there is no building in this country so perfectly protected as this. The total cost was only one tenth the amount requisite to protect it in the usual way with rods, or less than \$50 per acre.

Earth connections being all-important in all cases, I would recommend the following for country buildings: Extend the lightning rod underground, say 20 or more feet from the building; fasten and solder to its end a sheet of copper 2 by 4 feet; dig a pit 3 by 6 feet, and 4 to 6 feet deep; put 2 inches in depth of finely broken charcoal over the bottom, then put in the plate and rod, with another layer of charcoal and a few inches of earth; then fill up to surface with loose cobbles, leaving it so that the rainfall can freely find its way down to the copper plate; water from the roof may be led into the pit. One such earth termination is of more value than half a dozen of the usual kind.

Philadelphia, Pa.

J. D. RICE.

Heating with Natural Gas.

To the Editor of the Scientific American:

In your recent article on wholesale heating, you ask why some towns does not immortalize itself by using natural gas as fuel. It is used extensively throughout the Pennsylvania oil regions; and this town is supplied by a well three miles distant, through a three inch pipe, which is being replaced by a five inch one, to be continued to adjacent towns. The gas is used direct from the well without a gasometer; and owing to the variation of pressure, it is somewhat dangerous in careless hands. For lighting it is but little inferior to coal gas. With a good fishtail burner, it burns without smoke, and with almost as brilliant a flame as the best artificial gas. The present pressure at the well is about 65 lbs. per square inch; and with a gasometer to equalize the pressure, it would be the best and safest fuel in use.

Millerstown, Pa.

An Electrical Balance.

At a recent meeting of the Institute of Mining Engineers, Dr. P. De P. Ricketts exhibited an electrical phenomenon with an analytical balance. By rubbing the glass case the balance was thrown out of adjustment, which could be restored by discharging the electricity of the glass. The possibility of errors in analysis resulting from this cause were apparent.

A Sheffield Cutlery Manufactory.

Joseph Rodgers & Sons' cutlery works rank the first of the kind in the world, the factory having been established above a century and a half ago. The firm has a world-wide repute, and there is no doubt that the remotest country on the globe uses Rodgers' cutlery. The extensiveness of the manufacture and trade need scarcely be mentioned. Nothing, perhaps, in the shape of household articles—with the exception of crockery, which runs hand in hand with it—is so necessary and so much used as cutlery. The factory employs a large body of workmen, and the works are divided into a number of departments, such as the forging, the grinding, the polishing, the handlemaking, and various other departments. But the number of processes which the manufacture of each single knife has to go through before it is completed and ready for sale is something incredible. The first process is the forging. The workshops are generally small—for the forging of almost every kind of knife, with the exception of carving and larger knives, requires only one man. Many of these are connected with each other, and are all on the ground floor, the upper floors being occupied by more delicate processes. Each workshop contains a forge, one or two hammers, a pair of tongs, a long narrow table—on which the length of the blade to be forged is marked—a bucket or a small tub containing water, and several other necessary tools. With these the process of forging is executed with the greatest rapidity and precision. An experienced and skillful workman is able to forge 200 blades of ordinary penknives in one day, at the average of one blade in three minutes. The steel bars used for making blades are prepared in a separate department. They are made of different widths and thicknesses, according to the various kinds of knives to be manufactured. For penknives they are, of course, thin and narrow. The process is very simple. The steel bar (at first four feet long) is put into the fire, just a little longer from the end than the intended blade. When sufficiently soft it is taken out, and the red hot end cut to the exact length indicated on the table; and immediately after the bar of steel is again heated, in order that while the workman is forging one blade the material for another may be ready by the time he has finished it. Now, with the tongs holding the red hot piece in one hand, and the hammer in the other, the workman, standing at a short distance from the anvil, which is raised to a convenient height, executes his work with astonishing rapidity, for the entire blade is formed with a succession of only a few quick raps. Such is the skill of the workmen that the eyes of an ordinary visitor can scarcely detect any difference between any two of the newly forged blades. This done, the rough blade is once more buried in the fire, and a minute after it is drawn out and plunged into the bucket of cold water, by which process the blade is hardened.

The handle part (the stock of the blade and the pointed piece inserted into the handle) of a table or carving knife is made of iron. The joining is effected by heating the piece of iron cut off from a bar for the purpose and the handle end of the blade, and then welding them together; the proper shaping, with the indispensable pointed piece, has all to be done at once. Two men are required to carry through this process. It is very amusing to watch the dexterous movements of their hammers, which seem always to hit the right part mechanically, following, as it were, the rapid turning about of the material, well held in the grip of a pair of tongs under the management of one of the men.

From the forging workshops the blades are transferred to the grinding department, which comprises a number of processes; hence one knife generally goes through more than half a dozen hands before it is ready to be handled or used. The grindstones are the same as those in ordinary use, and are worked by machinery. They are of different sizes, and vary extremely in quality—that is, from the coarsest stone for the first process to the smoothest used in the last. We were told that the quality of the steel of all knives (at least of the same forging) is exactly the same, and it is the process of grinding that the fate of the blade—its future quality and value—are determined. Hence, if 100 penknife blades were handed from a forging shop to the grinding department, 70 of them may perhaps go through the shilling processes, while the remaining 30 may go through superior processes, and afterwards be valued at half a crown or ten shillings each. Many perhaps would be puzzled at this mode of doing business, and would probably ask: "Why are not the whole hundred knives, etc., made the value of ten shillings, for the profit would then be greater?" The answer is simple. The half crown and ten shilling blades go through a greater number of processes than the shilling ones, and more care and attention are bestowed upon the work. Care and attention mean valuable time, and valuable time signifies great expense. However, the quality and value of a knife do not entirely depend upon the grinding; for as the price of a book is very often made lower or higher according to its binding so does the value of a piece of cutlery depend in some measure upon its handle or case. For instance, we were shown two razors of the same steel and forging, and were told that one was a shilling razor and the other half a crown. Now the cause of the great difference was simply this: the shilling razor had only a cow's horn handle, while that of the other was made of ivory, and, of course, its blade was better ground.

The processes subsequent to the grinding are stamping of the name with the words, "Cutlery to Her Majesty," and the corporate mark, the putting on of the handle, and the polishing. The corporate or trade mark (*) of the firm of

Joseph Rodgers & Sons consists of a star with six points and a Maltese cross. It was granted in 1764, and is valued at \$300,000. Every piece of cutlery manufactured at these works bears the name and the well known mark.

The process of putting on handles to table and carving knives is very simple; but in the case of pen or pocket knives, where there are several blades, or any other kind of cutlery which is to be opened and shut, the work is a little more complicated, and therefore requires greater skill. In putting on the pins or rivets the workmen have to be very careful, in order that the blades may open and shut freely. The handles are made of elephants' tusks, pearl, and tortoise shell, and various kinds of wood, also stag and other horns. The former are imported from Africa and India, the African tusks being the finer and dearer. The tusks and horns are cut to the sizes of the required handles by machine saws, and afterwards they go through the more delicate processes of shaping, boring holes, etc. Lastly comes the polishing process. This is effected by applying the handles to revolving brushes, made, not of hair, but of linen stuff. The material is cut out in circular pieces of about 4 inches in diameter, with a round hole in the center; these pieces (a large number of them) are laid one on another in a cylindrical form, and the whole is then slipped on the spindle, the pieces being tightly held together by two small boards, one on each side of the spindle. These brushes are worked by machinery, and the effect of this mode of polishing is beautiful—smooth and bright; but the polish shows itself to the best advantage on dark handles, such as the ordinary shilling razor handles, which are generally made of cow's horn dyed or painted black, or variegated. This ingenious contrivance is an American invention, and is now largely used in works wherever polishing of this kind is necessary.

The men employed in this factory are paid according to their merit and capability, which plan can well be adopted with advantage in works of this kind, because it encourages them always to endeavor to do their best. It would be needless to mention the order and discipline we witnessed in Messrs. Rodgers' works, for any such attempt would be no addition to the long established fame of the firm; but it may simply be said that in this point of view no other works in England can be better conducted.

The show room, which we inspected on arriving and before leaving, was most attractive. The elegant and tasteful display of the various productions of the works—cutlery in all its forms—appeared magnificent. Penknives, table, and carving knives, scissors, razors, together with specimens of the electroplate works, are so arranged as always to be ready to attack the weak side of the liberal purchaser, especially of the fair sex. Two very curious pieces of cutlery adorn the show room. One of these is a kind of a huge "tool pocket-knife," consisting of 79 instruments—saw, corkscrew, gimlet, bradawl, file, etc.; the other has 1,876 blades to correspond with the Christian year, one blade being added to the number at the beginning of each year. These two, together with an enormous giantlike razor, are exhibited as curiosities of cutlery, and indeed they deserve that title, as they seem to be quite works of art.—*English Mechanic.*

A Novelty in Sonorous Tubes.

Our esteemed correspondent, Professor A. Ricco, sends us the following note from Modena, Italy:

"On blowing into a rubber tube having a spiral inside, such as is used for exhausting air, a note similar to that of a flute is heard, which becomes more and more acute the harder we blow. The successive harmonics up to the highest are thus obtained. By the use of a manometer, it is found that the necessary pressure of air is proportional to the square of the number expressing the order of the harmonic, or of the number of vibrations; which proves that the sound depends upon the velocity of the pulses of air striking against the turns of the helix. The notes are better when the tube is wound about itself. The diameter should not be large, and the length may be from 3 feet 3 inches to 26 feet. The long tubes give the most notes. Catching hold of one end of a tube and whirling it about like a sling, the centrifugal force produces a current of air and causes it to sound.

A. Ricco, Professor.

"Modena, Italy."

Translator's note: The rubber tube referred to is one in which a wire helix has been inserted to prevent it from kinking or flattening out. This helix acts as a reed. Not having such a tube at hand, I succeeded in producing a number of distinct notes with an ordinary rubber tube; and my friend, Mr. Geyer, who is a better musician, inserted the *embouchure* of a French horn in a rubber tube a little over 5 feet long, $\frac{1}{4}$ inch thick, and having $\frac{1}{4}$ inch aperture. He then obtained a series of clear notes, which may be expressed by the following notation. Calling the lowest note produced the first harmonic (C), and the fundamental (C), we have

C.....C.	a.	c.	e.	g.	e.
Rate of vibration,	1.....2	3	4	5	6.....8

C. F. K.

Digging Wells Deeper.

In some districts there is probably no remedy for dry or empty wells, especially where water is found just upon or above granite or rock foundation. When the usual supply is exhausted, there is no other recourse but to wait for the influx of water from heavy falls of rain. Such cases, however, are exceptional, and in most localities the simple remedy for lack or scarcity of water is to deepen the wells. By digging down to water in a time of drouth, a never-fail-

ing supply is usually secured—in fact, it is almost impracticable to obtain it at any other time, as an excess of it prevents going to a sufficient depth. The easiest method with which we are acquainted for reaching water in a well already dug, but dry, says the *Portland Press*, is to sink a barrel or hoghead its entire length at the bottom of the well. This barrel or hoghead should be made of ash or oak, well hooped and without heads, and of such diameter as to allow of its easy descent inside of the bricks or stones of which the well is made. The earth and water can be removed in the ordinary way, and as the amount will not be large, without the use of the more expensive methods required in digging a well from the beginning. The bottom of a well will not be found to be the coldest and most uncomfortable place in the world at this season of the year, and we presume the entire job can be done with less risk and suffering than is incurred in some morning tramp to a distant stream with a drove of farm stock. While we recommend and prefer this way on account of its economy and simplicity, and because it secures a present and future supply of water, we also advise as a temporary expedient the substitution of the iron pipes used in the drive well system. These may be very readily driven down in a dry well to the necessary depth and connected with a pump, and subsequently upon the return of high water as easily removed. We trust that none of our readers will be guilty of abusing themselves or their animals by unnecessary exposure to the cold in search of water. If practicable, they should without delay test the plans suggested, or any others that their ingenuity may devise.

The Science of Preaching.

The Rev. Dr. Swing, editor of the *Alliance*, of Chicago, says: "If a clergyman feels that something should be said to telegraphers, he should not try to find a pole and lightning in the sacred word, but should honestly confess that the Bible does not specify any of the day or night operators, and that hence he will not take a text, but will speak to men in the spirit of Christ, and not from a figure by Job or Ezekiel. This bondage to a text was well ridiculed by the story of the man who preached against lofty headdresses from the words: 'Top not come down.'

"Inasmuch as the world has become larger and fuller since the Scriptures were compiled, the clergy should not expect to find in those records any special advice to railroad men or steamboat captains, and hence would do religion more service by omitting a text than by citing Jehu as a prophecy of fast travel, or by alluding to Noah as a great captain on the high seas. Textual preaching is a good thing when there is an idea in the text to be developed; but when a preacher has a valuable lesson for a book agent or a sewing machine man, he need not soil his concordance to find what mention the Bible has made of these two forms of itineracy. Of course, he might find a remote allusion to them in the prophecy that in the latter days of the world great tribulations should come; but so many in the audience would doubt this application of the passage that it would seem better to preach to the souls of the agents and let the text go by the board. What a preacher needs most is not a doubtful text, but a real subject."

Watering Ships in Mid-Ocean.

M. Toselli, that exceedingly prolific inventor of diving machines and wreck-raising apparatus, proposes the very original idea of utilizing the springs of fresh water which are known to find their outlets on the bottom of seas, in order that vessels may always obtain a constant supply of pure water even when in mid-ocean. His mode of putting the notion into practice sounds easy enough; but we doubt whether it will prove so simple when it comes to be tried. The first thing to do is to find the springs; and that, we should imagine, would resemble a search for extremely small needles in a colossal haystack. But M. Toselli thinks that they can be found—the springs, not the needles—and he says it only remains to secure tubes to the outlets, of sufficient length to reach the surface, buoy them of course, and there are inexhaustible wells always available. There are some minor difficulties of the tubes being carried away by storms or ocean currents; but these, as well as those pertaining to the discovery, the indefatigable inventor tells the French Academy of Sciences he has overcome. We hope he has.

Poisonous Fireworks.

A correspondent, referring to our article under the above heading stating that a lady in Bristol, N. H., died from the effects of fumes from red fire, doubts whether this was the cause of her death. But if the red fire used was such an absurd composition as nitrate of strontia, black sulphide of antimony, sulphur, and chlorate of potash, it is evident that the arising gases must be injurious to health. Many recipes current in newspapers, scientific books, and even school books, are bad, and are evidently copied from some old, obsolete publication. "Properly made red fire," says our correspondent, "should contain no sulphur or antimony in any form whatever."

A PATENT has been taken out in France by M. Béranger for the cleansing of wool, woolen goods, woolen rags, etc., by means of sulphate of ammonia with heat; the stuffs to be treated are submitted for twenty minutes to the action of sulphate of ammonia and water marking 5° or 6°, then dried by means of the centrifugal machine and the stove. It is said that the color of the goods, however dyed, is never affected by this treatment.

THE SELDEN COMPOUND PUMP.

A high degree of expansion combined with a regular and steady velocity of piston has, we are informed, been obtained by Mr. A. Carr, of this city, by the compounding of his Selden pump. This pump, in its original form, consists of a steam and water cylinder, set in a direct line and connected rigidly by a center piece, the rod passing directly from the steam piston to the water piston, and being rigidly fastened to both. We give in the annexed engravings a perspective view of Fig. 1, and a sectional view of Fig. 2, showing the machine as compounded.

The larger or secondary cylinder, M, of the compound engine is provided with a piston, N, the rod of which passes

moving the valve, S; and by shifting the valve, the exhaust from the primary engine will pass from 9 through the port, 15, and pipe to the exhaust, R, and the steam from the boiler will go to the secondary cylinder by the port, 10, so that the secondary cylinder may be operated by the boiler steam or else by the exhaust steam from the primary cylinder, as occasion may require.

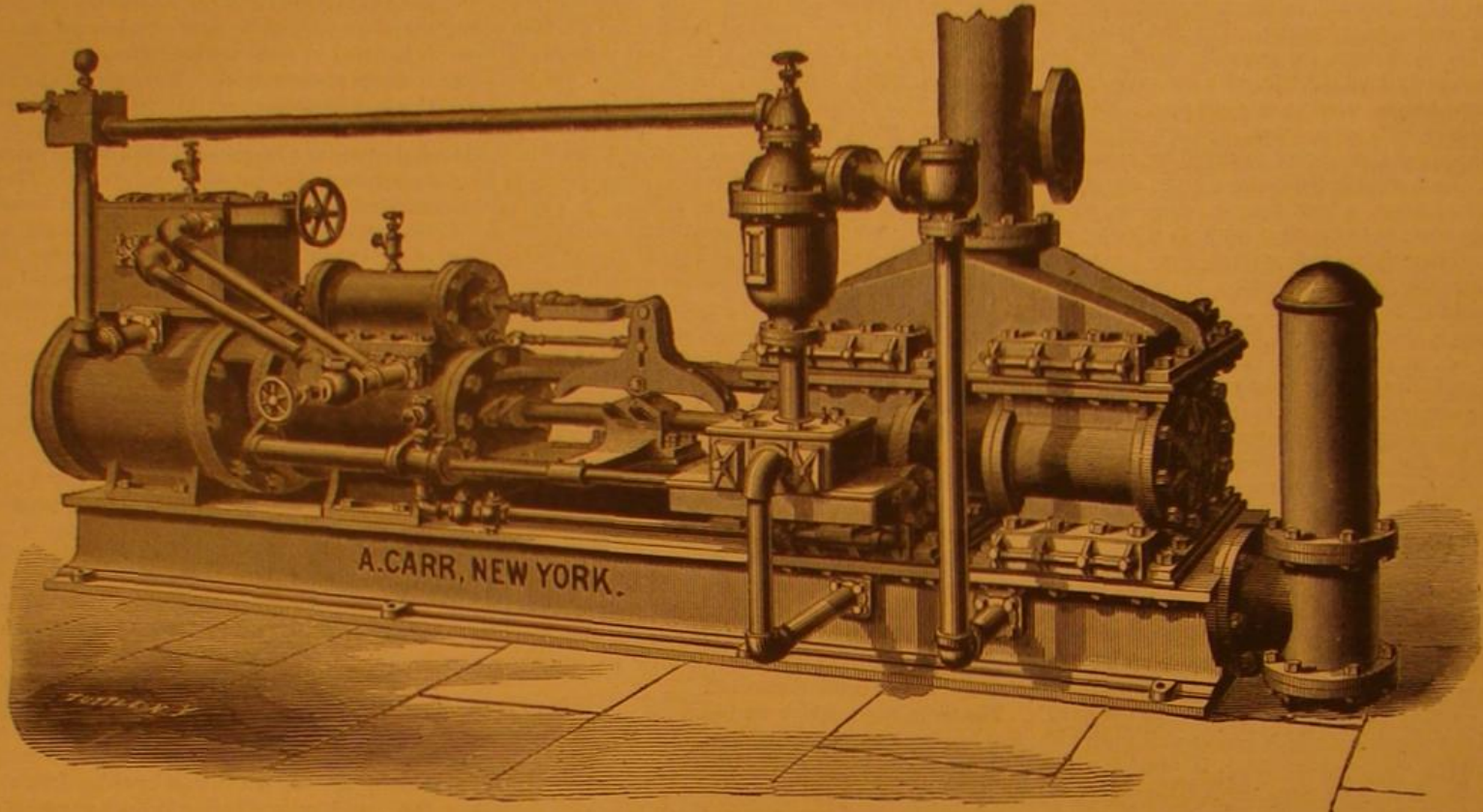
Dangerous Toys.

The past few weeks have been a harvest season for dealers in toys, candies, and all sorts of trifles, especially those intended for Christmas gifts to the dear children. Happy the family who have not suffered from the diabolical schemes of

covered with an incrustation, probably acetate of zinc, first directed Tollen's attention to this subject. He made an analysis of the doll and found that it contained not less than 60.58 per cent of oxide of zinc. Some lime, oxide of iron, and phosphoric acid were detected in the ash. Another doll, purchased in Brunswick, and especially recommended as "harmless," gave 57.68 per cent of ash, which consisted of oxide of zinc with traces of impurities—lead, iron, lime, and sand.

Ant Intelligence.

Sir John Lubbock has recently delivered a lecture on ants, which is replete with curious and interesting information,

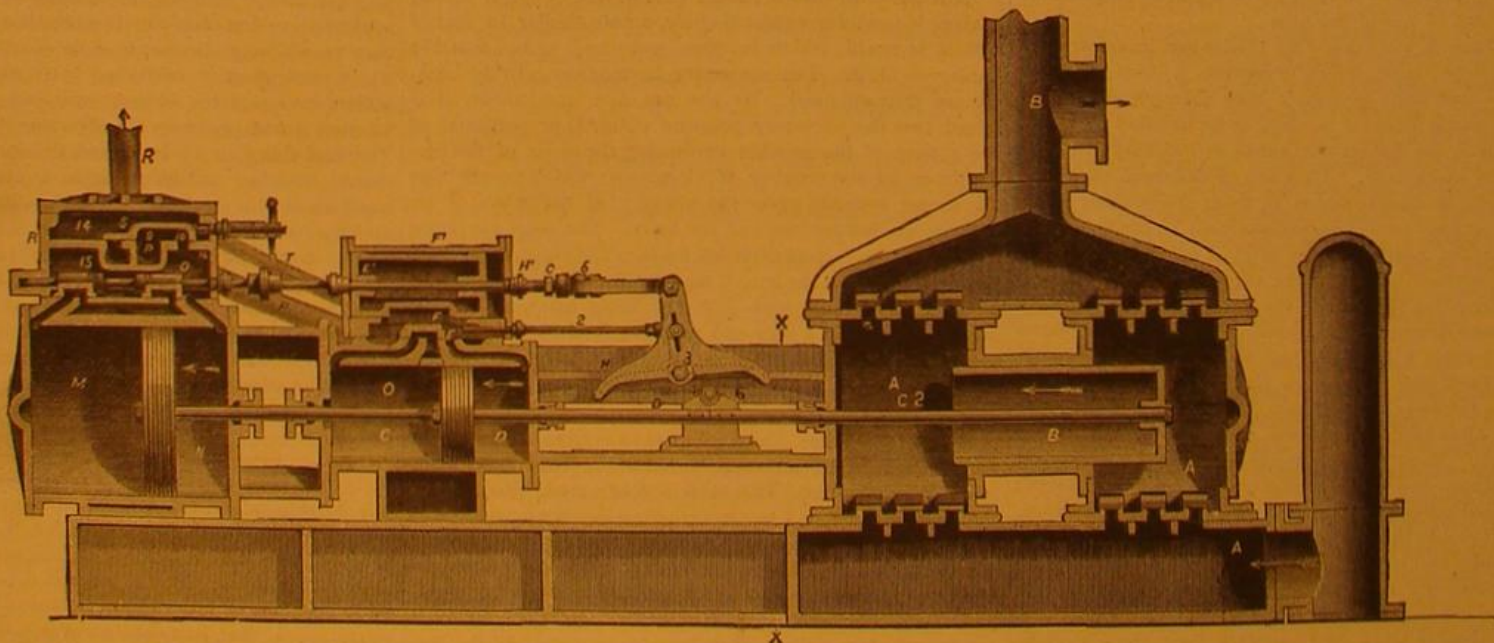
**THE IMPROVED SELDEN PUMP.—Fig. 1.**

to the piston, D, of the high-pressure cylinder, so that the two pistons move together, one in aid of the other, and both exerting their power upon the piston rods. This feature of a compound engine is not new, save in its combination with a direct acting pump, by connecting the valve, O, of the secondary cylinder with the valve-moving piston, E, of the primary engine, so that the steam acting upon this piston moves the valves of both engines simultaneously to open and close the respective ports. Ordinarily the exhaust steam from the primary engine passes by the pipe, P, to the valve chest of the secondary engine, and the exhaust steam from the secondary cylinder passes by the pipe, R, to the condenser.

the rapacious manufacturers. We do not refer to the little victims who paid the usual penalty for consuming candy and nuts in intemperate quantities. Unfortunately there are manufacturers who delight in introducing copper, lead, arsenic, and other deadly poisons into the nursery and kindergarten. So much has already been said and written in regard to Paris green that most intelligent and reading parents avoid presenting their little ones with green-colored picture books, or toys painted that color. We are sorry to say that other colors are frequently poisonous, and it is hardly safe to place any painted toy in the hands of a child that is liable to suck it or kiss it, as the little ones often do.

There is another class of articles, which have always been

the result of his own examination of some thirty nests of over twenty formic species, which he keeps under constant supervision. Sir John has not acquired a very high idea of the much-vaunted intelligence of the ant. He says that, when he cut off their food supply by drawing back a little strip of paper which had acted as a bridge, they had not intelligence to rebridge the chasm of one third of an inch by pushing the strip of paper back. Varied experiments of a similar character resulted in the same way, except where a hole leading into a box containing food was stopped by a little mould; then the ants speedily burrowed into the mould, and found their way into the box and again carried off the food. Sir John did not find that display of in-

**THE IMPROVED SELDEN PUMP.—Fig. 2.**

In order to arrange this engine so that the secondary engine may be partially or entirely supplied by live steam from the boiler, as occasion may require, the exhaust steam is led through the ports 9 and 10 in the divided steam chest, R, and through the D slide valve, S, that is placed over these ports, and said valve is operated by a handle, 12, or other means. The face, 14, of this valve, S, is wide enough to cover the secondary exhaust port, 15, when the face, 16, of the valve is over the port, 10. This face is narrow, so that the exhaust steam can pass through the port, 10, at one side of such face, 16, and the live steam will pass by the pipe, T, in at the other side.

The relative widths of these openings can be varied by

regarded as particularly safe and unobjectionable, but which have proven quite as dangerous as many other toys, namely, those made of india rubber. In a recent number of the *Deutsche Industrie Zeitung*, in regard to the use of oxide of zinc in india rubber, it is stated that the use of such rubber tubes and stoppers for nursing bottles was proven so injurious to health that the agitation against it abroad has had the effect of driving it from the market. B. Tollens, of Göttingen, has, however, found that most of the toys, dolls, animals, etc., are still made of rubber with oxide of zinc in it. A case where a child was taken sick after playing with an india rubber doll, and putting it in the mouth frequently, and where the doll, on being thrown into vinegar, became

telligence and affection which some naturalists have declared induce ants, when any of their companions are accidentally buried, to burrow down and rescue them. They do seem capable of discriminating between companions and strangers; for when a number of each were intoxicated and placed near a nest, the sober ants, after being very much puzzled at the unaccountable condition of the inebriates, carried into the nest their helpless friends and pitched the strangers into a dish of water. When, however, some friends and strangers were chloroformed to death and laid near a nest, the ants seemed to appreciate that the deceased were past remedy, and therefore pitched both friends and strangers indiscriminately over the edge of the table. Attempting to verify the

truth of Huber's declaration that, when ants had been separated for four months and then returned to their nest, they were recognized and caressed by their companions, Sir John found that, though there was no sign of recognition when a separated friend was returned to the nest, he was never attacked, while a stranger being put in was always driven out or even killed. As regards the senses of ants, though Sir John believes they hear, yet they take no notice of any sound he could make; and though they undoubtedly see, they cannot have very keen sight. His experiments do not confirm the suggestion that ants are able to communicate to their companions where food has been discovered; for when single ants had been placed on food, and, going back with some to the nest, were returning with companions to the store, in every case where these pioneer ants were captured their companions wandered about helpless and failed to find their way to the spot.

A NORWEGIAN TIMBER CHURCH.

There exists in Norway, says the *Building News*, a series of wooden churches of great interest to the antiquary. The subject of our engraving is, perhaps, the most curious of them all. Situated in the neighborhood of some of the wildest and most romantic scenery in the country, it is of strange and fantastic design, and the carved pinnacles at its angles give it the appearance of a Chinese pagoda rather than a Christian church. The building is entirely of pine, the roof and walls being covered with tooth-shaped shingles, protected from the weather by layers of pitch. It possesses nave, chancel, and apse, the roof of the latter forming a most curious feature—resembling a large beehive. A covered way, about 3 feet wide, runs all round the church. It is believed to have been erected in the 11th or 12th century, and the resemblance which the mouldings and capitals bear to English architecture of that date fully bears this out.

The Lesson of a Life.

In December, 1845, in the Department of the Vosges, Xavier Thiriat, a boy of ten, accompanied four young girls of about the same age to the church. They had to cross a brook, over which was placed a single loose plank. The boy crossed safely, the first girl who attempted it fell in. The boy jumped in, pulled her out, and then, walking in the water, guided each of the girls across. Some time was lost by this, and the party reached the church late. Xavier, ashamed of being late, did not go up to the stove, but kept behind. He reached home chilled, a dangerous disease followed, by which he was left a complete cripple for life; his only mode of moving about was on hands and knees, so completely were his legs paralyzed and distorted. Coming of very poor people, there was every prospect that Thiriat would be a heavy charge to his family and a wretched burden to himself. Instead of this, he reached manhood bright, cheerful, and intelligent. Reading all the books which he could lay hold of, he was soon the best educated man in his district, and rapidly acquired extensive influence, which was always used for good. He induced the young people to read and to study. Some contributions to the local newspaper, the *Echo des Vosges*, attracted attention and made him known, the result of which was that further intellectual opportunities were extended to him. He made himself a good botanist, meteorologist, and geologist, instructed others in these branches, and procured the foundation of several local libraries. He could not, however, be satisfied without achieving his complete independence and earning his support. He obtained the position of manager of the telegraph at a neighboring town, was made secretary to the mayor, became a favorite correspondent of several agricultural papers, and received the highest reward of the French Franklin Society—its gold medal.

All this was accomplished by native force of character and strong religious feeling, under circumstances not merely adverse, but at first absolutely hopeless. A horrible deformity, intense suffering, absence of instruction, crushing poverty—all these disabilities were overcome unaided, and this ignorant and crippled lad made himself the light, intellectual and moral, of his whole district.—*Public Ledger*.

Sumac.

Sumac (called by botanists *rhus coriaria*), owing to the large quantity of tannic acid which it contains, is extensively employed in dyeing, tanning, in the manufacture of writing inks, etc. Thousands of tons of the dried and powdered leaves and stems of this shrub are annually consumed in the arts. It comes into market in the form of a fine yellowish powder, its chief source being the island of Sicily, where it is extensively cultivated. Its present market value

in New York is: Fine Sicilian powder, \$120 per ton; Virginia, \$65 per ton. The poorer qualities sell for from \$50 to \$60 per ton. Various attempts have been made to reduce the great expense attending the transportation of the crude sumac for market by extracting the tannin directly upon the ground where the material is harvested, and sending the extract into market in a concentrated form; but it has been found that such extract cannot be kept for any length of time, as it is liable to a species of fermentation which converts the major part of the tannin into gallic acid, and greatly impairs its marketable value.

Diamond Cutting by Girls.

This is another new trade for women, and we wonder that those who are seeking new outlets for feminine work have not thought of it long ago. Diamond cutting is the mechanical labor which above all others requires that extreme delicacy of touch and nice perception of form, color, etc., which is inborn in the majority of women, but which nearly all men are compelled to use much practice to acquire. Diamond cutting involves no severe physical labor, except possibly in the grinding of the stones together to form the facets. That branch, requiring powerful wrist muscles, may be left to the men; but every other process, from the splitting of the rough gems up to the final polishing, is fully within feminine capabilities.

Twenty-three young women are now successfully working at this trade in Roxbury, Mass. and the credit of teaching

open to all the world. The shipment of butter in vessels provided with refrigerator rooms, such as are already used for conveying beef to Europe, was suggested; and the growing trade in spurious butter under various pretentious names was discussed and condemned. Many of the members present urged that legislation should put a stop to the sale of these compounds as butter. Legislation cannot stop the manufacture of any article not proved to be pernicious to the public; but it might properly compel the seller to designate, on his package, of what the contents consist, so that the purchaser may not be deceived.

The Manufacture of Ammonia Salts from the Ammoniacal Gas Liquor.

The following method of preparing ammonia salts from the gas house waters, by means of soda salts, is particularly interesting, since it produces a pure carbonate of soda at the same time, and is both cheaper and easier than the Solvay soda process; and it involves no waste products. Dr. G. T. Gerlach, of Kalk, near Deutz, is the inventor of the process.

If sal ammoniac is the salt we wish to obtain, chloride of sodium (table salt) is of course the source of the chlorine, and the process resembles in some respects that of Solvay. The crude ammoniacal liquors are first distilled and yield carbonate of ammonia: in this is dissolved a quantity of common salt, equivalent to that of the carbonate of ammonia present. This solution has a gravity of 1.22. Into it is passed a current of carbonic acid gas, as long as any bicarbonate of soda is precipitated. Some sulphuretted hydrogen is thus expelled, which had passed over in the form of sulphide of ammonia. The precipitated bicarbonate of soda is removed and dried; and on heating, enough carbonic acid is expelled to serve for the next operation, monocarbonate of soda remaining. The liquid contains chloride of ammonia with some undecomposed carbonate of ammonia, with chloride of sodium and a little dissolved bicarbonate of soda. The carbonate of ammonia is recovered by distillation, the sal ammoniac and salt by crystallization after concentration. Instead of being decomposed by lime, as in Solvay's process, the sal ammoniac is sent to the market. If, however, it is desired to make *aqua ammonia*, some of this mother liquor is treated with lime and distilled.

If sulphate of ammonia is the product desired, the sulphate of soda is employed to decompose the carbonate of ammonia. Either crystallized Glauber salt is dissolved in the concentrated solution of carbonate of ammonia, or the anhydrous sulphate (salt cake), obtained in the manufacture of nitric or hydrochloric acid, is dissolved in a less concentrated solution of the ammonia salt. Equivalent proportions of the salts are employed, and the solution has a specific gravity of 1.3. Carbonic acid is passed into this solution until the bicarbonate of soda ceases to be precipitated. The latter salt is removed and dried as before. In solution are sulphate of ammonia, undecomposed carbonate of ammonia and sulphate of soda, with a

trace of dissolved bicarbonate of soda. The carbonate of ammonia is recovered by distillation, the other salts by concentration and crystallization. When nitrate of ammonia is the product required, the carbonate of ammonia is decomposed by means of Chili salt-petre, or nitrate of soda. The reactions are the same as before, the chief products being nitrate of ammonia and bicarbonate of soda. It is evident that the use of chloride, sulphate, and nitrate of soda, instead of the corresponding acids, must be both cheaper and more convenient, while the simultaneous production of soda ash still further increases the profits. The separation of the salts which remain in solution is an easy matter, owing to their unequal solubility. In the first case we had common salt and sal ammoniac; on concentrating to a certain point the former will crystallize out of the boiling solution, and after this is removed the solution is allowed to cool, when the latter will crystallize out. Sulphates of ammonia and soda crystallize from solution as a double salt containing two equivalents of water of crystallization. But on evaporating a solution of these salts to a certain point, the anhydrous Glauber salt will separate, and sulphate of ammonia will remain in solution. The anhydrous Glauber salt is not pure, and is employed for decomposing a fresh quantity of carbonate of ammonia. In separating table salt and Glauber salts at a boiling heat, care must be taken not to burn the salts, and on a large scale steam heat should be employed.

A good waterproof cement may be made by mixing glue 5, rosin 4, red ochre 2 parts, with a little water.



ANCIENT TIMBER CHURCH IN NORWAY.

them is due to Mr. Henry D. Morse. That gentleman has hitherto employed trained diamond cutters from Amsterdam; and by carefully watching them he became quite an expert himself. The Amsterdam cutters are nearly all Israelites, and they are exceedingly chary of imparting their knowledge to strangers, preferring to teach only their sons or family relatives, or at best Dutch boys of their own selection. It is their invariable rule to decline to take apprentices except under the above restrictions; and accordingly, when Mr. Morse requested his workmen to teach American boys, they peremptorily refused. Anticipating this result, he had secretly established a shop in Roxbury, and there had taught six or eight girls. Consequently, when his men mutinied, he discharged them forthwith, and replaced them by his female employees. The Yankee girls are now cutting and polishing diamonds in superior style.

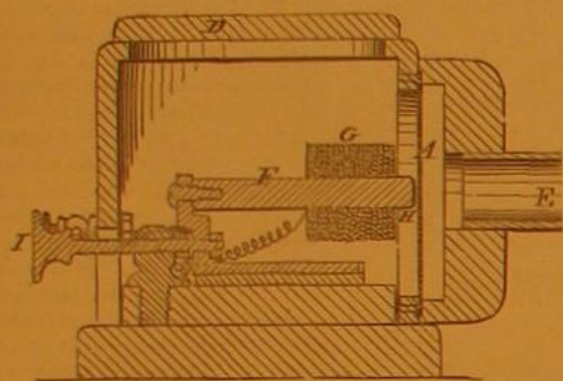
The Dairy Interests of the United States.

The fourth annual convention of the National Butter and Egg Association was recently held at Chicago, Ill., and was very largely attended. The President, Mr. George E. Gooch, of Chicago, spoke of the benefit which the trade derived from such meetings, and of the magnitude of the interest, adding that \$6,000,000 worth of butter was sent eastward from Chicago during the past year. The butter and cheese produced in this country last year reached a value of \$124,000,000, and the milk sold in addition was 325,000,000 gallons. He also called attention to the prizes, value \$1,500 gold, to be given for the best exhibits of butter and cheese by the Royal Agricultural Society of England, at their meeting to be held in Liverpool next July, the competition being

[Continued from first page.]

sounds of different degrees of the gamut be made simultaneously before No. 1. These also will be repeated by the other instruments, and the same would be true if, before the first instrument, any number of different sounds were made. Now, let it be previously understood that all messages sent to station No. 2 will be uttered in note C for instance, those to No. 3 in note D, and so on, a different note for each station; then, as the signals for each message differ in pitch from those for all the other messages, the operator has only to fix his attention upon the message sounded in the note he has learned to recognize, and he may ignore all the rest. In this way, the number of despatches which may be sent simultaneously is very large. Where, however, a large number is forwarded, rendering it the more difficult for a receiving operator to recognize his particular note, his message may be automatically received by a resonator provided with a membrane which vibrates only when the note with which the resonator is in unison is emitted by the receiving telephone. The vibrations of the membrane may be made to operate a circuit breaker, which will operate a Morse sounder or a telegraphic recording apparatus. Of course where several persons speak in the vicinity of telephone No. 1, their utterances are in a like manner simultaneously transmitted to all the telephones in the circuit. If this verbal

Fig. 4.



communication should be used for telegraphic purposes, the messages would have to be taken down by the receivers in short hand. We understand that Professor Bell has patents pending for some further improvements in his apparatus. These we shall notice at some future time.

We are indebted to a correspondent for the sketches whence we have prepared the engravings (Fig. 1, front page) representing Professor Bell lecturing on the telephone, at Salem, Mass., on February 12 last, and also the group in the inventor's study, in Exeter place, Boston, receiving his communications during the course of the lecture. The apparatus, an exterior view of which is also given, is all contained in an oblong box about 7 inches high and wide, and 12 inches long. This is all there is visible of the instrument, which during the lecture is placed on a desk at the front of the stage, with its mouthpiece toward the audience. Not only was the conversation and singing of the people at the Boston end distinctly audible in the Salem hall, 14 miles away, but Professor Bell's lecture was plainly heard and applause sent over the wires by the listeners in Boston.

Professor Bell was born in Edinburgh, Scotland, and came to this country about six years ago. His father, Professor A. M. Bell, who became noted as the inventor of a method for teaching deaf mutes to speak, and of a universal system of phonography, is now living in Brantford, Ontario. Professor Graham Bell, the present inventor, has also been exceptionally successful in the instruction of deaf mutes, and in one case he has enabled a girl who had never produced an articulate sound to pronounce words distinctly after having her under his tuition for the short space of two months. "If I can make a deaf mute talk," the now famous inventor is reported to have said, "I can make iron talk." We need not add that his promise has been fulfilled.

Electro-Chemical Illumination.

MM. Gauduin and Gramme have recently conducted a series of experiments in order to determine the effects of various foreign substances, combined with carbon pencils, upon the production of electric light. The materials introduced into the pencils were phosphate of lime (from bones), chloride of calcium, borate of lime, silicate of lime, pure precipitated silica, magnesia, borate of magnesia, phosphate of magnesia, aluminum, and silicate of aluminum. The proportions were calculated so as to obtain 5 per cent of oxide after the baking of the pencils. The latter were submitted to the action of a current, always in the same direction, furnished by a Gramme electric machine of sufficient power to form an electric arc of from 0.4 to 0.6 inch in length. The negative pencil being placed below, the following results were observed:

1. The complete decomposition of phosphide of lime. Under the triple influence of electrolytic action, calorific action, and the reducing action of the carbon, the reduced calcium accumulated on the negative pencil, and burned (in contact with the air) with a reddish flame. The lime and phosphoric acid produced abundant smoke. The light obtained, measured by the photometer, was double that yielded by pencils of similar dimensions made from gas retort residue.

2. Chloride of calcium and borate and silicate of lime were also decomposed; but the boracic and silicic acids seemed to

be volatilized through the action of the current. Less light was obtained in this case than with the phosphate of lime.

3. Silica rendered the pencils worse conductors, diminished the light, and melted and volatilized without becoming decomposed.

4. Magnesia and borate and phosphate of magnesia were decomposed. Magnesium in vapor went to the negative pencil, and burned, in contact with the air, with a white flame. Magnesia and boracic and phosphoric acids escaped in the state of smoke. The augmentation of the light was less than with the lime salts.

5. Aluminum and silicate of aluminum were decomposed only with a very strong current and large electric arc; but under these circumstances the decomposition was quite manifest, and the aluminum vapor could be seen leaving the negative pole, as from a gas jet, burning with a dull bluish flame.

The authors state that, considering that the flame and smoke which accompanied these electro-chemical lights would prove a great obstacle to their utilization, they continued their experiments no further. They point out, however, that the introduction of foreign bodies into pure carbon pencils is an excellent mode of studying the effect of electricity upon such bodies, which is susceptible of many very interesting applications.

Planing Mill Machinery.

An important point to be observed in the care of bearings for fast running journals is their lubrication. It needs no argument to demonstrate the necessity that exists for lubricating a shaft or bearing, and none to prove that the best and most economical way is to do it properly. Cylinder bearings that are supplied with oil from below, by means of wicks, valves or capillary attraction of any kind, should never be used, as they cannot be trusted for any length of time, and the result is that the operator pours on just as much oil—and wisely, too—as if they were of the ordinary pattern.

The common practice of squirting the oil from a can is another bad plan and very wasteful. Generally where one quart is really used in this manner five are wasted; and thus mill owners are often induced to buy cheap oil under the impression that it lasts just as long as the best, as it certainly does when an operator thinks he must use just so much and apply it just so often no matter what the quality may be.

For the journals of high speed machinery only the best lard or sperm oil should be used, and it should always be fed from an adjustable glass oiler placed on the top of the can in plain sight. "With this arrangement I have seen," says Mr. F. H. Morse, in the *Northwestern Lumberman*, "under my supervision, 24 inch machines with 8 inch journals run steadily for 10 hours, as a test, with only a teaspoonful of sperm oil to each journal, and at the end of that time the spindles were as cool as if they had run only half an hour. However incredible this may seem to those who are in the habit of applying more than that every 15 or 20 minutes, it is a fact, and one which I can readily substantiate. If those in charge of planing machinery would pay more attention to this part of their business and use more care and prudence than they usually do, the expense account of many mills might be sensibly reduced."

It should be the aim of every foreman and superintendent of a planing mill to keep the machines under his charge constantly at work, as no machine was ever known to make a dollar by standing idle. There may be cases where, had all the machines stood idle, or had they never been started, their owners would have been better off; but the fact still remains that, if there is any profit in running a planing mill at all (and certainly it should not be operated when there is not), it must be made by keeping all the machines steadily at work. If there are more machines in a mill than the amount of business calls for, part of them should be stopped altogether, and only those which are required for the various kinds of work, and which can be kept steadily employed, should be used. It does not pay to keep an operator standing idle over his machine one third of a day that he may work the balance of the time; for when he stops, his assistants and the machine stop, and consequently the profits stop; but his wages do not, neither does the interest upon the capital invested. There was a time, not many years since, when the profits of the planing-mill business were large enough to withstand such drawbacks; but that day has passed, and now it is only with the best management in every particular that it can be made to pay even a moderate percentage upon the investment.

A Gigantic Model Dairy.

The food supply of London has long engrossed a large share of public attention, and upon the purity of the articles supplied depends in a great measure the health and happiness of its inhabitants. Some ten years since the design was introduced of supplying the dwellers in this great city with milk and other dairy produce which, for general excellence, could not be surpassed. Like most good works, these laudable efforts were at first in a great measure abortive; but, by dint of perseverance and good management, the Aylesbury Dairy Company has assumed an importance far exceeding even the most sanguine expectations of its originators, and may fairly be designated one of the most useful and prosperous corporations now in operation. To give some idea of the gigantic nature of the business so successfully developed by this company, we may state that they daily supply some 5,000 families with milk, which is guaranteed, so far as human care and judgment can insure it, to be not only of

the purest description, but obtained from perfectly healthy sources. Upwards of 25,000 gallons of milk are dealt with every week, being the produce of nearly 50 farms in some of the best of our dairy counties. To carry on this enormous trade the company have, in addition to their town premises in St. Peterburgh place, Bayswater, a large factory at Swindon and a dairy at Bourton, where all the surplus milk is converted into cheese. With such admirable sources of supply, it is not a matter of surprise that the business has rapidly extended, and that so successful a commercial result has been achieved. The Aylesbury Dairy Company can take into their Swindon factory 3,000 gallons of milk daily, which they hold, as it were, in reserve. In the summer time, when the fashionable world is seeking recreation in garden parties, and when strawberries and cream and other suchlike seasonable delicacies are in request, then the company are in a position to meet any sudden demand. They possess every modern appliance suitable for the dairy, and have the power of setting 1,500 gallons of milk in 800 square feet of milk pans—the product from which in 10 hours' time would be a large quantity of cream. The cream is daily sent to London; and, after the orders are executed, the surplus is made into butter, the excellence of which is such that the demand exceeds the supply.—*London Court Circular*.

Wash for Fruit Trees.

At the last meeting of the Farmers' Club, a stranger inquired how he might remove the scales from the bodies and branches of his fruit trees.

The chairman stated that W. S. Carpenter used to put a pound of crude potash in two gallons of water, and after the potash is dissolved, dip a large swab in it and apply the liquid to the trees, which will kill the embryo insect in the scales.

Mr. Whitman said: That is a good remedy where one can get potash. But as this article is so unpleasant to handle, so difficult to procure except by the barrel, and so costly by the pound, I prefer to use cheap soap, with which I make a strong liquid and apply it with a swab. I have tried tobacco, soap, and carbolic soap, which are very expensive. Now I procure the Washington soap, which can be obtained in almost every city and village by the box, at only a few cents per pound. I take a cake of this soap, shave it up into thin slices and dissolve it in a pail of hot water. After it has stood a day or two the liquid will appear like mucilage, which is applied to the bodies of the trees when it is almost boiling hot. One or two applications will remove all the scales and make the bark look smooth and healthy. I procure a box of this soap every year, not only for the trees, but there is no better soap for culinary and laundry purposes.

Carbonic Acid Exhaled by Animals.

A German chemist has made a long series of careful experiments to ascertain the quantity of carbonic acid given off in respiration and perspiration by different animals. From among his most important conclusions, printed in the *Journal of the Chemical Society*, we select a few which appear worth wider notice. In proportion to their weight, the largest quantity of carbonic acid is given off by birds—mammals come next—and worms, amphibians, fishes, and snails form another group in which the excretion of carbonic acid is much smaller; of these, worms give off the most, and snails the least. Those that live in water give off more carbonic acid to the air than they do to the water; and young animals more than old ones. Experiments with colored light show that under the green and yellow more carbonic acid is excreted than in ordinary daylight; and on comparing light and darkness, it was found that much less carbonic acid is given off during the night than during the day. In colored light the milk-white and blue rays come next to the green and yellow in activity; and the red and violet are the least active.

Produce Exported in One Day.

Some idea of the vast amount of produce going from this country may be formed from the following statement: Portion of shipment from the port of New York, Saturday, March 3, taken from official sources: Corn, 99,735 bushels; apples, 2,100 barrels; bacon, 2,566 boxes; cheese, 2,400 boxes; butter, 3,827 packages; fresh beef, 90 tons, 1,488 quarters; sheep, 385; miscellaneous: 3,500 pieces maple timber, 600 barrels of oysters, 500 packages of agricultural implements, 450 tierces of lard, 24,025 cases of canned goods, and 500 barrels of shoe pegs. A single manufacturer in this city turns out 1,200 bushels shoe pegs a day. His best foreign market, he informs us, is Germany.

Pigs and Poisonous Plants.

A correspondent writes to point out that, in our recent article entitled "Absence of White Color in Animals," Mr. Darwin is quoted as to the effect of a poisonous plant on pigs in Virginia, with the comment of Dr. Ogle that there is no proof that the black pigs eat the root which poisons the white pigs; but, in fact, the white pigs are deficient in taste and smell, and not able to discriminate as to poisonous plants, etc. Our correspondent does not know what plant has such effects on pigs in Virginia, but there is a plant in Florida which may be the one referred to by Mr. Darwin. It is called paint root, and the root is a small bulb. The root and top are used as a dye by the Indians. Hogs are very fond of it, and hogs with black hoofs fatten on it; but those with white hoofs become lame and the hoof drops off. If a hog has three black hoofs and one white, the white one will fall off.

Postal Card Ink.

With the numerous useful and useless little inventions for which our country is noted, it is surprising that no one has yet placed in the market any kind of invisible ink for postal cards. Although we do not believe that such ink would prove very useful, it would probably meet with considerable sale, partially from the novelty of the thing. Many kinds of magic ink have been known for years, but most of them possess some disadvantages. A writer in the *Deutsche Industrie Zeitung*, in discussing the subject, claims that postal card ink should possess the following properties: 1. The writing must, of course, be invisible at first. 2. It must be of such a nature as to be rendered visible quickly and easily by means in the possession of every one at all times. 3. There should not be several kinds of this ink in market, one of which is developed by light, another by heat, a third by common salt solution, etc., so that, on receiving a blank card, the receiver would be at a loss to know how to develop it. This writer then goes on to recommend the use of a solution of nitrate or chloride of cobalt, mixed with a little sugar or gum to make it flow easily from the pen. Such writing is made visible by moderate heat, even a burning match being sufficient. Dr. Böttger, in a note to this article, recommends the use of ferrocyanide of potassium, or yellow prussiate of potash, which is readily developed by the sulphates of copper and iron (blue or green vitriol), the former yielding brown, the latter blue, letters.

Dr. Böttger is an exceedingly ingenious chemist, and most of his suggestions are very practical, but we beg to differ with him this time. Very few persons, except chemists, may be supposed to have solutions of either blue or green vitriol always at hand; and even a chemist, unless notified to this effect beforehand, would not think to try the effect of these solutions until he had tried several other reagents. This could be remedied by writing on the back of the card with common black ink an ambiguous or nonsensical sentence containing the name of the developer to be employed. For chemists, a convenient ink would be a solution of some lead salt, which is developed by sulphuretted hydrogen.

For ordinary use the most convenient ink is an iron salt; the common tincture of iron of the drug store will answer, if diluted. This writing is scarcely perceptible when dry, but comes out a beautiful black on pouring over it some ordinary green or black tea. The tannin in the tea unites with the iron to form a black ink precisely like that used for ordinary correspondence.

Another ink, less convenient for the writer, but more convenient for the receiver, is to write on the card with thin starch paste. When perfectly dry, the card is flowed with a solution of iodine in very strong alcohol. This imparts a reddish color to the card, but does not develop the writing, owing to the absence of water. The receiver has only to dip the card in water, when the writing will appear in blue characters. We offer this as a suggestion to manufacturers of magic inks. Of course, the operation of flowing with tincture of iodine might be left for the person who receives it, provided he were furnished with a key to the developer required. In this case dilute alcohol, or a solution of iodide of potassium, could be employed as a solvent for the iodine.

Another method, more curious than useful, consists in writing on the card with a solution of paraffin in benzol. When the solvent has evaporated the paraffin is invisible, but becomes visible on being dusted with lampblack or powdered graphite, or smoking over a candle flame. H.

Antidote for Oidium on Grape Vines.

M. Chatot, a Frenchman, recommends common table salt as an antidote for oidium, or grape vine disease. He says that his vines and grapes were covered for some years with a fungus-like substance, and that last spring he sprinkled a handful of salt about the roots of each vine. The effect was marvellous, the vines grew luxuriantly, and bore an abundance of grapes entirely free from the fungus of oidium.

NEW BOOKS AND PUBLICATIONS.

THE ELEMENTS OF MACHINE DESIGN. An Introduction to the Principles which Determine the Arrangement and Proportions of the Parts of Machines, etc. By B. Cawthorne Unwin, Professor of Mechanical Engineering at the Royal Indian College of Civil Engineers. Price 3s. 6d. (84 cents gold). London, England: Longmans, Green & Co., Paternoster row.

The designing of machinery has hitherto been principally left to the draftsman, and no attempt has been made until recently to reduce their different practices and methods to a science; and although it might be easy to form a collection of rules deduced from actual practice, no principles could be laid down on the authority of such empirical formulae. To systematize the whole subject, and thus to simplify the practice and render it easy of acquisition by students, is the author's object, and he has succeeded in completing a work of the highest excellence. The chapters on materials and strength of materials, on riveted joints, and on shafting, are especially to be noticed for their terse and clear explanations; and throughout the book the mathematical expressions used need not deter any careful and painstaking student by their depth and abstruseness. The author has evidently put into this volume an amount of practical knowledge which must have taken many years to acquire.

THE MICROSCOPIST. A Manual of Microscopy. By J. H. Wythe, M.D. Third Edition. Illustrated. Price \$4.50. Philadelphia, Pa.: Lindsay & Blakiston, Publishers. New York city: D. Van Nostrand, 27 Warren street.

Professor Wythe offers a practically new work, since he has retained nothing but the name and perhaps the general design of his earlier editions. The present book is in all respects creditable both to the author and the publishers; and we can cordially commend it to students of microscopy. It abounds in clear, practical suggestions; its descriptions of microscopic objects and their mode of preparation are exceedingly lucid; while an abundance of admirable illustrations is provided. Beginning with a description of the various forms of microscope, the author explains all the accessories, mechanical arrangements, etc., including the micro-spectroscope and the practice of micro-photography; chapters on the use of

the instrument and how to prepare objects follow, and then the several applications of the instrument, as a means of investigation in the various sciences, are separately and fully considered.

THE LIFE HISTORY OF OUR PLANET. By William D. Gunning. Illustrated by Mary Gunning. Chicago, Ill.: W. B. Keen, Cooke & Co.

A popular and readable work on a subject which is calculated, better than any other we know of, to test an author's powers of discrimination. We can give Mr. Gunning credit for presenting his views in a new way, and can heartily commend the progressive manner in which he leads the reader from the simpler to the complex subjects. Besides, all the book has a timely value, because many recent discoveries—notably those of Professor Marsh and the deep sea expeditions—are explained in popular form, and are brought into their proper connection with the history of the world.

A PRACTICAL TREATISE ON HEAT. By Thomas Box. Price \$5. New York city: E. & F. N. Spon, 446 Broome st.

The second edition of an excellent standard work. It takes account of all the recent advances in the science, embodies a large number of the tables which enter into the daily practice of mechanical engineers, and, in brief, is a handbook, a thorough knowledge of the contents of which would be invaluable to any one in a mechanical profession. We can commend it to the many correspondents who frequently ask us what books young engineers should study.

CELESTIAL DYNAMICS. By James W. Hanna. Price 30 cts.

The author, who says he knew nothing about astronomy a year ago, now undertakes to upset the science by affirming the non-revolution of planets about the sun.

FIRE IN THEATERS. By Eyre M. Shaw, R.E., Chief of the London Fire Brigade. Price 50 cents. New York city: E. & F. N. Spon, 446 Broome street.

A very sensible treatise on an important subject, by a writer of great knowledge and experience.

On page 359, volume XXVI, we described and illustrated Mr. C. Baillarge's new system of mensuration. We are in receipt of a "Key to Baillarge's Stereometrical Tableau," relating to the same subject. Published by C. Darveau, 82 Mountain Hill, Quebec, Canada.

"Cleaning and Scouring" is the title of a handy little book of recipes for laundresses and others. Published by E. & F. N. Spon, 446 Broome-street, New York city. Price 20 cents.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

LEATHER PATENT.—NATHAN C. RUSSELL, APPELLANT, vs. SAMUEL DODGE, JR., AND SAMUEL DODGE, JR. (Appeal from the Circuit Court of the United States for the Northern District of New York.—Decided October Term, 1876.)

Where a useful result is produced in any art, manufacture, or composition of matter, by the use of certain means for which the inventor or discoverer obtains a patent, the means described must be the essential and absolutely necessary means, and not mere adjuncts, which may be used or abandoned at pleasure.

Where a reissued patent is granted upon a surrender of the original, for its alleged defective or insufficient specification, such specification cannot be substantially changed in the reissued patent, either by the addition of new matter or the omission of important particulars, so as to enlarge the scope of the invention as originally claimed. A defective specification can be rendered more definite and certain so as to embrace the claim made, or the claim can be so modified as to correspond with the specification; but, except under special circumstances, this is the extent to which the operation of the original patent can be changed by the reissue.

Where the patent was for a process of treating bark-tanned lamb or sheep skin by means of a compound, in which heated fat liquor was an essential ingredient, and a change was made in the original specification by eliminating the necessity of using the fat liquor in a heated condition, and making in the new specification its use in that condition a mere matter of convenience, and by inserting an independent claim for the use of fat liquor in the treatment of leather generally, the character and scope of the invention as originally claimed were held to be so enlarged as to constitute a different invention.

The action of the Commissioner of Patents in granting a reissue within the limits of his authority is not open to collateral impeachment, but his authority being limited to a reissue for the same invention, the two patents may be compared to determine the identity of the invention. If the reissued patent, when thus compared, appears on its face to be for a different invention, it is void, the Commissioner having exceeded his authority in issuing it.

The case of Klein vs. Russell, reported in the 19th of Wallace, stated and qualified.

Mr. Justice Field delivered the opinion of the court: This is a suit for an infringement of a patent obtained by the complainant for an alleged new and useful improvement in the preparation of leather, with a prayer that the defendants be decreed to account for and pay to him the gains and profits derived by them from making, using, and vending the improvement, and be enjoined from further infringement. The patent bears date in February, 1870, and was issued upon a surrender and cancellation of a previous patent obtained by the complainant in August, 1869, upon the allegation that the original patent was inoperative and invalid by reason of an insufficient and defective specification of the improvement. The validity of the reissued patent is assailed on the ground that it describes a different invention from that claimed in the original patent, and for want of novelty in the invention. Other grounds of invalidity are also stated, but in the view we take of the case they will not require consideration.

In the schedule accompanying the patent, giving a description of the alleged invention and constituting a part of the instrument, the complainant declares that he has "invented a new and useful improvement in the preparation of leather;" that "the invention consists in a novel preparation of what is known as bark-tanned lamb or sheep skin," by which the article is rendered soft and free, and adapted, among other uses, for the manufacture of what are termed "dog-skin gloves;" and that "the principal feature of the invention consists in the employment of what is known among tanners and others as 'fat-liquor,' which is ordinarily obtained by scouring deer skin after tanning in oil," but which may be produced by the cutting of oil with a suitable alkali. The schedule then proceeds to state that in treating the leather with fat liquor "it is desirable to heat the liquor to or near the boiling point; and that it is preferred to use the same in connection with other ingredients;" and that "the fat liquor is used in specified quantities for each ten gallons of the heated liquor; and that 'to effect the treatment' the skin should be well dipped in or saturated with the fat liquor or compound, of which fat liquor is the base." The schedule closes by a declaration that what the patentee claimed and desired to be secured by letters patent was:

1. The employment of fat liquor in the treatment of leather, substantially as specified.

2. The process, substantially as herein described, of treating bark-tanned lamb or sheep skin by means of a compound composed and applied essentially as specified. It is clear from this statement that the patent is for the use of fat liquor in any condition, hot or cold, in the treatment of leather, and for a process of treating bark-tanned lamb or sheep skin by means of a compound in which fat liquor is the principal ingredient. The state of the liquor is not mentioned as essential to the treatment, or to accomplish any of the results sought. It is only stated as a thing to be desired that the liquor should be heated, and that it would be preferable that other ingredients were mixed with the heated liquor to make the compound mentioned. In other words, the specification declares that by heating the liquor the effect desired will be more readily produced—that is, more speedily or with less trouble and expense; not that the heating is in any respect essential to the treatment. Where a useful result is produced in any art, manufacture, or composition of matter by the use of certain means for which the inventor or discoverer obtains a patent, it is, as justly observed by the presiding justice of the circuit court, too plain for argument that the means described must be the essential and absolutely necessary means, and not mere adjuncts which may be used or abandoned at pleasure.

The original patent was less extensive in its claim than the reissue. That patent was for a process of treating bark-tanned lamb or sheep skin by means of a compound, in which heated fat liquor was an essential ingredient. The specification was explicit in this particular, and left no doubt on the subject. The reissued patent covers the use of the fat liquor in any condition, hot or cold, and when used alone or in a compound with other ingredients, and thus has a more extended operation, bringing under it manufactures not originally contemplated by the patentee. Is such a reissue valid?

The statute of 1836 (5 Statutes at Large, 329), under which the reissue was granted, provided that whenever any patent was inoperative or invalid by reason of a defective or insufficient description or specification, or by reason of the patentee claiming as his own invention more than he had a right to claim as new, if the error arose from inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, it should be lawful for the Commissioner, upon the surrender of such patent and the payment of a prescribed duty, to cause a new patent to be issued to the inventor for the same invention, for the residue of the period then unexpired, in accordance with the corrected description and specification.

According to these provisions a reissue could only be had where the original patent was inoperative or invalid, by reason of a defective or insufficient description or specification, or where the claim of the patentee exceeded his right, and then only in case the error committed had arisen from the causes stated. And as a reissue could only be granted for the same invention embraced by the original patent, the specification could not be substantially changed, either by the addition of new matter or the omission of important particulars, so as to enlarge the scope of the invention as originally claimed. A defective specification could be rendered more definite and certain so as to embrace the claim made, or the claim could be so modified as to correspond with the specification; but except under special circumstances, such as occurred in the case of *Lockwood & Morrey* (8 Wall., 250), where the inventor was induced to limit his claim by the mistake of the Commissioner of Patents, this was the extent to which the operation of the original patent could be changed by the reissue. The object of the law was to enable patentees to remedy accidental mistakes, and the law was perverted when any other end was secured by the reissue.

Judged by that law, and the provisions of the act of 1870 on this subject are substantially the same, there can be no doubt of the invalidity of the reissue. The original patent was not inoperative nor invalid from any defective or insufficient specification. The description given of the process claimed was, as stated by the patentee, full, clear, and exact, and the claim covered the specification—the one corresponded with the other. The change made in the old specification by eliminating the necessity of using the fat liquor in a heated condition, and making in the new specification its use in that condition a mere matter of convenience, and the insertion of an independent claim for the use of fat liquor in the treatment of leather generally, operated to enlarge the character and scope of the invention. The evident object of the patentee in seeking a reissue was not to correct any defects in specification or claim, but to change both, and thus obtain, in fact, a patent for a different invention. This result the law, as we have seen, does not permit.

The decision of the Commissioner in granting the reissue is, it is true, so far conclusive as to preclude in the present suit for infringement any inquiry into its correctness outside of the patents themselves. His action in any case, within the limits of his authority, is not open to collateral impeachment. But that authority being limited to a reissue for the same invention as that embraced in the original patent, a reissue for anything more is necessarily inoperative and void. To determine the identity of the invention the two patents may be compared. Thus compared, the reissue here appears on its face to be for a different invention, and the Commissioner, therefore, exceeded his authority in issuing it. (*Seymour vs. Osborne*, 11 Wall., 544; *Wicks vs. Stevens*, 2 Wood's C. C. Reports, 312.)

In the case of *Klein vs. Russell* (19 Wall., 463), the question was not before the court whether the reissued patent was invalid because not for the same invention. The point was not made in that case in the court below, and for that reason, it was stated, the point could not be made here. It was to be presumed, said this court, until the contrary was made to appear, that the Commissioner did his duty correctly in granting the reissue. What was subsequently said of the character of the first claim, so far as it conflicts with the construction here given, does not meet our approval after the extended consideration the subject has since received.

But assuming that the reissue is not void for the reasons stated, the patent is still invalid for want of novelty in the alleged invention. The use of fat liquor in the treatment of bark-tanned skins was general with manufacturers for many years previous to the alleged invention. Testimony to this effect is given by numerous witnesses. It would subvert no useful purpose to state this testimony. It is set forth with ample fullness in the opinion of the circuit court. It is sufficient for us to say that it is entirely satisfactory to our minds. The decree is affirmed.

United States Circuit Court—District of Connecticut.

BOLT PATENT.—WILLIAM J. CLARK vs. THE KENNEDY MANUFACTURING COMPANY AND EDWIN HILLS.

[In Equity.—Before SHIPMAN, J.—Decided January 1, 1877.]

The invention described in the original patent to Wm. J. Clark, February 2, 1864, consists in the manner in which he applied lateral compression to the manufacture of an angular neck, and in the manner in which he permitted the shaping mechanism to become anvil ends, upon which the header could operate to form a head upon the bolt.

He did not discover that swaging round iron would form an angular neck; and that upsetting would form a head, and that both operations would form a bolt; but he did invent what was before unknown—the mechanical means by which swaging would form an angular neck from round iron, which mechanism could be used in connection with upsetting.

The thing invented and patented was not any mode of swaging combined with upsetting; but it was the employment of specified means, or their equivalents, for the accomplishment of a desired end.

A patentee cannot, by obtaining a reissue for a process, enlarge his right to a monopoly beyond the actual invention.

The claims for the process of forming the angular neck and protuberant head, as contained in the reissue, construed to be to the use substantially of the dies described in the specification, or their equivalents.

The patent covers dies constructed with the round and square portions of similar area, whereby the lateral swaging is effected before the header operates; and it is not infringed by the use of dies, the square portion of which is of greater area than the round, and the swaging and upsetting operations are simultaneously performed.

The claim in the reissued patent does not include any machine for making bolts from round iron, in which machine the two operations of forming the angular neck by dies which will swage, and forming the head by upsetting, are combined.

Claims should be so construed, if possible, as to embrace the invention actually made and described.

Bill dismissed.
[Chas. E. Mitchell and Benj. F. Thurston for plaintiff.
Chas. B. Ingersoll for defendants.]

United States Circuit Court—District of Massachusetts.

WATER WHEEL PATENT.—THE SWAIN TURBINE AND MANUFACTURING COMPANY vs. JAMES E. LADD.

[In Equity.—Before SHEPLEY, J.—Decided January 2, 1877.]

Claims which would be void as being functional should be so construed as to embrace the described means for effecting the result.

When changes of form involve functional differences, producing new or better results, they are patentable.

The claims in a reissued patent are to be construed so as not to embrace any invention broader in its scope than the invention described, or substantially suggested or indicated in the original.

ABSTRACT FROM THE OPINION OF THE COURT.

SHEPLEY, J.:

The reissued patent No. 28,314, dated November 19, 1872, has its first, second, third, and fifth claims so worded as in their broad and literal construction, without any limitation to the invention described in the specifications of the original and the reissued patent, to claim any form of "water wheel having an effective inward flow and discharge of part of the water simultaneously in one wheel, whereby the effective area of discharge is increased without increasing the diameter of the wheel." This is the exact language of the fifth claim, which would be void as a claim merely functional, unless this claim be construed as must also the first, second, and third claims, as including the described means of effecting the result. To uphold these claims they must not only be construed in connection with the described means in the reissue, but so construed as not to embrace any invention broader in its scope than the invention described, or substantially suggested or indicated, in the original. However meritorious and original the invention of Swain was (and of its originality and merit as an advance in the state of the art at the date of Swain's invention, the court does not entertain any doubt), nevertheless, its great merit and utility will not justify such broad claims in a reissue as shall effectually interpose a barrier in the path of subsequent inventors, and arrest the progress of invention. The broad language of these claims, literally construed, eliminates from the combination in the reissue the downward and inward curvature of the crown which forms an essential functional element of the combination in the original. Such a literal construction of these claims, with the scope contended for by the complainants, would render the reissue void, according to the decisions in *Wells vs. Gill*, and many other cases decided by the Supreme Court of the United States, including *Seymour vs. Osborne*. In this connection the court can only repeat the language of the opinion in *Foryth vs. Clapp* (1 Holmes).

The court will look beyond the mere form of words in the claim of a reissued patent into the specifications in both the original and reissued patents; and, even if on the face of the reissued patent it does not embrace anything not described or suggested in the original, nevertheless the court will ascertain whether there is any substantive invention adequate to support a claim ingeniously worded, not so much for the purpose of describing what the patentee really invented as of grasping within its terms some contrivance not within the knowledge or contemplation of the patentee, and for that reason, not by inadvertence or mistake, not embraced in the claims of the original patent.

Giving to these claims the construction which we have indicated, the word crown as a crown as is described in the original patent and represented in the drawings of the original and the reissue, and the fifth claim will be limited in its scope to water wheels possessing such elements as we have hereinbefore recited as the described essential component parts of the turbine wheel described in the specifications and drawings of the original patent. Giving this construction to the claims, the defendant does not infringe, and the bill must be dismissed.

[J. S. Abbott and H. W. Boardman, for complainants.
Broune & Holmes and C. E. Mitchell, for defendant.]

Recent American and Foreign Patents.

NEW HOUSEHOLD INVENTIONS.

IMPROVED COAL SCUTTLE.

William Richards, Woodhull, Ill.—This consists of a scoop or body of peculiar form, set angularly in a base piece or hoop, the object being to provide a scuttle which may be easily manufactured.

IMPROVED IRONING TABLE.

Edward H. Caylor, West Elkton, O.—This ironing table is so constructed that it may be attached to a table, and may be supported at any desired height, may have a shirt-board and a sleeve board attached to it. It is provided with a clothes-rack and a stand for the sad iron.

IMPROVED DISH WARMER.

Nathan Clark, New York city.—In using this device, an iron plate is warmed to the desired temperature by being placed upon the stove, and is then inserted in a painted wooden holder. The dish to be kept warm is placed upon it, and the whole is then placed upon the table.

IMPROVED TEA KETTLE.

Leonard A. White and George W. Lewin, North Dighton, Mass., assignors to themselves and Joseph B. Warner, of same place.—This invention consists of a laterally sliding and guided lid, secured in closed position by a spring catch of its handle to a lug of the kettle; and it consists, further, of flattened off parts or seats of the bottom, body, and spout of the kettle, to support the same in inclined position. The last mentioned device steadies the kettle, and facilitates the pouring of the contents, dispensing with the annoying lateral motion or oscillation of the kettle caused by the pivoted handle.

IMPROVED CARPET SWEEPER.

Henry A. Gore, Goshen, and George W. Edgcomb, Lima, Ind.—This consists in a combination of levers with the driving wheels of the sweeper by means of which the said wheels are thrown into contact with an intermediate friction roller attached to the rotating brush when a downward pressure is exerted on the said driving wheels. The advantages claimed are that the device is noiseless in its operation and the automatic adjustment of the driving wheels insures a positive motion of the brush.

IMPROVED COMPOUND VALVE FOR WASH BASINS, ETC.

Francis E. Kernochan, Pittsfield, Mass.—The object of this invention is to prevent sewer gas from escaping into the house through the discharge pipes of wash basins, bath tubs, water-closet basins, etc. It consists in the combination of two or more valves, fastened side by side upon a common support and operated by a single shaft, stem, or lever, the latter being made to pass through all the valves and open or close all of them at once by a part or whole revolution.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED DEVICE FOR SECRET WRITING.

Alexander Berghold, New Ulm, Minn.—By this device or key, short messages can be written by a correspondent to another who has a device or key similarly constructed and arranged, by means of which the message can be promptly read and understood, or copied, but cannot be possibly understood by any other person not provided with the key, and this invention consists in an alphabet, the different letters of which are printed, engraved, or marked upon strips of metal, paper, etc., that are interchangeable, and can be transposed, one for the other, the strips having a perforation for each letter, through which a dot, puncture, or mark can be placed upon paper or other suitable material to indicate a special letter or symbol, according to the position that it occupies in the message. The inventor states that the apparatus measures about $\frac{1}{2}$ by 1 $\frac{1}{2}$ inches by $\frac{1}{8}$ inch thick, is made of metal, and can be sold for 50 cents, and that the use of it can be learnt in a few minutes.

IMPROVED POCKET KNIFE.

William R. Rightor, Helena, Ark.—This design unites in a single knife case, together with the usual cutting blades, a detachable whetstone for sharpening the latter, and also a saw blade, having a right angular side mousing surface. The handle of the knife easily carries in one of its side pieces the independent whetstone, instead of the bone, ivory, or other piece usually secured fixedly therein, and this stone can be quickly used by turning back the saw blade, with its rear flange, and thus allowing the stone to be slid out from its supporting seat, and used independently of the handle.

IMPROVED PARALLEL RULER.

Eugene J. Towne, North Dana, Mass., assignor to himself and J. W. Goodman, of same place.—This is an improved T-square that combines the advantage of a common and bevel square with a parallel ruler admitting parallel shading at any position of the blade in a convenient manner. There is also an adjustable blade, sliding by its head in a recessed guide-piece, attached to the drawing board. The guide piece carries in end brackets a longitudinal screw shaft that is operated by a thumb rest, ratchet, and pawl, and an adjustable stop device, so as to move the blade by a split locking nut at equal distances for parallel ruling.

IMPROVED EXTENSIBLE SHAWL STRAP BAR.

Lyon Lewine, Brooklyn, N. Y.—This consists in a shawl strap bar so constructed as to be capable of extension and contraction to enable it to be adjusted to correspond in length with the length of the package to which it is to be applied. It is formed by the combination of the middle part, having T-grooves upon its lower side, and provided with the stop pins with end parts rabbeted upon their side edges, and provided with the longitudinal grooves.

IMPROVED HAME FASTENER.

John C. Moore, Chicago, Ill., assignor to himself and James A. Doran, of same place.—This invention consists of a strap attached by a long loop to one hame section, and passed through a staple of the other hame section, being secured by an eccentric and toothed cam and lever. It is locked in position by a link running in the long loop, and retained by a spring in a groove of the lever.

IMPROVED ADVERTISING DEVICE.

William A. Brice, London, England.—The object of this invention is to provide a mode of exhibiting advertisements automatically by the dropping of one or more coins in an aperture provided for the same, while at the same time the coins, after effecting their work, drop into the till or cash box placed underneath for their reception. The device was described and illustrated on p. 134, vol. 36.

IMPROVED GRAIN DRYER.

José Guardiola, Chocoma, Guatemala.—By means of a machine, which was described and illustrated on p. 82, vol. 36, the grain or coffee is constantly agitated while it is subjected to the influence of hot air, which permeates the entire cylinder, the said apparatus being supplied with heated air by any of the ordinary well known means.

IMPROVED QUILTING FRAME.

Frances M. Tinsley, Lincoln, Neb.—This consists of a quilting frame composed of rails made of hinged pieces, that are stiffened at the joints by locking hook and eyes, and connected at the corners by flanged metallic seats and fastening thumb screws. By loosening the hooks of parallel rails the frame and quilt may be folded; by detaching the rails and loosening all the hooks the entire frame may be folded up.

IMPROVED SHOE FASTENER.

William J. Brown, New York city.—This relates to shoe fasteners designed to take the place of the ordinary buckle or lacing; and it consists of a hasp attached to the flap of a shoe, and a double spring catch or bolt attached to the side of the shoe for engaging the hasp.

IMPROVED SOAP COMPOSITION.

John W. Bartlett, Moline, Ill., assignor to himself and M. Witherell, of same place.—This is a machine soap, formed of rain water, pulverized lime, soapstone, carbonate of potash, chloride of lime, concentrated lye, golden machine oil, cotton seed oil, lard oil, and melted lard.

IMPROVED STRAINER CUP.

Jacob W. Oberholtzer, Hiawatha, Kan.—This is an improved strainer cup, by which the patients may drink without raising their heads and spilling the contents, and by which toast water, beef tea, and other fluids may be strained before passing to the cup, without requiring an extra straining cloth for this purpose. The invention consists of a cup with small discharge spout at one end, and a detachable strainer section at the other end.

IMPROVED AUTOMATIC RELIEF VALVE FOR CASKS.

Addison Smith, New York city.—This is an improved valve designed especially for casks containing beer and other fermenting liquids, but which may be used for other purposes. It is so constructed as to open and allow the inclosed gas to escape when the outward pressure rises above a certain point. It is easily adjusted to resist any desired pressure before opening.

IMPROVED FIRE ESCAPE.

Julius A. Tixier, Brooklyn, N. Y.—This device consists of a frame which is firmly fitted in the window, and the upper part of which projects outward. In said upper part are cylinders, around which the two lowering ropes pass. Each rope carries a chair, and makes two or three turns around one of the cylinders. Both of the cylinders are acted upon by springs, so the ropes may be lowered with their load quite slowly.

IMPROVED CIGAR BOX AND CIGAR BOX CATCH.

Ferdinand Hasselbach and Ernst Hasselbach, Brooklyn, N. Y.—The first invention relates to such an improvement in cigar boxes with hinged front sections that the lateral sides are retained rigidly in position when the cigars are packed and pressed into the boxes. The box has a hinged front part, which is connected to the sides by pivoted clasps fitting into the recesses of the front part for locking the same, and strengthening the sides against spreading in lateral direction. The second invention consists of a swinging hook, that is pivoted by a U-shaped strip into a cross slit or recess of the front wall of the cigar box, and arranged to engage the bent and recessed part of a top strip of the lid in a recess of the latter.

IMPROVED VENTILATING FAUCET.

Ole H. Larson, Fort Dodge, Iowa.—This invention consists in a faucet in which the plug, and cylinder which contains it, are provided with an aperture for admitting air to a tube that runs lengthwise through the faucet to its inner end. A check valve is there provided which admits air to the cask when the faucet is opened, but prevents the exit of beer through the air pipe. The invention also consists in placing the plug of the faucet below its main body, so that, in driving the faucet into a cask, it will not become battered, so as to leak.

IMPROVED SCHOOL SEAT.

James Page Clair, Philadelphia, Pa.—In this invention a lateral stud on the side of the short arm of the seat support works in a curved slot of the standard between rubber spring buffers at each end to relieve the shocks, and render the seat noiseless. The stud hooks around the wall of the slot to support the pivot.

IMPROVED BOB SLED.

Alfred L. Needham and Edward Z. Needham, Farmington, Minn.—This bob sled is so constructed that it will readily adjust itself to any position required by the inequalities of the path, without undue strain upon any of its parts.

IMPROVED FARE REGISTER.

William Stokes, New York city.—This is a device for indicating fares received on street cars. Each fare is indicated by a stationary hand on a revolving dial, together with the sound of a bell provided for such purpose, so that each passenger may have a check on the conductor.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WATER CLOSET.

Michael J. McEwan, New York city.—This consists in the arrangement of a sliding valve at the bottom of a closet-bowl, for dropping the contents of the bowl into the trap, and for preventing the rising of effluvia from the trap or sewer below.

IMPROVED WATER CLOSET.

George R. Kuhn, Brooklyn, N. Y.—Directly above the bowl is arranged a supplementary lid, which is preferably made of two semi-sections, that overlap at their meeting edges, and are lined with rubber to form a hermetically sealing joint. The connecting lever mechanism is provided with weights or springs, that serve to close the lid sections automatically as soon as the pressure on the seat or treadle is released. In this way escape of bad odors is prevented.

IMPROVED CHIMNEY DAMPER.

Thomas Speed, Louisville, Ky.—This is an improved damper for the throat of a chimney at the top of a grate front, to enable the said throat to be nearly closed after the fire is fully kindled to prevent the warm air from the room from passing off up the chimney.

IMPROVED APPARATUS FOR VENTILATING DRAIN PIPES, ETC.

Edward G. Banner, London, England.—This invention has for its object to prevent the passage of sewage gas into dwellings from soil pipes, drains, cesspools, or sewers. For this purpose a trap is placed at the lower end of the soil pipe, which latter is carried up to the top of the house, and there left open to form an inlet for fresh air; and to the soil pipe, just above the trap above mentioned, a ventilating pipe (which may be of smaller diameter than the soil pipe) is connected, which is also carried up to the top of the house, and has upon it a ventilating cowl, so constructed that the passage of a wind through it shall produce at all times a continuous current of air from the inlet through the soil pipe and out at the cowl; or, by a slight modification, the direction of the current of air in the soil pipe may be reversed by placing the ventilating cowl upon the top of the soil pipe itself, and providing an inlet of air to the soil pipe, just above the trap, or in the upper part of the trap itself.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CULTIVATING PLOW.

Thomas T. McAllister and William W. McDonald, New Albany, Miss.—This implement is so placed as to straddle the row of corn or cotton plants, and thus cultivate the ground on each side thereof. Blocks run on the surface of the ground, and serve to push gradually toward the plants a portion of the earth loosened or thrown up by the colters, which work immediately in advance of them. The weeds and grass are covered by the earth thus thrown upon them, and their destruction thereby effected, while the earth immediately contiguous to the roots of the plants is not disturbed.

IMPROVED PLOW.

Jacob Ruch, Mount Eaton, assignor to himself and William M. Johnston, Wilmet, O.—This plow is so constructed that it may be readily adjusted to work deeper or shallower in the ground, and to take and leave land, as may be desired. By loosening the nut upon the upper end of the bolt attached to the standard, the forward end of the plow beam may be raised and lowered to adjust the plow in the ground, as may be required. By a simple regulating of nuts the plow beam may be adjusted vertically or laterally.

IMPROVED CHURN.

George W. Knapp, Arbuckle, W. Va.—Dasher rods are fixed to the dashers and connected to cranks diametrically arranged on the shaft by connecting rods. Said dashers are guided between grooved friction rollers. These rollers, at one side of the dasher rod, are supported by a hinged frame, by which they may be thrown back out of the way when the dashers are to be removed from the churn. When the frame is closed down on the cross piece that supports it, a catch is caused by the spring to engage with a pin in the cross piece.

IMPROVED CIDER PRESS.

Russell C. Quinn, Texas Valley, N. Y.—The working of this invention is based on the principle of the endless chain, receiving continuous charges of pomace from the grinder for pressing and discharging the same without interruption. The chain carries a number of spring-acted sacks resting on slat bottoms and revolving in connection with a charging grinder, and with a simultaneously revolving follower belt. The device is guided in proper manner to register with the pomace sacks and press the juice out on an inclined spout below, while the end sacks are discharging their contents.

IMPROVED SEED PLANTER.

Jacob R. Sample, Liberty, Miss., assignor to himself and William P. Anderson, of same place.—This machine is so constructed that it may be readily adjusted to plant corn, peas, and other smooth seeds, and to plant cotton seed and distribute fertilizers. The invention consists in the leather strap provided with the radial spikes or pins, in combination with the grooved dropping cylinder and the slotted lower end of the hopper. The pins pass through slots in the lower part of the hopper, so as to take hold of the fertilizer, drawing the same from the hopper, and allow the fertilizer to drop to the ground.

IMPROVED HARVESTER.

Ole S. Knudson, Houston, Minn.—This machine is so constructed that it may be run at less speed than the ordinary machine, and may thus be more durable and of lighter draft. To the axle is attached the drive wheel, which by gear wheels actuates a shaft. The latter revolves in bearings attached to the frame, has a crank formed upon its middle part, and a weighted arm attached to its inner end. The crank and the weighted arm project in opposite directions to balance each other. The crank, by connecting rods and an elbow lever, communicates with the sickle bar. The arms of the lever are made of such a relative length that the sickles attached to the sickle bar may move through the space of, and cut the grain against, two of the fingers attached to the cutter bar, and the fingers hold the stalks until they are cut.

IMPROVED PLOW.

Gideon Black, Dadeville, Ala., assignor to himself and John T. Moye, of same place.—This plow is so constructed that it may be readily adjusted to work deeper or shallower in the ground. The handles and braces move upon their pivots when the standard is adjusted, and will be held firmly in place when the standard is locked.

IMPROVED TILTING GATE.

Isaac Brokaw, Litchfield, Ill.—This consists of a swinging and weighted gate that swings in fulcrums of the gate posts, and is opened or closed by a suitable cord arranged to withdraw a spring latch for raising the gate, and also to release a brake spring for lowering.

IMPROVED SELF-ADJUSTING TREE SHIELD.

Almon Roff, Southport, Conn.—To prevent the millers from having access to the trees, this inventor incloses the lower part of the trunk with a sheet of lead bent around the tree, and made of such a length that its sides may overlap each other sufficiently to allow for two or three years' growth of the trees. The shield is coiled so closely around the trunk that the millers cannot pass down between it and the trees, and is kept from contact with the tree by thin strips of wood interposed between it and the said tree. As the tree grows, the lead will expand and so adjust itself.

IMPROVED INSECT DESTROYER.

George B. Drum, Syracuse, Neb.—This consists in a vehicle containing a combined catching and destroying mechanism, to be drawn about the fields for the purpose of ridding them of noxious insects. The insects passing over a brush are drawn through rolls and killed, falling upon the ground. Wings are provided to catch the insects and prevent their flying over the machine and escaping.

IMPROVED SEED PLANTER.

Benjamin F. Miller, Gatesville, Tex.—This is an improved machine for planting cotton, and also for planting corn and other smooth seed. New devices are included whereby the pitch of the plow may be changed as desired; and the ends of the beams of the covering plows are received in clevises attached to the ends of a bar which is secured to the frame.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED STEAM TRAP AND BOILER FEEDER.

Bennett Vandecar, Canajoharie, and Henry V. Harper, Albany, N. Y.—This relates to floats to be used for controlling the supply of water to a tank or boiler. It consists of a float-ball having a tubular lever, provided with an outside connection for the escape of water that may sweat or condense in the ball. It also consists in a vent tube running through the tubular lever for the admission of air to the float ball, and also in an improved valve attached to the float lever for closing the inlet pipe of the tank or boiler.

IMPROVED DOUBLE-ACTING PRESS.

Louis Prahar, New York city.—This is an improved foot motion press so constructed as to cut out a blank with the rearward motion of the foot lever, and, by the forward motion of said foot lever, to carry the said blank to a die and press it to the desired form.

IMPROVED ROTARY ENGINE.

Robert W. Skirrow, Windsor, Conn.—This invention relates to the construction and arrangement of the valves and sliding abutments and the means for operating them. Said means consist in tappet arms keyed on rock shafts and eccentrics keyed on the shaft of the engine, and connected with the rock shafts by means of bars or rods. The tappet arms engage notches formed in the under side of the curved arms of the valves.

IMPROVED MACHINE FOR GALVANIZING TERNE PLATES.

John D. Jones and John Gape, Audenried, Pa.—This consists of an iron receptacle for the melted metal, in which two sets of rollers are placed, which are actuated by a spur wheel, which meshes into pinions on the roller shafts. An inclined guide plate extends down to the rollers; this, together with a table between the sets of rollers, and an inclined guide plate beyond, forms a way on which the plates or hoops move into and out of the melted metal. Another pair of rollers is placed at the end of the last mentioned plate to remove the superfluous metal.

Business and Personal.

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

Inventors, send address (with stamp) to T. Sharts, Sec'y "Amer. Artisans' Union," 237 Broadway, New York.

For Sale—Patent on small Household Article. Address Daniel Freese, N. Amherst, Ohio.

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

For Sale—30" x 10 ft. Engine Lathe, \$225; 18" x 22 ft. do., \$200; 18" x 6 ft. do., \$105; 16" x 6 ft. do., \$105; 13" x 5 ft. do., \$100; 20" x 3 ft. Planer, \$175; at Shearman's, 132 N. 3rd, Phila.

Gas lighting by Electricity, applied to public and private buildings. For the best system, address A. L. Bogart, 702 Broadway, N. Y.

Pencil Point Protector—For Sale or to manufacture on royalty. New Patent Reversible Eraser and Pencil Point Protector. Address C. H. Nash, P. O. Box 778, N. Y. city.

For Sale—One 8 H. P. Portable Engine, \$325; one 10 H. P., \$375; one 12 H. P., \$450. J. Harris, Titusville, Pa.

Hearing Restored—Great invention by one who was deaf for 20 years. Send stamp for particulars. Jno. Garmore, Lock-box 905, Covington, Ky.

For sale cheap for cash. Letters Pat. of a new invention; a woodworking tool much in demand. S. R. Ray, Peoria, Ill.

A man of experience and ability will take a position as machinist's Foreman, Draftsman, or Superintendent. Address Supt., 136 State st., West Phila., Pa.

Catechism of the Locomotive. 600 pages, 250 engravings. \$2.50. Address M. N. Forney, 73 Broadway, N. Y.

Prescott's "Electricity and Electric Telegraph," 978 pages, large octavo, 568 illustrations. Full description Telephone and all telegraph inventions. Cloth, \$5.00, postpaid. Address J. N. Ashley, P. O. Box 339, New York.

More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 205.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker St., below 147 North Second st., Philadelphia, Pa.

Articles in Light Metal Work, Fine Castings in Brass, Malleable Iron, &c., Japanning, Tinning, Galvanizing. Welles' Specialty Works, Chicago, Ill.

Skinner Portable Engine Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.

Yacht and Stationary Engines, 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

Emery Grinders, Emery Wheels, Best and Cheapest. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N. Y.

Send for James W. Queen & Co.'s Catalogue of Drawing Instruments and Materials; also catalogue of Microscopes, Field Glasses, Telescopes, and other optical instruments. 924 Chestnut St., Philadelphia, Pa.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 550 Water St., N. Y.

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

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 409 Grand St., N. Y.

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

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Shingle Heading, and Stave Machine. See advertisement of Trorer & Co., Lockport, N. Y.

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



J. M. L. will find directions for making soap on pp. 331, 379, vol. 31. To make vinegar, read the instructions on p. 109, vol. 32.—R. B. C. will find directions for making printers' rollers on p. 283, vol. 31.

—B. C. M.'s question relates to proportional compasses, to be purchased of any dealer in drawing instruments. Copper plates may be flattened by following the instructions on pp. 149, 181, vol. 30.—A. J. R. will find a recipe for hair dye on p. 138, vol. 27.—J. F. will find our articles on straightening metal plates on pp. 149, 181, vol. 30.—J. C. G. will find directions for making fulminate of mercury on p. 90, vol. 31.—T. P. H. can make a metal stamp by running type metal into a plaster mould containing the required device.—J. F. M. is informed that crude gutta percha usually contains dirt and other impurities. A cement for leather is described on p. 171, vol. 30.—S. S. K. will find directions for reducing tin scrap on p. 219, vol. 31.—H. L. is informed that the details of Mr. Lowthian Bell's method of making iron rails have not yet reached us.—C. R. W. will find instructions for making lightning rods on p. 277, vol. 35.—J. W. can frost the surface of glass by following the directions on p. 281, vol. 33.—A. W. will find a description of the postage stamp manufacture on pp. 208, 277, vol. 27.—T. J. B. will find something on tanning birds' skins on p. 187, vol. 36.—S. A. H. will find something on constructing Rhumkorff coils on p. 219, vol. 32.—J. A. C. will find two articles on the blue glass deception on pp. 129, 145, vol. 36.—J. J. will find a recipe for blue ink on p. 357, vol. 32; for green ink on p. 27, vol. 30.—W. S. will find directions for moulding rubber on p. 203, vol. 35.

For giving a black finish to rubber, see p. 123, vol. 30.—J. L. is informed that he can make good soap moulds of pewter.—C. S. C. will find directions for polishing brass on p. 298, vol. 29. For a varnish for brass, see p. 310, vol. 35.—F. G. T. will find directions for making printers' rollers on p. 283, vol. 31. To make rubber hand stamps, see p. 303, vol. 35. For transfer paper, see p. 378, vol. 28.—A. L. W. will find directions for brazing metal plates together on p. 347, vol. 30.—T. H. B. will find something on the extraction of vanilla from pine-wood on p. 18, vol. 35.—W. A. M. can paint his model with black paint and varnish with shellac in alcohol.—H. R. F. is informed that lead pipe is made by forcing lead through a hole in a metal plate in which a core is inserted.—W. Y. G., M. A., A. G. L., J. B. C., 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) F. J. S. says: 1. I want to make an induction coil 1 foot long. What number and what length of wire shall I use for the primary and secondary coils respectively? A. About 1 1/2 or 2 lbs. of No. 36 for the secondary, and 150 feet of No. 14 or 16 for the primary. 2. Shall I keep each layer of the primary wire separated by placing something between the layers? A. A sheet of paraffin paper is sufficient. 3. Shall I keep each layer of the secondary wire separated? A. Better wind the secondary in two sections and exercise the greatest care in insulating. It is well to place the coils in melted paraffin until well saturated.

(2) J. R. says: 1. You show the misapplication of the word force in many instances but the word is used in a very slipshod manner when speaking of the force of gravity as applied to the atmosphere. All authors agree that the atmospheric pressure is about 15 lbs. on the square inch of the whole earth's surface. But this is not atmospheric pressure, but is the whole effect of gravity, including that of the air also. Gravity is known to extend to the moon and far beyond; whereas the atmosphere does not extend very far. At 45 or 50 miles height it is not dense enough to reflect the sun's rays. It is also asserted that a cubic foot of atmospheric air weighs only 535 grains, and is 820 times lighter than water. A. The pressure of the air is due to its weight; and though the weight of a single cubic foot is very small, the column of air producing the pressure is many feet in height. 2. What has become of the result of Venus' transit? A. The results of the transit observation have not yet been computed; and it will probably be at least a year before they are finished.

(3) W. S. says, in answer to many correspondents who have asked how to cut glass tubes: Take a small round file, break a little off the point to get a sharp edge, then insert it into the tube to where it requires to be cut, and scratch around the inside, when the other part of the tube will fly off instantly. In most cases the crack runs ahead of the scratch.

(4) A. J. L. says: Is steam turned directly on to lumber to dry it, or is it conveyed into a heater and the lumber dried from the heat generated? A. In the great majority of cases steam is used confined in pipes, and circulating to and from the boiler, thus heating the air in the room, and by the circulation of the latter, drying the lumber. 2. I have a dry house, 14 x 16 feet, and would be glad to know if a 3/4 supply pipe will be sufficient to convey steam to it? A. Yes, if arranged as above described and with a return pipe to boiler. See No. 6, p. 123, vol. 30.

(5) G. W. S. says: You give a recipe for paint made of Portland cement and sand. Is it for wood? Can it be used on a frame house instead of white lead and oil? A. It is only suitable for brickwork, stonework, or concrete walls.

(6) R. P. W. says: 1. Please give me your opinion of nitrous oxide gas. Is it safe to use in dental surgery? A. If the gas is made from pure nitrate of ammonia, and subsequently well washed in a solution of protosulphate of iron, it is one of the least objectionable and safest of known anesthetics. If free from nitrous acid and chlorine, it may be administered without danger except in cases where there is already an overactive circulation in the brain. 2. What are its effects? A. When inspired into the lungs, owing to its solubility, it is rapidly dissolved in the blood, and quickly diffused throughout the body. The transient intoxication which it causes is due to augmented oxidation produced in the system by the gas.

(7) J. T. H. asks: Please give me a recipe for staining wood a dark cherry red, a permanent and bright color? A. 1. Boil 1/2 lb. logwood in 3 pints of water, and add 1/2 oz. salt of tartar. Stain the wood with the liquor boiling hot. 2. Boil 1/2 lb. madder and 1/2 lb. fustic in 1 gallon water; use hot, as before. 3. Boil 1 lb. Brazilwood and 1 oz. of washing soda in 1 gallon of water, apply hot, and then brush over it before dry, a solution of 2 ozs. alum in 1 quart of water.

(8) N. C. L. asks: 1. By what process are medals cast? A. Medals are usually stamped out by means of machinery similar to that employed in making coins. 2. How are stereotypes copper plated? A. The deposition of copper is obtained by electroplating the form in a bath of sulphate of copper. 3. How can I prepare the plaster of Paris for stereotyping, so as to prevent airholes in the mould? A. Slightly but uniformly oil the face of the type, and then pour over it a thin cream of the plaster, which work well into the letters with a camel's hair brush. Then run the thicker plaster, and allow to set. Dry the cast well in an oven and, by means of a soft brush, uniformly coat the matrix with a film of black lead (plumbago).

(9) F. H. asks: If the temperature is at zero, and stays so for two weeks, and ice forms two feet thick in that time, if then you take two thermometers that indicate alike, place one on the ice, the back of it lying on the ice, and hang the other two or four feet above the ice; will they indicate the same after being there a little while? A. Yes, all the conditions being the same.

(10) J. W. R. asks: What is the best method of preventing heat in rooms in hot weather, under flat tin roofs where the center rises some 2 1/2 to 3 feet? We are greatly discomforted in hot weather by the heat in our upper rooms; and we propose to put on another story with French roof, which will also be flat, or as

much so as the present one. In doing this, how can the excessive heat be prevented in this new story? A. Inclose a space under the roof about 3 feet in height at the ridge and about 1 foot at the eaves, by hanging a cribbed ceiling from the roof beams. Provide a special flue in each chimney, opening by a stationary register, or by a number of small openings in the brickwork, near the top of this inclosed space, and provide similar openings to the exterior air under the eaves of the house, which latter openings will come near the bottom of the inclosed space. By this means a circulation of air may be secured under the roof that will keep the temperature nearly as low as that of the exterior atmosphere.

(11) F. P. F. says: I wish to use kerosene to make a liniment and for other purposes where the strong smell is objectionable. Is there any way to get rid of the smell without destroying the nature of the kerosene? A. By agitation for several days with powdered chloride of calcium, the disagreeable odor of the oil may be removed; but the oil cannot be completely deodorized.

(12) C. H. asks: 1. What size of wire is the best for winding a large electro-magnet of horse-shoe shape to give it the most power? A. The size of the wire should be made to suit the battery used with it. Nos. 14 or 16 will probably answer your purpose. 2. How many cells (Daniell), each holding about 3 quarts, will be needed to make an electric light sufficient to light a room 50 x 100 feet? A. It is difficult to get a light with less than 40 or 50 Daniell cells, and they should be large, so as to give but little internal resistance. 3. How can I coat the inside of a large tin can with copper, so that it will not come off? A. By the battery process, after the usual cleaning. Place the solution in the can, connect the latter to the zinc of the battery and the copper of the battery to a copper plate in the solution. 4. How shall I make the carbon points for an electric light? I have coke carbon, but it is not of the right shape. A. It is better to buy them, but you can saw them out of coke taken from gas retorts if you have patience enough.

(13) C. V. W. asks: How can I clean a bronze statue? A. Rub it with a little oxalic acid solution and pipeclay, afterwards with a brush and tripoli powder.

(14) W. H. V. asks: 1. What is the best method of constructing a refrigerator or butcher's ice box? These boxes are generally about 9 feet long, 4 feet wide, and 6 or 8 high, and are built of tongued and grooved stuff, with 3 inches of sawdust between the outer and inner lining. What is the proper position for the ice crib? A. Near the top of the box. 2. Should the dripping pan be placed directly under the ice or not? A. It should consist of V-shaped gutters a little distance below the slots in the bottom of the crib, conveying the water away. 3. What will cause the cold air to circulate through the box? A. The air coming in contact with the ice will fall to the bottom of the box, and the warmer air will take its place, thus establishing a circulation. 4. Will a bottom of cement be any better than one of wood? A. No. 5. What is the best to put between the linings? A. Sawdust is good; but some have the interior of inclosing walls lined with paper pasted over the surfaces, and no other filling. We ought to say that many of the above devices are covered by a patent.

(15) G. W. asks: How can I unite vulcanite (in which artificial teeth are set) so as to make a durable joint that will resist the heat and moisture of the mouth? A. Dissolve 1 part of sulphur and 3 parts pure caoutchouc in 6 parts alcohol and 100 parts bisulphide of carbon, and evaporate to the consistency of a thin paste. Join the fractured edges with this, and heat the whole to about 310° Fah. for 4 hours.

(16) W. D. says: 1. I want to lay 1,000 feet of water pipe from soft water spring to house and barn. Which, lead, galvanized iron, or common iron pipe, is most durable? A. Galvanized iron pipe will be the most serviceable. 2. Is lead pipe dangerous on account of poisonous matter? A. If lead is exposed to the combined action of pure water and air, an oxide of lead is formed on the exposed surfaces which is dissolved by the water with which it is in contact. This solution is highly poisonous, as are all of the lead salts. The presence of chlorides or nitrates in the water assists this corrosive action, while it is retarded by the sulphates, phosphates, and carbonates. Bicarbonate of lime, a salt found in many spring waters, prevents this corrosion by depositing a coating on the exposed surfaces. In the use of lead pipes as conduits for drinking water, it should be carefully ascertained whether the water to be conveyed contains foreign matters, which will prevent its action upon the metal. 3. Should I plumb my house with iron water pipe and protect the pipe from cold by filling around the pipe with sawdust? A. Yes. The method is a good one. 4. Will iron pipe sweat and rust in the sawdust? A. It is difficult to keep such pipes perfectly dry in warm weather, even when protected as above. The pipes may, however, be in a great measure prevented from rusting by coating them with asphalt varnish.

(17) T. P. H. asks: What degree of heat is required to harden rubber in a vulcanizer, so as to answer for hand stamps? A. It requires a temperature of 250° Fah. There is no danger about it.

(18) J. E. S. says: If a locomotive pull a train of cars around a curve, I say that every one of the cars would bear the flange of its outer wheels against the inner side of the outside rail. A friend says the last five or six cars would not, because the train in front would be gone around the curve so far as to have a tendency to pull the rear part of the train against the inner rail. Who is right? A. You have about the right idea.

If I am 150 lbs. in weight, and fasten said weight to one end of a rope, and take hold of the other end, can I pull up any more than that weight over a single sheave, everything being in balance? I contend that I cannot pull up any more than 150 lbs., unless my feet were pinned to the ground. Am I right? A. As we understand the question, you are right.

(19) E. H. A. says, in answer to correspondents who ask for a cure for chilblains: Dissolve 1 lb. alum in about 1 gallon of water, soak the feet or parts affected in the solution just before going to bed every night for from 5 to 8 nights, using the same water, and

having it as warm as the flesh will bear easily. It will restore the flesh to its natural color and feeling.

(20) E. L. asks: Of what diameter or size should drills be to fit 3/4, 1/2, 3/8, 1/4 inch, and up to 4 inches pipe taps? A. Make the holes just so large that the end of the tap for each respective size will just enter the hole.

(21) B. W. L. asks: How is sulphuret of iron manufactured? A. Heat iron turnings to bright redness in a black lead crucible; and, while in this condition, throw in an equal weight of crude sulphur, in small pieces. The combination will take place immediately; and as soon as the sulphide formed is thoroughly fused, it should be poured out and covered with sand, to cool slowly.

(22) E. J. asks: Can rubber be made considerably hard and yet retain its flexibility and toughness, so as to bend quite short without cracking? A. Yes. There is vulcanized rubber in the market that will answer all your requirements.

(23) C. C. says: I have an emery wheel 1 foot in diameter, the hole of which is very rough and too large for the spindle. Could I run Babbitt or other metal in it and turn it out to fit the spindle to make it run true? A. Make a Babbitt metal bush, and insert it in your emery wheel. 2. How fast should it run for gumming saws? A. At about 4,000 or 5,000 feet of circumferential speed per minute. 3. How many teeth should a circular saw of 14 inches diameter have for ripping hard and soft wood? A. There is a difference of opinion upon this point. 4. Does hard wood need more teeth than soft wood? A. As a rule, yes. 5. What should be the size and length of journal for arbor of foot lathe for turning wood? A. Two and a half times the diameter of the arbor. 6. Would there be much difference in the necessary amount of power required to drive said lathe if two journals were used on said arbor instead of one? A. Not if properly adjusted.

(24) W. W. M.: Send for information about windmill to T. K. A., 22 East 12th street, New York city.

(25) A. T. N. asks: What solutions are used in coloring articles of horn or vegetable ivory? A. For black, lay the articles for several hours in a strong aqueous solution of nitrate of silver, and then expose to strong sunlight; or boil in a strong decoction of logwood and then in solution of acetate of iron. For blue, immerse for some time in a dilute solution of sulphate of indigo, partly saturated with potash. For green, boil in a solution of verdigris in vinegar. For red, dip the articles first in a tin mordant and then into a hot decoction of Brazil wood or cochineal. Scarlet, use lac dye instead of the preceding. Violet, dip in the tin mordant and immerse in a decoction of logwood. For yellow, impregnate with nitrohydrochlorate of tin and then digest in a strong decoction of fustic. The coal tar colors are now generally used for this and similar purposes.

(26) T. S. asks: What is chloroxynaphthalic acid (C₁₂H₈ClO₂)? A. Chloroxynaphthochinone (C₁₀H₆ClO₂) is a yellow crystalline powder. Its salts are used as dyes. It may be obtained from any large dealer in the coal tar colors.

(27) J. H. asks: 1. Can I get an elastic rubber of a white or light tint? A. You can purchase such rubber as you mention. 2. Is there any way to bleach it? A. The rubber cannot be bleached by any ordinary means, but by the introduction of such bodies as chalk, sulphate of barytes, pipeclay, sulphide of zinc, etc., before vulcanization, an artificial whiteness may be produced in the rubber.

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

F. W.—No. 1 is basalt, containing crystals of iron pyrites (sulphide of iron). No. 2 contains chrysocolla, a hydrous silicate of copper, also a little malachite (carbonate of copper).—A. D. W.—It is a piece of flint containing crystals of iron pyrites. We found neither silver nor lead.—W. M. W. says: I send you herewith a box containing specimens of coal, with some white substance in the seams. Will you please inform me what it is, and whether it is of frequent occurrence? A. It is paraffin. We have had similar samples sent us before; but it is not of common occurrence.

COMMUNICATIONS RECEIVED.

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

On a Driver's Seat. On Planetary Meteorology. By R. M. On Hydrophobia. By M. G. On Geographical Anatomy. By A. W. On Spiritualism. By J. H. P. On the Shape of the Earth. By W. E. B. On the Lost Paradise. By C. On Lightning Rods. By J. H. P.

Also inquiries and answers from the following: A. S.—A. S. G.—W. M.—P.—H. T.—J. K.—T. W.—W. R.—J. D.—J. B. D.—J. H.—B. L.

HINTS TO CORRESPONDENTS.

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

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

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FOR WHICH

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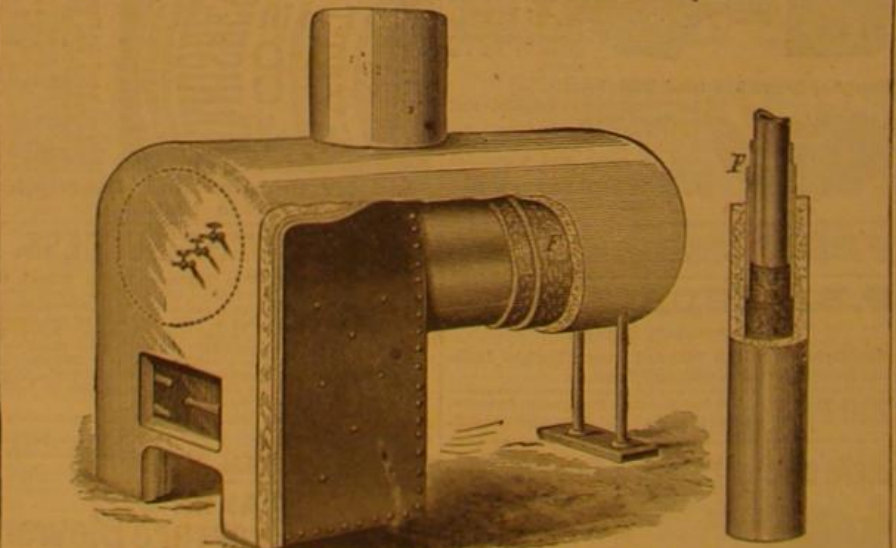
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Vol. XXXVI.—No. 14.
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IMPROVED STEAM WHEEL.

We illustrate herewith a novel form of steam engine, to which the inventor has given the above title. While outwardly resembling a machine of the rotary type, it will be seen that, though allied nearest to that class, it is not a true rotary engine in the sense of one in which the steam follows the piston around the circle; for here the impulsive power is communicated only over a segment of the entire periphery. The advantages claimed are, besides simplicity of construction, the working of the steam at the same leverage at all points of the circle, and its use expansively "from boiler pressure down to atmospheric pressure in place of exhausting it under high pressure." The machine is intended to run slowly, and hence friction is reduced, while it is further claimed to move uniformly without back-lashing, to be free from the accidents peculiar to reciprocating engines, and to save a large percentage of fuel.

Fig. 1 is an exterior perspective view, and from Fig. 2 the working parts will be understood. The wheel, the shaft of which rotates in bearings in the case, has ring flanges on the edges of its face, making a wide and deep channel thereon. Six or more arms connect the rim to the hub, midway between which and on the face of the wheel are formed deep transverse recesses, in which work the radial pistons, A. To the inner edge of each piston is attached two or more rods, B, which pass through stuffing boxes, so as to prevent any steam from leaking around them into the interior of the wheel. These rods are secured to boxes in which are placed bars, C, said bars being held out by springs. As the bars pass through slots in the ends of the boxes, the pistons are thus allowed a little play, while the springs also serve to hold them against packing, noted further on. At D are radial bars attached to the rim and the hub of the wheel. In guide slots in these the ends of bars, D, enter, and they also pass through holes in the long arms of levers, E, which are pivoted to the wheel arms. To the short arms of said levers are pivoted bars, F, which slide in keepers on the wheel rim, and have pins on their ends. These pins carry friction rollers which move in guide slots, G, in the sides of the case. The object of the jogs in said slots is to throw the pistons, A, out to receive steam, and to draw them in at the exhaust ports.

Fig. 1 is the steam chest, resting upon the upper edge of the case and fastened to packing, I, Fig. 2, which is curved upon the arc of the circumference of the wheel, and has abutments, J, to fit into the space between the rim flanges. These abutments are beveled as shown, and are provided with brasses held out against the rim by springs. The brasses have arms which, in similar manner, are pressed against the inner side of the wheel flanges. They are also so constructed that they may be expanded and contracted longi-

tudinally to allow of nice adjustment to the wheel. On their inner side, a plate is provided, acted on by springs to prevent steam from passing between their parts when they are expanded. The packing, I, rests on a concave block, K, which may be moved forward and back by the screw, L; it may be adjusted so as to cause the packing to bear squarely against the

by the valve, N, the stem of which is pivoted to an arm on the rock shaft, B, Fig. 1. A crank arm on this shaft receives a notch on the connecting rod, which is guided in a bracket on the case. A pin on the rod enters a groove in the side of wheel, P. This groove has as many offsets as there are pistons, A, and these are in such positions as to operate the valve to admit steam as each piston passes the inlet port, the length of the curve regulating the length of time in which the valve is held open.

By suitable construction, the connecting rod may be regulated to govern the throw of the valve; and by engaging the hook, Q, on the protruding end of the shaft above, the notch in the rod is raised from the crank, so that the valve may be operated to start the wheel regardless of the position of the same. The hole shown in the rock shaft is for a hand lever, so that the valve may be operated by hand for starting the wheel.

The inventor states that he has experimented on this engine for two years, and that he is satisfied that probably a saving of fifty per cent of the fuel expended in using the common forms of steam engines may be effected by using the steam wheel here illustrated.

Patented through the Scientific American Patent Agency, January 30, 1877. For further information relative to purchase of patent rights, etc., address the inventor, Mr.

THOMAS' STEAM WHEEL.

J. C. Thomas, Carlinville, Macoupin county, Ill.

A New Life-Saving Rocket.

Captain F. F. Atkinson, of the British army, is soon to conduct a series of experiments at Sandy Hook on a new life-saving rocket. The invention has already, we learn, been adopted by the English Board of Trade. It consists of a long cylinder, in which there are four tubes filled with powder; the end of the tube is closed by a plate of iron, in which are four holes, corresponding to the four tubes; firmly fixed on the plate, so that it cannot revolve, is a four-bladed screw. When the fuse is ignited the gas generated by the combustion of the powder rushes violently against the helicoidal surfaces and imparts to the rocket a rotary motion, which gives it a steadiness similar to that of a conical rifle bullet. The war rockets have a shell head, which is filled with Greek fire, nitroglycerin, or any other explosive or inflammatory substance. In the life-saving rocket this shell may be omitted, or a magnesium light can be placed there for the double purpose of a danger signal and of showing the position of a wreck. The line is made fast to a short chain, attached to the rocket by a double swivel, thus preventing the destruction of the line by fire. The rocket is discharged from a V-shaped steel slide mounted on wheels. In the early part of December, the inventor, Mr. J. Singleton Hooper, drove six rockets a distance of 350 yards, over a vessel 60 feet in length, each rocket falling with great accuracy.

Fig. 1

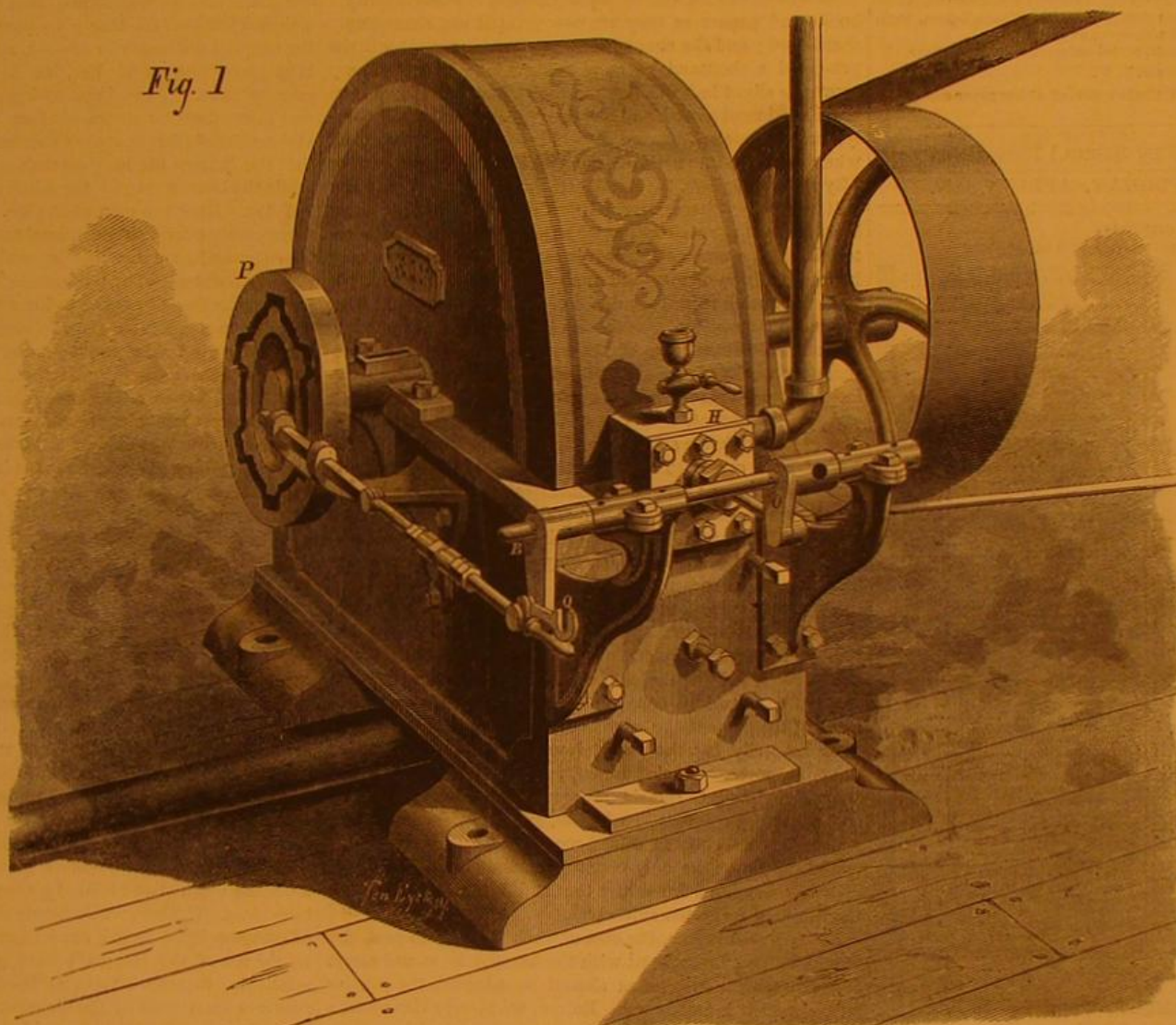
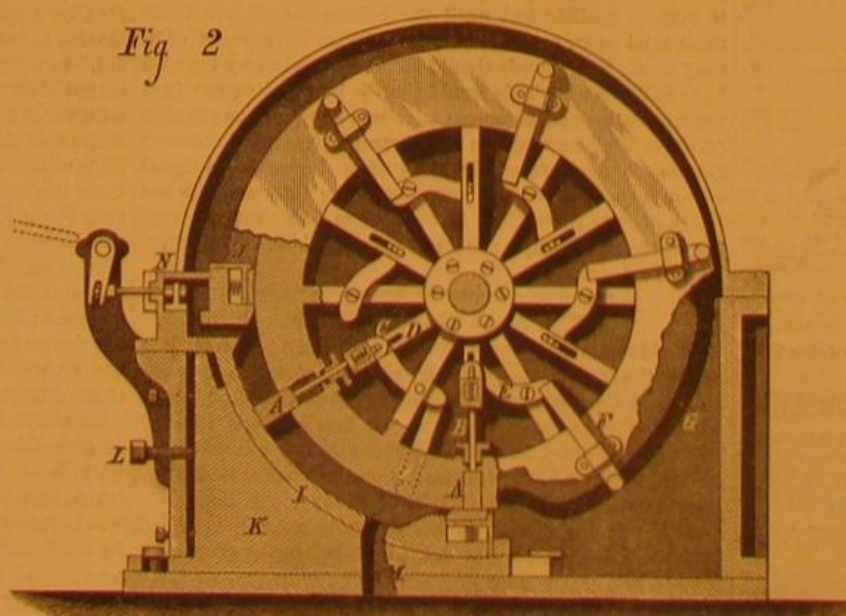


Fig. 2



THOMAS' STEAM WHEEL.

Scientific American.

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THE PRESERVATION OF LEARNING.

Printing has been aptly styled the art conservative of all the arts. But what shall conserve the products of the art of printing?

As was shown in our recent suggestion "For Posterity," books and papers as they are now printed are exceedingly short-lived; and the chance that any existing print will be preserved a thousand years, if matters take their ordinary course, is slight indeed. Even of the writings that have been considered most sacred, and have been guarded most religiously, perfect copies a thousand years old are extremely rare. And when we take into account the vicissitudes of five, ten, or fifty thousand years, the likelihood that our remote posterity will retain any literary record of these days, or any exact knowledge of the civilization we enjoy, is too slight to be entertained for a moment. Yet it is certain that, whatever may be the condition of mankind at any future epoch far remote from us, such a record would be of inestimable value. Our suggestion, therefore, was that an effort be made to put into imperishable form some of the more valuable of the representative works of modern civilization, and store them away in some secure place for the benefit of future ages.

A correspondent, who favors the idea, suggests that the cost of imperishable stereotype plates might be saved by the use of gum copal. The fact that this substance has withstood the elements for such a considerable period, as is indicated by the conditions under which it is found, is ample proof of its durability under ordinary circumstances; and all that would have to be specially guarded against would be its possible exposure to fire.

The plan proposed is briefly this: To varnish on both sides the printed sheets to be preserved, and then by the application of heat and pressure mould them into solid blocks. This done, the blocks might be placed in earthen vessels and covered with melted copal. Thus, like flies in amber, the ideas of the present age might be fossilized and laid away in their integrity for the entertainment or enlightenment of times to come. Buried under public buildings, or other structures likely to remain in some form to challenge the curiosity of explorers—geologists, maybe, of some distant geological era—such fossilized records of our day and generation might be the only clue to the mental and moral condition of a type of humanity that had long since passed to the limbo of forgotten existences.

As we urged before, the cost of such a legacy to posterity would be small compared with the benefits it would carry. If the amended suggestion should be adopted, the relative cost would be infinitesimal. Before, we merely threw out a suggestion; now we would make a serious proposition. It is this:

In a few years one of the grandest monuments of the age will be erected in or near this city—the magnificent gift of France in commemoration of our Centennial year. When we are building the tower on which to set the colossal statue of Liberty giving Light to the World, let us make room in the foundation, or elsewhere, for a legacy of intellectual light to remote posterity. Without weakening the structure in the least, spaces might be left for storing our more precious and instructive volumes, duly embalmed in copal or otherwise, to remain undisturbed until the celebration of our tenth centennial year, or longer, in case the preservation of ordinary books and records should be more satisfactory than we have anticipated. This would simply be carrying out in a more scientific and comprehensive way the common practice of depositing newspapers and transient matter in corner stones. A more favorable opportunity for setting a signal example to the civilized world touching this matter is not likely soon to occur than in connection with the light-bearing statue of Liberty; nor a more appropriate opportunity. Let it be done!

THE BLUE GLASS EPIDEMIC.

The blue glass epidemic continues its silent progress; it is now quite common along our streets and avenues to see frames of the azure crystals hanging within dwelling house windows; while, on sunny days, the invalid grandfather or other patient, may be noticed basking in the ethereal rays, his countenance filled with hope, though streaked with blue. In one case, that of an old lady of seventy-four, that lately came to our knowledge, in her desire to secure the coveted benefits of the blue, she took her seat before the glass after the sun had nearly gone down, and in a short time declared that the blue glass had thrown her into a perspiration. This suggests the possibility that the blue glass may be used to better advantage, upon some persons, in the absence of sunshine, and perhaps in the absence of light.

The proprietor of an extensive medical bath-house informs us that, in deference to the demands of his patrons, he has placed blue glass in his windows; but the only practical effect thus far perceived is to make his premises dark and gloomy, especially on cloudy days. He states as the result of his observations, extending over several years, that patients derive the most benefit from air baths in pure sunshine, without the interposition of any glass whatever.

Upon what basis or evidence does the supposed power of blue glass upon the animal economy rest? Upon no other, apparently, than the ludicrous inferences and whimsicalities of good old General Pleasonton, whose ideas of science and mathematics seem to be sadly mixed. Being requested, by the President of the Philadelphia Society for Promoting Agriculture, to explain to that body the nature and facts of his discovery, he gave the following as its original experimental basis: On the 3d of November, A.D., 1869, he imprisoned three sows and a barrow pig, all weighing 203 lbs., in a common sty; and on the same day, three other sows and a barrow pig, all weighing 167½ lbs., in a blue glass sty. On the 4th day of March, 1870, the animals were weighed, and it was found that the common sty pigs weighed 537 lbs., the blue glass pigs 522½ lbs. Allowing for the original difference in weight, this showed a gain for the blue glass pigs of 21 lbs., or 5½ lbs. each pig, in four months' time. From these and other comparisons the General infers that "it seems obvious that the influence of the violet-colored glass was very marked." He, however, states that the barrow pig in the common pen increased 151 lbs., while the barrow pig in the blue glass pen only increased 124½ lbs. Here is a gain of 26½ lbs. in a single animal in the common sty over a single animal confined in a blue glass sty. The General explains this by saying that the common sty pig was a strong fellow who stole more food from his companions than well behaved swine are expected to take. But any person not a blue glass believer would naturally infer that the reason why the common sty pig gained 26½ lbs. over the blue glass pig was that, for barrow pigs at least, the blue glass was a damage rather than a benefit. After mentioning these pig experiments and that of a calf, the General proceeds to explain to his hearers that it is electricity evolved by blue glass that makes it so powerful; it is electricity, he says, that produces the sparks that we sometimes see when a horse's shoe strikes the pavement; electricity, he says, ignites the hydrogen gas which is evolved when two sticks of wood are rubbed together until fire is produced. But here the General's science is as lacking in weight as his blue glass barrow pig. It is the affinity of oxygen for the heated particles of iron or wood that causes the spark and the combustion he mentions, not the evolution of hydrogen or electricity.

It is well known that Dr. Crookes' admirable little instrument, the radiometer, is very sensitive to electricity; and if, as the General supposes, the blue glass rays have superior electrical or other power, the vanes of the instrument should rotate faster under blue glass than under common glass. But a friend of ours, who lately tried the experiment, reports that, while his radiometer made 135 turns per minute in the sunlight, behind ordinary window glass, it fell to only 60 turns a minute when placed behind a sheet of General Pleasonton's blue glass. If, then, we designate 135° as the indicated power of common light in this experiment, we lose 75° of power by the use of the General's blue glass; which corresponds relatively, to some extent at least, with the loss of pork power experienced by the General in the use of his famous blue glass experiment upon the barrow pig.

A CURIOUS HISTORY OF AN OLD INVENTOR.

A queer bit of history concerning an inventor has recently been unearthed in England, which may well serve as a companion piece to the interesting article on Papin's achievements, which Professor Joy recently contributed to our columns. Solomon De Caus was engineer and architect to Louis XIII., King of France; and he stands fourth in chronological order on that list of the original discoverers of steam power, which is headed by Hero of Alexandria. In 1615, De Caus published a book quaintly entitled the "Causes of moving forces, with divers machines useful as well as pleasant," in which he states that "water will, by the aid of fire, mount higher than its level;" and he describes a globe filled with water and an attached vertical pipe, through which the water was elevated by the expansion of the steam generated by heating the vessel. This is the sum and substance of De Caus' discovery, but it is obviously one of importance; and even in the early period when it was produced, it attracted the attention of scientific men, and among others that of the Marquis of Worcester. That noble inventor seems to have appropriated De Caus' idea, and many years later he described in his "Century of Invention" a substantially similar device to De Caus', which he constructed and operated, and on which his fame as another original inventor of the steam engine is founded.

So much for fact and for De Caus' work, and by way of preamble to his history. That record, as usually met with, is to the effect that Solomon one day suddenly vanished, that he fell a victim to royal jealousy, and that he was imprisoned for being ahead of his time. Subsequently he went mad, and was shut up in an asylum, and there he was visited, says the chronicle, by the Marquis of Worcester, who, during a lucid interval of the unhappy inventor, obtained from him the secret of his discovery. All this makes a very tragic story, which the world has credited for about forty years, and which has placed Solomon de Caus in pop-

ular estimation in a high place among the "martyrs of Science."

The difficulty is, however, that the statements are pure fiction; and that the inventor's reputation was manufactured for him by the brilliant imagination of a not over-conscientious editor, is the substance of the story which our English contemporary now vouches for as truth. In 1834, there existed in France a journal called the *Musee des Familles*, which was addicted to blood-curdling romances, after the fashion of many of our present periodicals. The editor, wanting an illustration of a maniac in a cell to illustrate some harrowing recital, ordered a suitable engraving. But the engraver failed to finish his work in time, and the cut was not received until after the paper was published. The economical editor, not wishing to lose his picture, thereupon set to work to write up a story appropriate to that engraving, and he accordingly took down a "Universal Biography" to find a fitting historical personage to serve as his crazy hero. Solomon de Caus' name was the first one he saw; and it occurred to him that Solomon's genius might have driven him mad, even if it actually did not. Consequently he made the inventor into a maniac; and to give an air of truth to the romance, the editor put his story in the form of a letter written by a court lady who had seen De Caus in prison, in which letter the visit of the Marquis of Worcester was incidentally described. When the romance was published, it created an unlooked-for sensation; people accepted the story so completely that, even when the editor acknowledged that it was wholly imaginary, he was not believed, and learned antiquaries insisted that it was genuine. Consequently, ever since, Solomon de Caus has been regarded as a wretched lunatic who perished miserably; while the truth is that he never was imprisoned, never went mad, but lived a learned and honorable life, and, on dying, received special funeral honors from his king.

To those excellent readers of ours who occasionally lecture us in their letters on the responsibilities of editors—and of scientific editors in particular—we commend the above story as a text for future admonitions.

ON KEEPING AN INDEX.

The recent production of several books on scientific subjects, in which the authors all state that the work originated in casual notes gathered during the study or active practice of their various professions, will suggest to many the advantages of keeping an index or memorandum of facts met with in reading or observation. A well known engineer of this city lately showed us a huge volume, constructed in a way well suited to this purpose, in which, for several years, he has noted down, indexing as he proceeded, all the useful articles and hints relating to engineering or mechanical subjects which had appeared in the various publications which he deemed worth remembering. He did not of course copy the articles entire, but simply jotted down a sentence or two embodying their gist, and an accurate reference to the source of information—often merely the latter. By practice he had acquired the habit of making these rough notes on the spot, wherever he might be. Once a month or so he gathers his scraps into his book and posts his index; an hour or two's work at the most. The result is that he now has a fund of information at hand, acquired with very little trouble, the value of which can hardly be overestimated.

This is only one instance of others within our knowledge, and we would strongly commend the extension of the practice. An enormous amount of the most useful material never finds its way into books. We would not confine our notes to newspaper articles alone, but include in them all facts likely to be of future use which come under personal observation or are obtained in conversation with others. And the earlier this habit is acquired the better. An apprentice in almost any shop is sure to see the older workmen doing work after a fashion of their own. He may not know why one man who produces particularly good castings—runs his mould, for instance, in a certain way—or hammers an iron plate to straighten it after a certain manner peculiar to himself; yet he can use his eyes and ask questions, and put down what he sees and is told. In after years, he may turn back to his notes and find in them aid which is of money value. In the same way, the student will find a college course far more useful to him if he will watch for "points" in his various studies. Many a professor has a short way of his own for working this or that problem, or a neat explanation or illustration of a knotty fact, or a short cut around some technical difficulty, by which he secures his pupils' more rapid advancement.

We once heard an old housewife say that she saved all the stray bits of carpet, broken furniture, and other apparent trash, because it was, according to her experience, "sure to come useful sometime within seven years." We do not adhere to the mystical number seven; but doubtless she was substantially right, and the same rule will hold good regarding the odd scraps of information gathered. We would more especially commend the above to readers of this journal. If all our one hundred thousand readers, in their great variety of callings, would keep such records, and each one would once in a while favor us with a few lines therefrom regarding interesting facts which had been noted, an immense fund of valuable suggestions could be given to the world, and useful thoughts thus be rapidly interchanged. Besides, the effect would be to spare us the necessity of inserting that paragraph which heads our query column every week, wherein we inform A. B., for perhaps the twentieth time, that a recipe for dissolving rubber or bronzing gun barrels will be found on page so and so, this or that volume, etc. As we said in

the beginning, many valuable books are prepared from notes thus made, and these become a source of considerable returns to the compiler.

Such books, moreover, are generally exceptionally good because they relate to pure practice and what has been done, and are free from speculations, mere theories, and second-hand statements. It is well to remember also that the necessity of keeping indices or notebooks is a growing one. The tendency of every profession, every trade, every calling, is toward differentiation. People are becoming specialists by force of circumstances. No one now pretends to know any one science or trade thoroughly; certainly not in this country, where the progress of invention is so rapid, or in this age, when new discoveries are of almost daily occurrence. The greatest portion of any man's knowledge must remain in the condition of an index; he may not remember the details of a subject, but he can know where he can place his hand on a source whence he can derive all the information; and to this last species of knowledge the well maintained notebook is a most important aid.

No one, we believe, has ever imputed the gift of prophecy to that great satirist and poet, Alexander Pope. We are inclined to think him in a most prophetic mood, however, when he penned the couplet—far more true in our days than in his:

"For index learning turns no student pale,
Yet holds the eel of Science by the tail."

AMERICAN INVENTIVE PROGRESS.

The future historian of the inventive progress of this country will find that the record of the same naturally divides itself into two distinct parts, each marking a separate era. These may be termed respectively the period of conception and the period of development. During the former most of the great American inventions were first originated; during the second, which includes the present time, the tendency of inventors has been more towards seeking new applications for established principles or improving upon earlier embodiments of the same.

The first era begins with the labors of Franklin, Rittenhouse, Hare, Evans, and their contemporaries. It terminates with the end of the year 1849. Inspection of the records of the Patent Office shows quite clearly the substantial basis for the division we have suggested. The first patent granted by the United States was dated July 31, 1790, and was issued to Samuel Hopkins for a process of making pot and pearl ashes. During that year, the total number of patents was but 3; the following year it amounted to 33, and then for sixteen years the aggregate fluctuated, falling as low as 11 and reaching as high as 99. For the seventeen years following the variations were between 100 and 300, the last-mentioned number not being exceeded until 1825. The increase subsequently was more rapid; and by August, 1836, when the present system of numbering the patent began (it appears with those of Thomas Blanchard, for turning irregular forms), the total had reached 10,041; or, for the period of sixty years comprised in the first era, the aggregate amounted to 17,447. Yet in this small number are included Whitney's cotton gin, McKean's first steam saw mill, Whittemore's wool and cotton card-making machine, Hare's oxy-hydrogen blowpipe, Blanchard's tack machine, Fulton's steamboats, Hall's breech-loading fire-arms, Perkins' steel engraving, Stevens' tubular boiler and screw propeller, Lowell's power loom, Burden's horseshoe and spike machinery, Mott's stoves for small coal, Saxton's magneto-electric machine, Bogardus' ring flyer for cotton spinning and the long category of other important devices of that wonderfully prolific inventor, Professor Henry's splendid electro-magnetic discoveries, Morse's telegraph, Guthrie's discovery of chloroform, Boyden's patent leather, Baldwin's improvements in the locomotive, Howe's pin machine, McCormick's reaper, Colt's revolvers, Wells' hat body machine, Goodyear's vulcanization of india rubber, Bigelow's carpet loom, Howe's sewing machine, Siskel's cut-off, Morton's discovery of the anæsthetic qualities of chloroform, Rodman's hollow casting of ordnance, House's printing telegraph, and Ericson's steam fire engine.

To show with what rapidity inventors made improvements on inventions embodying original principles, it may be noted that in the early days of the sewing machine 116 patents were granted for improvements thereon in a single year; and out of the 2,910 patents issued in the year 1857, 152 were for improved cotton gins and presses, 164 for improvements in the steam engine, and 198 for novel devices relating to railroads and improvements in the rolling stock. In the year 1848, three years after the publication of this paper was commenced, but 660 patents were granted; but under the stimulus of publishing those inventions as they were patented, ten years later, in 1858, the number had increased sixfold, reaching 3,710, while up to January 1, 1860, as already stated, the aggregate of patents issued amounted to 17,447; since that time and up to the present the total is 181,015.

Curiosity here leads us to review our own work, extending back for, say, twenty years, or to 1857, a period during which 170,745 patents have been issued. We find, by actual count, that 62,662 applications have been made through the Scientific American Patent Agency for patents in the United States and abroad. This averages almost ten applications per day, Sundays excluded, over the entire period, and bears the relation of more than one quarter to the total number of patents issued in this country up to the time of writing.

We might indulge in some pardonable egotism in claiming

to have done no small share toward aiding the development of the inventive genius of our country, and thus advancing our national prosperity—the above statistics would seem to justify it—but this we forego, or better, leave it to be done by the editor of the *SCIENTIFIC AMERICAN* a century hence. He will have a larger story to tell, and likely, be less modest than the editor of to-day.

EXHIBITION OF MICROSCOPES.

The *soirée* of the American Microscopical Society was held in the large hall of Kurtz' photographic establishment, 23d street, New York city, on the evening of March 6. The exhibits were admirably arranged by Dr. Rich, the President. On each of twenty tables were four instruments, illuminated by one or two student's lamps, so that about eighty instruments were exhibited, representing thirty or forty exhibitors. Various kinds of microscopes were shown, from the most elaborate and expensive to the simplest; while some were noticeable for originality and special adaptation. No inferior instrument was to be found in the collection.

Dr. Rich exhibited six microscopes, a Beck grand binocular, a Zentmayer grand, a Curtis mounting microscope, two Wales and Hawkins improved, and a Beck "popular." Special mention must be made of Dr. E. Curtis' invention, which, in regard to convenience in use, originality of design, and capability of diverse applications, stands foremost; it is undoubtedly the best dissecting microscope, it may be used as a binocular, and is simple as well as compound. The stage and illuminator are not attached to the microscope, but consist of an oblong rectangular box which stands on the table under the objective lenses, and the whole arrangement is evidently the result of the experience of a hardworking professional microscopist. Dr. Rich exhibited under these instruments most beautiful specimens of the wing cover of the West Indian beetle, and also some remarkable arrangements of diatoms, first produced several years ago by a lady in London: they were for a long time a profound mystery, until the German scientist Müller, in Holstein, produced them for the trade. The diatoms are on slides containing 100, 400, or 600 specimens each, all classified in species according to an accompanying catalogue.

Among the appendages shown was the improved section cutter of Dr. E. Curtis, in which the knife is inclosed in a frame moving over a plate of glass, in the center of which the object to be cut is screwed upward through a hole, and may be made to project a distance as small as one thousandth of an inch or thereabout.

Mr. Rutherford exhibited a microscope by the famous Italian maker Amici, which was presented to him by Amici, when in Italy thirty years ago. The connoisseurs present all agreed that Amici was far ahead of his time; and his instrument, so far as optical effects are concerned, compares favorably with many of the best imported microscopes of the present day. Professor Julien, of the School of Mines, Columbia College, showed five sections of various stones, such as granite, agate, etc., by means of two Power and Leland grand binoculars, which have an ingenious arrangement for swinging the polarizer in and out of the tube. Dr. Vander Weyde exhibited four instruments: one by Andrew Ross, to which various attachments had been made to change it into a single dissecting microscope, an inverted chemical microscope, a horizontal microscope, especially adapted for drawing, and an instrument to which had been attached an eyepiece for two observers, the invention of the exhibitor. In this device, one observer sees the object under polarized light and the other under unpolarized. Dr. Vander Weyde also showed a large inverted microscope of his own invention, with a colossal eyepiece and a large field (this was illustrated and described in the "Record of Scientific Progress" for 1865, published by MUNN & Co.); and also a new polarizing instrument for observing the colored rings around the axes of crystals, whereby the system to which they belong may be determined. The same inventor also showed several little contrivances, which he explained to those interested in practical microscopy: such as new methods of illumination, a new finder, and a micrometer of new and peculiar construction. His most remarkable exhibit consisted of the muscles of the human eye, which contract and dilate the pupil: these muscles can only be revealed by the use of polarized light.

Want of space prevents our mentioning in detail all the exhibits, although many of them deserve honorable mention; but Zentmayer's improved stand, with rotating and centering stage, an arrangement which causes the mirror to work in the optical axis, McAllister's four microscopes, and those of George Wales and Pike, may be specially mentioned. Crouch, of London, was represented by eight splendid instruments, all provided with his own objectives. Woolman exhibited some fine instruments by Queen of Philadelphia, and four London ones, three by Beck and one by Crouch.

The visitors were all much interested in the exhibition, which will doubtless do much to popularize the fascinating study of microscopy.

Steam in the Streets of Philadelphia.

Seven steam street cars were placed upon the Market Street Railway, Philadelphia, on March 21. A small boiler incased in wood is placed in front of the car, and by an ingenious contrivance the whole power of the engine can be concentrated on the brakes. The trial trips were very successful, the cars being stopped in a few seconds, even when going at high speed, heavy grades not causing as much trouble as had been anticipated. The engines were noiseless, and horses were not frightened.

NEW FRENCH WOODWORKING MACHINES.

In the annexed engravings, we illustrate four new wood-working machines, invented and extensively manufactured by M. Ferdinand Arbey, of Paris, France, which were patented through the Scientific American Patent Agency on January 30 last. They were exhibited, with others from the same manufactory, at the Centennial Exposition, and there attracted considerable attention owing to their difference from the machines for similar purposes here in use and from the perfection of their finish.

Fig. 1 is a machine for jointing staves so as to produce an exact fitting of the joints, according to the curvature and diameter of the barrel. Its main object, however, is to form the staves so that barrels may be made of staves of varying widths, and wood thus economized. The staves are clamped, at D, in a longitudinal arc-shaped frame, E, which is pivoted to the side standards of the lathe, A. By means of the center pins, b, the stave and its clamps, D, are adjustable to a greater or less diameter of the barrel, said pins forming the axis of the barrel and being adjustable up or down in the standards. The swing of the frame on its pivots is limited by the set screws, f, Fig. 2. For a greater width of staves, the set screws are placed at a greater distance from the center line and *vice versa*. When the frame is thus adjusted to the radius of the barrel and width of the staves, the circular saw, C, which is placed at the end of the vibrating arm, B, and rotated by a belt from the driving shaft, B', is passed along one side of the stave. Then the frame is swung over, and the saw cuts the opposite side. In this way, the edges are cut true, and those of any two staves will fit together, regardless of the size of the staves.

In Figs. 3 and 4 is represented an exceedingly simple lathe for turning irregular forms, such as sword handles, gun stocks, etc. The tool used is a V-shaped cutter, e, which is secured to a pivoted lever, D, the latter being pivoted, by a link, f, to a second pivoted lever, D'. Lever D' swings therefore parallel to lever D, and of course transversely to

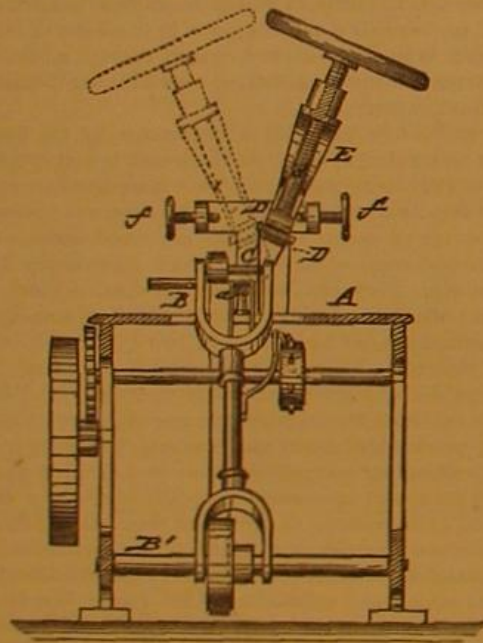


Fig. 2—STAVE-JOINTING MACHINE.

the longitudinal axis of the lathe. By means of a handle on lever, D, the tool is removed from the wood as desired; while it is pressed up to its work by the action of the power-

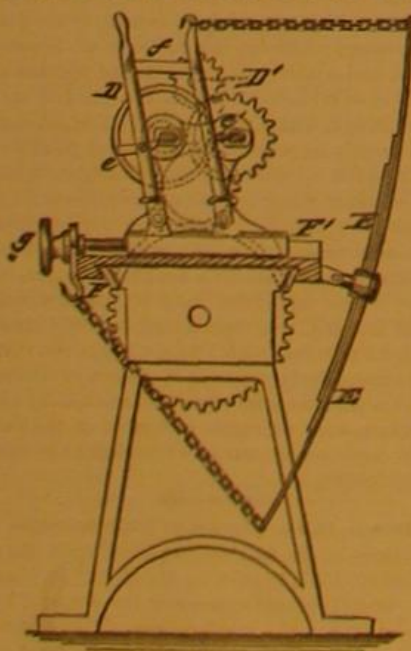


Fig. 3—LATHE FOR IRREGULAR FORMS.

ful leaf spring, E, to which the lever, D', is attached. At the same time a blunt guide tool, on lever, D', is pressed

against a model, e', the shape of which is to be copied. The pivot levers are attached to a laterally adjustable part of the carriage, F, which travels automatically forward and backward. The joint motion of the cutter tool, produced longitudinally by the carriage travel and laterally by the power of the spring which presses both guide and tool against the bodies, accomplishes in the blank an exact reproduction of the model.

Fig. 5 represents a new carving attachment for common lathes, for the purpose of grooving, channeling, pearling,

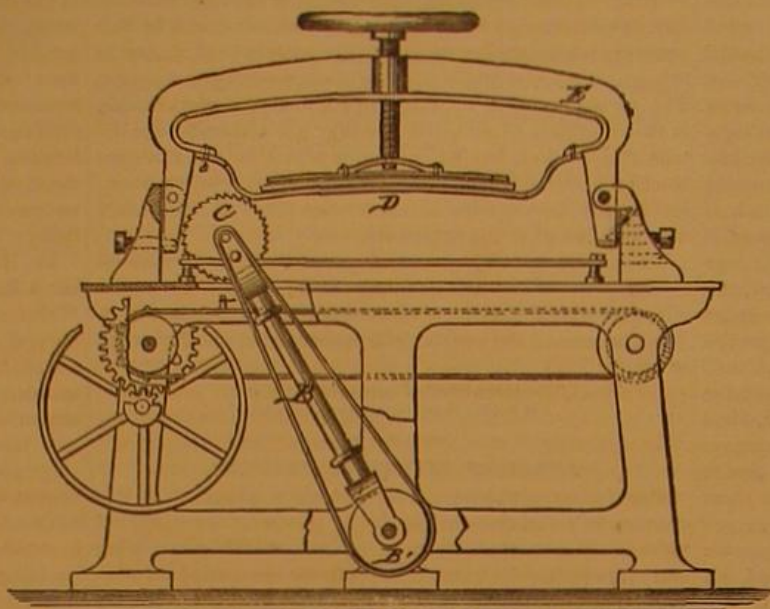


Fig. 1—STAVE-JOINTING MACHINE.

and ornamenting balusters, table legs, and other articles of irregular shape, which are fastened in the lathe centers. The cutting tool is attached to a shaft, B, which revolves in bearings at the ends of swinging counter-weighted arms, C. The latter are pivoted in a hollow standard, D, which is secured to the carriage. The mode of rotating the cutter shaft and tool is clearly exhibited in the engraving. The tool passes longitudinally along the object and works out channels in the same, the dividing disk, F, being turned for the distance of one subdivision after each channel is made to produce the next channel by the return motion of the carriage. By slowly rotating the work in the lathe, helicoidal grooves are made.

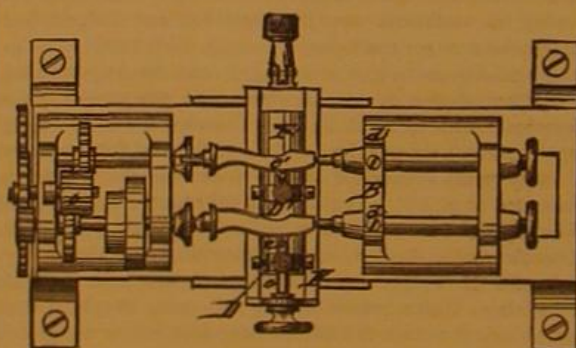


Fig. 4—LATHE FOR IRREGULAR FORMS.

Fig. 6 represents a novel tenoning and mortising machine, in which the work represented by the dotted lines is first fed to a pair of horizontal saws, and then to a pair of vertically cutting saws, which produce the recesses at both sides of the tenon. The work is fixed to the sliding table, B, and moved up by the lever, B'. The saws are adjustable as to their distances apart, and the upper saw shaft may be moved later-

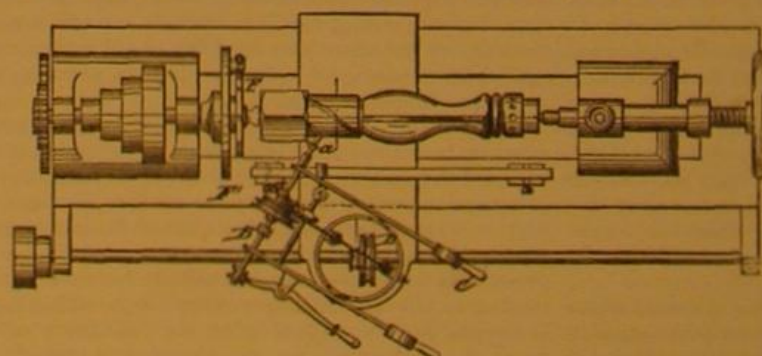


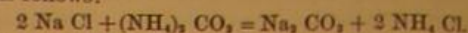
Fig. 6—TENONING AND MORTISING MACHINE.

ally by the handle, D'. Tenons and mortises of different angles are produced by placing the saw bearings on swinging plates of the carriages, and securing the plates by clamp screws, after giving the required degree of inclination. The apparatus may also be used as an ordinary circular sawing machine.

Another Soda Ash Process.

Scherbascheff, of Charkow, is using a new and important modification of the ammonia soda process. Instead of producing the bicarbonate, as Solvay's process does, the monocarbonate is formed at once. Ordinary sal soda, which crystallizes with 10 molecules of water, when dissolved in water and heated to over 95° Fah., cannot take up more than

7 molecules of water, and at a still higher temperature it loses by dissociation more water and only retains 1 molecule of water. The higher the temperature of the solution, the more potent this dissociation, and in the presence of common salt the reaction is still more energetic. Consequently when common salt and carbonate of ammonia are dissolved together in one vessel at a high temperature, a double decomposition results, and mono-carbonate of soda is formed with 1 molecule of water, which salt is almost insoluble in water. The reaction is as follows:



As carbonate of ammonia is also dissociated at a high temperature into carbonic acid and ammonia, the solution should not be heated above 140° or 158° Fah. At a higher temperature the reaction is reversed.

In Scherbascheff's works, a large vat is half filled with brine, which is heated to 140°, and in it is suspended a basket of common salt, and another of carbonate of ammonia. As they dissolve they react on each other; the crystalline, almost insoluble, carbonate of soda is precipitated, while the chloride of ammonia remains in solution. The vat has a cover provided with pipes for conducting the liberated carbonic acid and ammonia gases into the brine of the adjoining vat. The operation is finished when the liquid in the vat becomes saturated with ammonia salt. The baskets of carbonate of soda and salt are at once transferred to the next vat, but a temperature of 140° to 160° is kept up in the first vat for a while until all the soda is precipitated. The solution of sal ammoniac is now drawn off, and the soda shoveled out and dried in a centrifugal apparatus, after being washed with a boiling solution of soda to remove any sal ammoniac or common salt that may be mixed with it. It is now pure enough to put at once on the market.

A New Hydrostatic Safety Lamp.

We recently commented upon the danger of explosion in kerosene lamps, due to the ignition of the vapor which forms

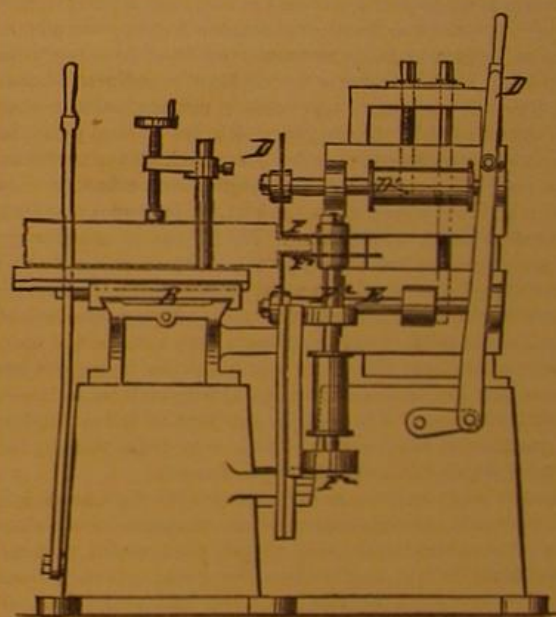


Fig. 6—TENONING AND MORTISING MACHINE.

in the space above the oil when the latter runs low. This ignition is liable to take place directly from the wick, especially when the latter is too short. A new lamp has recently

been exhibited to us, which seems to be wholly free from possibility of explosion from the above cause. It is so constructed that water placed in a central reservoir constantly tends to lift the oil up a tube to the wick. In this way the oil is kept at a level at a short distance below the burner until it is wholly burned away; and at no time can any large space be formed wherein inflammable vapor can accumulate. The lamp is known as Kendall's "Hydrostatic Safety Lamp," and is manufactured by the Union Machine Company, 89 Liberty street, New York.

Evolution of the Brain.

In a recent lecture at Glasgow on "Evolution of the Brain," Professor Allen Thompson stated that we have no direct evidence from anatomy, physiology, or pathology, of any mental act being performed apart from the brain; and as to the question whether the human brain had been directly formed, and was constantly maintained by an act of creative wisdom, or whether, according to the Darwinian view, it had gradually assumed its complex structure and lofty powers exhibited in presently existing man, he preferred the latter view, because it was the one which was most consistent with all that was known of the coincident development of the mental powers and the cerebral organization.

STRAIGHTENING METAL PLATES.

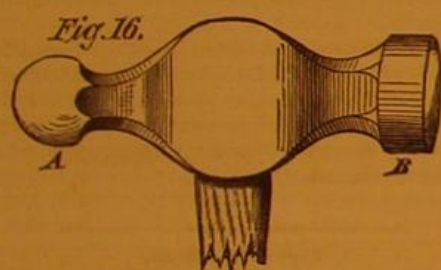
No. III.

We now come to straightening as effected by pening, a process usually applied to straighten or, if necessary, to bend bars, rods, beams, frames, and other thin pieces of wrought iron which, from being too heavy or from their positions, cannot be straightened upon an anvil.

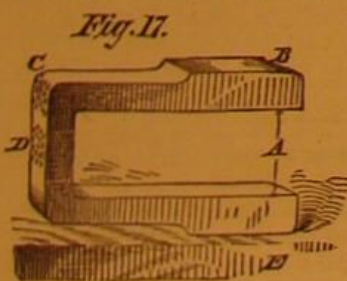
The principle involved in the process of pening is that of stretching the skin of the metal, and thus producing a surface strain that holds, by tension, the rest of the surrounding metal out of its natural shape. Suppose, for example, that Fig. 15 represents a rod of iron which it is required to straighten. It is obvious that if we stretch the skin on the hollow side by hammering it all over (as shown at A, in Fig. 15, by the hammer marks denoted by the small circles), the face on that side will be stretched; and becoming in consequence longer, it straightens out. The hammer used for pening is shown in Fig. 16. It usually weighs about $\frac{1}{2}$ lb. The ball end, A, is employed to deliver the stretching blows, that



shape being preferred because, by delivering the force of the blow upon a small area, the effect of the blow is greater; then again the indentations made by the hammer, being dish-shaped, do not disfigure the plate so much, especially as the blows are light and the hammer marks so close together as to contact or partially cover one another. The flat face is used in cases where much pening has been done, to efface as much as possible the marks left by the ball pen end of the hammer. In many cases, however, this is unnecessary. While pening a piece of metal, it will greatly assist the operation if a pressure is placed upon the work in the direction in which the work is required to go or set; and for this purpose clamps are often used. Suppose, for example, that a strap such as is shown in Fig. 17 requires to be made narrower at A. We may rest it upon the bench, E, in the position shown, press down the end of the jaw, B, and deliver the blows denoted by the marks shown on the round corner, C. In this case, the effect of the hammer blows will be sufficient, if the flat face of the hammer is used. If, however, the strap



had a sharp corner, it would be necessary to rest the two ends of the strap jaws on the bench, and, using the ball pen, deliver the blows shown by the marks at D. In either case, the effect will be to close the distance between the jaws at A. The reason in the latter case for pening the strap in the middle is that, since the pening will tend to round the face lengthways, the filing out the pening marks will tend to straighten that face, and may be more quickly performed; for, if we were to pen the face in two places, the filing out of the marks would aid the pening to round the face. It is obvious that, were the jaws too narrow at A, pening the inside crown face of the strap would widen them. The blows should fall dead—that is, the hammer should fall, to a great extent, by its own weight, the number rather than the force of the blows being depended upon; hence the hammer marks will not be deep. This is of especial importance when pening has to be performed upon finished work, because, if the marks sink deeply, proportionately more grinding or filing is required to efface them; and for this reason the force of the blows should be as near equal as possible. Another and a more important reason, however, is that the effect of the pening does not penetrate deeply; and if much of the pened surface is removed, the effects of the pening will be also removed: for, as a rule, the immediate effects of the blows do not penetrate deeper than about $\frac{1}{4}$ inch. While the work is being pened, it should be rested upon a wood or a lead block, and held so that the part struck is supported as much as possible by the block. In no case

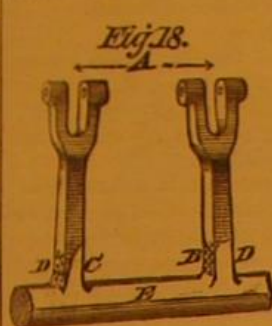


should it be rested upon an iron or any hard metal block, as that would tend to stretch the underneath face, and partially nullify the effects of the pening.

Wrought iron shafts of considerable thickness may be straightened by getting them red hot, and suddenly cooling the high side until it assumes a black color, then reheating the shaft again and repeating the cooling process, which should be performed as quickly as possible. This process, repeated a sufficient number of times, will inevitably straighten the shaft. The principle involved in this manipulation is as follows: When the shaft is red hot all over, it is also expanded all over, and the cooling contracts the spot or side cooled, which shrinks, creating a strain which draws the hot side out

of its natural shape, so as to accommodate the shape of the contracted side.

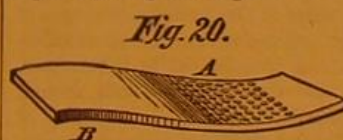
In straightening work of cast iron, pening bears an important part, especially in the case of iron patterns or light iron castings. Suppose, for example, that Fig. 18 represents an iron casting, and that the distance, A, from the center of one double eye to that of the other was too short: by pening the arms on the faces denoted by B, C, and in the place denoted by B, the distance, A, could easily be made correct. If the width at A were too great, similar pening at D D would be required. If, however, the shaft itself should be out of straight and does not require to be turned up in the lathe, it becomes a consideration whether two evils cannot be remedied by one pening operation.



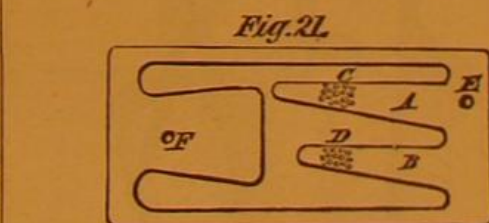
pened separately. It is obvious, however, that, if the shaft

must be pened, it must be operated upon first. As an example of straightening cast iron plates by pening, let Fig. 20 represent a warped plate. The pening marks shown at A, and similar blows delivered upon the other side in the hollow at B, would straighten it; or, in Fig. 21, if the tongues, A, B, were warped so as to stand up too high, pening at C and D would straighten them.

Patterns for plate castings often become warped in time from the rapping of the pattern: for example, in Fig. 21 are two holes, E and F. Into these holes pieces of stout wire are placed; the moulder then strikes the wires on all sides to loosen the pattern in the sand or mould. In course of time, the metal around these holes becomes bulged, and there is created a local tension apt to distort the pattern, so that it requires pening to straighten it.



plates, such as shown in Fig. 21, he finds that the points of the tongues, A and B, always curl up in the mould to about $\frac{1}{4}$ inch too high. He will then pen the pattern so that the tongues stand $\frac{1}{4}$ inch too low, and thus save a great deal, if not all, of the pening. Another plan adopted by moulders to straighten castings is to uncover the parts



that are apt to sink in the sand. If any part of a casting has the sand removed from its upper surface while it is still red hot, that part cools the quickest and lifts up; and of this fact the moulder takes advantage, uncovering the part which experience has shown him requires to be lifted. The cause of the cooled part lifting appears to be as follows: The part cooled contracts the quickest; and to sink in the mould, it would require to compress the bed sand or else to raise the other part of the casting. The whole weight of the sand in the cope, as the top part of the mould is called, tends to keep the casting down; and when that weight is removed at any part by removing the sand, the contracted part naturally rises, because there is less resistance offered to its rising than there would be to its falling. In many cases, this cooling process is aided by the application of water, which much increases its effect; and it is astonishing, under skillful manipulation, how much a plate or casting can be shaped at will, by water judiciously employed, without causing it to crack.

Iridiated Glass—Possible Rediscovery of a Lost Art.

It is well known that, under the influence of moist air and in the course of great lengths of time, certain kinds of glass lose their transparency and become covered with opalescent layers, which are easily cracked off. This occurs most frequently with glass that has been long buried in the earth. In the collection of ancient relics exhumed at Cyprus by General Di Cesnola, there are abundant examples of glass bottles, cups, vases, etc., which are as brilliantly iridescent

as is carved from the pearl shell. The reason for this change, as we have already explained, is that the alkaline base in the glass combines with the carbonic acid of the air, setting free the silicic acid of the material. Then the alkaline carbonate so formed is washed away by water, and in place of the glass we have nearly pure silicic acid. This has been proved to be the fact by actual analysis of some of General Di Cesnola's specimens.

But there is good cause to believe that the ancients were in possession of processes for producing this iridiated glass in brief periods of time; and it also appears that the glass-workers of China and Burmah have like knowledge. In April of last year, we noted the fact that specimens of the Chinese glass had been sent to M. Clemendot, a noted French chemist, for examination. We now find in the report of a recent meeting of the French Academy of Sciences that, in conjunction with M. Frémy, the above scientist has succeeded in reproducing the iridiated glass, and that numerous fine specimens have been exhibited before the aforesaid society.

The process, which is said to be certain in its results, consists simply in submitting ordinary glass for six or seven hours to the action of water containing 15 per cent of hydrochloric acid at a pressure of from 2 to 3 atmospheres, corresponding to a temperature of about 248° Fah. The beautiful glass thus quickly produced will doubtless find many ornamental applications.

Influence of Pressure on Combustion.

Some interesting observations have been made by M. Wartha on the influence of pressure on combustion. He observed the burning of six stearine candles in free air, and in an iron case under a pressure of 1.95 atmospheres. They burned under the pressure with a flame $3\frac{1}{2}$ to $4\frac{1}{2}$ inches long, and gave much smoke; their luminous power diminished, while the flame assumed a yellowish-red color. The decrease of weight after one hour of burning was found to be less than in burning in free air. This last result is opposed to the observations of Frankland, who has affirmed that the consumption of the burning material of a candle, or the like, is not perceptibly dependent on the pressure of the medium in which the combustion occurs. It is supposed that the difference of pressure in Frankland's experiments (on Mont Blanc and at Chamounix) was not sufficiently great to give a distinct difference in consumption of the burning matter. M. Wartha further put a candle to burn under an air pump receiver, with special apertures; and with increasing rarefaction, the flame was seen to enlarge, and its luminous power to diminish. At a pressure of $3\frac{1}{2}$ inches, the greatest rarefaction produced, the luminous power was quite gone, and the flame, which had now assumed threefold size, appeared to consist of three parts, an inner bluish-green cone with a violet sheath and a weakly violet mantle. The diminution of the luminous power in this case Mr. Wartha explains by the fact that, under less pressure, less of the products of combustion are separated in the form of soot.—Nature.

Eucalyptus Globulus.

The Central Pacific Railroad Company has lately arranged to have 40,000 trees of the above species set out along the 500 miles of the right of way of the company. This is only the first instalment, as it will require about 800,000 of the trees for the 500 miles of valley where they are to be cultivated. The immediate object of the plan is to increase the humidity of the region, and lessen the liability to droughts. It is an established fact that the destruction of our forest trees over large tracts of the country is having a direct effect on the climate, and we are glad to know that this company is replacing, at least in part, the forests which have been destroyed.

The beneficial influence exerted by the foliage of the eucalyptus in malarial districts is well known. Experiments have proved eminently successful in this direction, notably that of the English Government at the Cape of Good Hope, and of the local government of a region in Belgium. The *eucalyptus globulus*, or blue gum, is supposed to be efficacious in marsh and other fevers, and is known in Spain as the "fever tree." The bark and leaves of the tree contain much tannin, which is extracted on a large scale in Australia for European markets. A new interest has lately been given to the genus by the discovery of a body in the leaves and bark closely resembling in its properties those of cinchona or Peruvian bark (the source of quinia), and much more abundant. Vaquelin obtained, in an analysis of the leaves, an essential oil containing eucalyptol or eucalypt camphor, and a resin closely resembling resin of cinchona. This extract yielded a substance capable of neutralizing the strong acids, and forming crystalline salts. The crystals of its sulphate are almost identical in form with the star-shaped crystals of sulphate of quinia or cinchona, and present the green coloration on the action of chlorine and ammonia, hitherto supposed to be peculiar to quinia. The dried and powdered leaves and bark, and even the wood, of this tree have found employment in medicine. The wood is close grained, heavy, and of a dark color, and may be used with advantage by the cabinet maker.

Tools and chisels for cutting French burr stones may be tempered by heating to a dark cherry red and quenching in the following solution: To 3 gallons water add 3 ozs. each spirit of niter, spirit of hartshorn, white vitriol, sal ammoniac, and alum, and 6 ozs. common salt, with a double handful of hoof parings.

Communications.

Lamp Explosions.

To the Editor of the Scientific American:

Many of the lamp explosions we are constantly hearing of are not oil explosions at all, but glass explosions, if "explosion" is the proper word, which I am inclined to doubt; and it may be that the so-called lamp explosion, referred to in an article on this subject, in No. 12 of your current volume, was of this class, as it was stated that there was no more noise heard than would result from the breaking and falling of a lamp chimney, and that the "explosion" did not throw any pieces of the lamp more than a few inches, and the oil was not scattered at all. This seems to show that the lamp did not explode, but simply "went to pieces," as your correspondent stated; whereas, if there had been any explosion sufficient to break the lamp, the oil would certainly have been scattered in every direction.

From some reason not fully understood, but believed to result from imperfect annealing, glass articles are liable to crack and fall to pieces without apparent cause. Glass vessels, when used for other purposes than lamps, do not cause any damage when they "explode," beyond the loss of the article and its contents, and, it may be, a stain or two on the clothing or carpets; and no one therefore pays any attention to this matter. But when a glass lamp falls in pieces in this manner, it generally spreads the warm oil over the surrounding objects, such as clothing, the table cloth, or the carpet, and these, being of a fibrous nature, act as wicks, causing the oil ignited from the burning lampwick to readily burn, and thus a disastrous fire is the result, and we hear of another "coal oil explosion." Coal oil has sins enough of its own to answer for, as every one knows; but it is a good servant when properly managed, and it is not fair that it should be credited—or rather discredited—with more than its proper share.

Glass is one of the most treacherous substances that we know of, and should not be depended on to contain such a dangerous material as the coal oil usually sold for illuminating purposes. Glass articles may be used for years in safety, and yet are liable at any time—to say nothing of the danger of breaking from an accidental blow or fall—to fly to pieces, causing (when used for oil receptacles for lamps) immense damage to property and frequently loss of life by the most horrible of deaths. The writer has known several instances of glass articles other than lamps breaking in this manner, one of which was a large fruit dish that broke into an immense number of small fragments.

Occasionally there may be seen, in closely examining glassware, a flaw or speck resembling a white stone, from one sixteenth to an eighth of an inch, or even more, in diameter, imbedded in the substance of the glass. This is believed to be a portion of the silica that has not properly combined with the other materials and is not therefore glass. It probably has a different rate of expansion from the glass with which it is surrounded; for it is found that glassware is extremely liable to crack at the place where such flaws are found, and some glassmakers say that such ware is sure to fly at some time under the varying degrees of temperature to which domestic utensils are subjected. In view of this, glass buyers should always avoid purchasing an article of this class, and particularly so if the object to be bought is a lamp.

Glass has its advantages over metal in some respects, being more easily kept clean, as it is not liable to oxidation, and, being a poor conductor of caloric, does not heat up the oil as quickly as metal; but its superiority in these respects is more than counterbalanced by the liability to fall to pieces without warning. Glass lamps can, however, be made safe if provided with metal oil receptacles inclosed in the glass, which would then form merely an ornamental stand or casing for the oil vessel. Several patents have been granted for lamps on this principle, some of which, I believe, have expired, and the inventions covered by them may be manufactured by any one who chooses to do so without fear of infringement.

Washington, D. C.

OCCASIONAL.

On the Shape of the Earth.

To the Editor of the Scientific American:

In your paper of March 10 there is a communication on the above subject, in which the author maintains that the shape of the earth would be what it is at present even had it always existed as a solid mass. His reason is that, owing to the rotation of the earth, there would be a pressure at the poles, in excess of that at the equator, by an amount equal to the pressure of a column of iron thirteen miles high; and this, he thinks, would cause the poles to sink in. Let us assume for the present purpose that the highest mountain rises five miles above the level of the sea, and that the greatest sea depth known is three miles. Here is a variation from the form of equilibrium for a fluid globe of eight miles, and yet the earth is stable. Now it is a well known fact in physical geography that the highest mountains are in general contiguous to the deepest seas, or, more exactly, the largest mountain systems are contiguous to the largest oceans. Hence these changes of outline are much more abrupt than would be those in a globe of iron, where the variation from the form of equilibrium was gradual from the equator to the poles. Your correspondent loses sight of the fact that, in order to crush a solid, there must be an excess of pressure in some one direction equal to its crushing

strength. A vertical column of any known solid five miles high would undoubtedly crush its base; but a mountain five miles high stands secure, simply because the vertical pressure at the center of its base which tends to crush out the material, is resisted by the lateral pressure of the surrounding material. So, were the earth solid and a perfect sphere, although it would be about twenty-six and a half miles above the outline of equilibrium for a fluid earth at the poles, it would still be able to maintain this figure, since there would nowhere exist in its interior an unbalanced stress capable of crushing its material.

Woburn, Mass.

W. E. BUCK.

Icy Fringes Around the Stems of Plants.

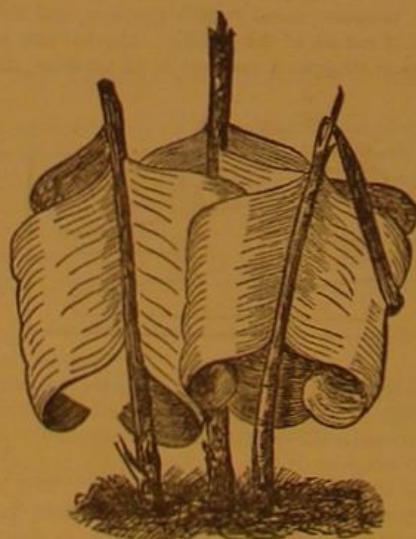
To the Editor of the Scientific American:

Under the heading "The Frost Plant of Russia," your correspondent, Mr. J. Stauffer, of Lancaster, Pa., calls attention, in the SCIENTIFIC AMERICAN for February 24, 1877, p. 116, to the remarkable accumulation of ice around the stems of the *cunila Mariana* (Maryland dittany).

As long ago as 1850, it was my privilege to call the attention of the scientific world to an identical class of phenomena in a paper entitled "Observations on a Remarkable Exudation of Ice from the Stems of Vegetables, and on a Singular Protrusion of Icy Columns from certain kinds of Earth during Frosty Weather." This paper was published in the "Proceedings of the American Association for the Advancement of Science," third meeting, Charleston, S. C., March, 1850 (pp. 20-34), and likewise in the *London, Edinburgh and Dublin Philosophical Magazine* for May, 1850 (third series, vol. 36, pp. 329-342).

As far as I am aware, this paper contains the first attempt at an explanation of the phenomena as manifested in vegetables, as well as their co-ordination with the protrusion of icy columns from the earth. So far as the notice of the fact of such accumulations of ice around the stems of plants is concerned, I was anticipated by several observers. Stephen Elliott, in his "Sketch of the Botany of South Carolina and Georgia," published in 1824, notices a remarkable protrusion of crystalline fibers of ice from the stems of the *conyza bifrons* (vol. 2, p. 322). Sir John F. W. Herschel published a short notice of a similar exudation of icy fringes, occurring around thistle stalks and stumps of heliotropes, in the *London and Edinburgh Philosophical Magazine* for February, 1833 (third series, vol. 2, p. 110). Professor S. P. Rigaud, of Oxford, notices the occurrence of an analogous phenomenon on a recently built stone wall, in the succeeding number of the same journal (third series, vol. 2, p. 190, March, 1833). Professor J. D. Dana appears to have noticed similar phenomena on the twigs of plants (*vide* "Manual of Mineralogy," second edition, p. 46, New Haven and Philadelphia, 1849).

The plants in which I observed the phenomenon were two species of the genus *pluchea* of De Candolle, or *conyza* of the older botanists, namely: *pluchea bifrons* and *p. camphorata*. It is more common and conspicuous in the former. Both of these plants grow abundantly in wet soils, around ponds, and along the roadside ditches, in the low country of Carolina and Georgia. The accompanying sketch, reproduced from my paper in the "Proceedings of the American Association" above indicated (pp. 22 and 23), conveys a toler-



ably good idea of the appearance presented by the friable sheets, or ribands, of semi-pellucid ice around the foot stalks of the *pluchea*.

This is hardly the proper place to reproduce my explanation of the ice phenomenon in plants, or to show its co-ordination with the more general phenomenon of the protrusion of columns of ice from certain kinds of earth during frosty weather. In the paper referred to will be found a full discussion of the possible sources whence the large supply of water is derived, which, by freezing, forms the accumulations of icy fringes in the one case, and the icy columns in the other. Suffice it to state that I have there shown that, in both cases, the phenomena are purely physical, having, in the case of plants, no connection with the vitality of the stem; and that the appearances "are quite at variance with any idea of the deposition of these icy fringes from the store of aqueous vapor in the general atmosphere, in the manner of hoar-frost."

If your correspondent will consider all of the facts which are established in relation to the phenomenon in question, he

will, I am sure, be convinced of the untenability of his explanation. The explanation given by Dr. Darlington, in his *Flora Coarctica*, in 1853 (as quoted by your correspondent), is more in accordance with known facts.

JOHN LE CONTE.

University of California, Oakland, Cal.

State Legislation on Patents.

To the Editor of the Scientific American:

I notice in your issue of March 3 an article from Mr. J. Pusey, of Philadelphia, in reference to legislation by the States upon patents granted by the United States.

The bill introduced in New York appears to be similar to that passed by the Legislature of this State in 1871 ("Compiled Laws of Michigan," p. 519), and one of the same character was held in Indiana (43 Ind., 167, 13 Am. Rep., 395) to be unconstitutional, as interfering with the exclusive power of Congress to regulate patents. See also opinion of Davis, J., *ex parte* Robinson, 3 Ind., Stat. 365: "If the patentee complies with the law of Congress on the subject, he has a right to go into the open market anywhere within the United States, and sell his property." "The law in question attempts to punish, by fine and imprisonment, a patentee for doing with his property what the National Legislature has authorized him to do, and is, therefore, void."

See further upon this subject, Pendar v. Kelley, Supreme Ct. of Vermont, Am. Law Register, Sept., 1876, 511.

JAMES B. ROMEYN, Counsellor at Law.

Detroit, Mich.

Boiler Explosions.

To the Editor of the Scientific American:

The cause of boiler explosions is nothing more nor less than carelessness and incompetency of owners and engineers in charge. There are men in charge of machinery and boilers who know nothing about either. I do not blame the men; the owners and operators are to blame for the explosions and loss of life. Many men put in charge of boilers have no idea of the amount of pressure in a boiler; and they will put up a new boiler and let it run until it blows up or burns out. It is seldom that we hear of any person here cleaning out a boiler—not one out of one hundred. When the boiler gets too full of water, they open the blow-off cock and blow some of it away.

I would recommend that surface cocks be placed in line with the middle gauge to blow off the sediment that accumulates on top of the water. The sooner there is a boiler inspector appointed, and engineers put through a thorough examination, the better it will be for owners, operators, engineers, and the community at large.

Turkey City, Pa.

J. T. C.

Lightning Rods.

To the Editor of the Scientific American:

In last June, an elm tree standing 10 feet behind my house was struck by lightning. On the comparatively smooth upper limb, which was thoroughly drenched by the falling rain, no marks are visible. As the descending fluid encountered the rough bark—which was more or less dry underneath—of the larger branches, its effects became manifest. The rough bark was scaled off a place three or four inches in width. On the body of the tree, which was very shaggy, the bark was split through to the wood in three places. At the base of the tree, for about two feet above the ground, no effects are visible, which may be accounted for in this way: The upward spattering of the raindrops upon the surrounding stones had thoroughly saturated the bark at the base of the tree, and so afforded a good conductor for the electric fluid. To all appearance, the lightning left the tree as soon as it reached the ground, and ran off upon the surface. Had it followed a root, it would most likely have thrown up the dirt, as it usually does in such cases.

I maintain that it is just as well for a lightning rod to terminate at or just beneath the surface as it is to extend down several feet. For, in the first case, inasmuch as it almost always rains during a thunderstorm, if the rod were struck, the fluid would find no difficulty in passing off upon the wet surface; but in the second case it would often—and especially near a cellar wall—be very apt to find a dry terminus.

Franklin, N. Y.

P.

Feeding Poultry.

To the Editor of the Scientific American:

In raising poultry, it is not sufficient merely to provide proper food; but the food must be properly given. Some persons have an idea that, if they throw down a heap of corn once or twice a day, that is all that is required; but no plan is so extravagant nor so injurious as this. The corn or other food should be scattered as far and wide as possible, that the birds may be longer employed in finding it, to the benefit of their health; and that they may not accomplish in a few minutes that which should occupy them for hours. It is the nature of fowls to take a grain at a time, and to pick grass and dirt with it, which assists digestion; but if, contrary to this, they are enabled to eat corn by mouthfuls, their crops are soon overfilled, and they seek relief in excessive draughts of water. Nothing is more injurious than this; and the inactivity that attends the discomfort caused by it lays the foundation for many disorders.

Yarmouth, Me.

B. D. ALLEN.

New Fac-simile Printing Process.

We have lately examined, says the *Paper and Printing Trades Journal*, a novel fac-simile printing process (Byford's patent) introduced by Messrs. S. Straker & Sons, of Fenchurch street, London, E. C., by which useful invention a number of fac-simile copies of circulars, drawings, or any matter that can be written on ordinary paper, may, with the aid of an office copying press, be printed in a few minutes, and with little or no preparation, and on any description of dry paper, the original document or drawing remaining unimpaired. The fac-simile printing process is based on the well known and remarkable qualities of aniline. The document from which a number of copies are required is written with a patent aniline ink of immense strength, which is allowed to dry without being blotted up. A sheet of transfer paper is damped, the document is laid on its face downward, they are then placed in the "printing pad" (which is a leather portfolio of peculiar construction), and subjected for a few moments to pressure in the copying press. On removing the original document, a copy in reverse will be found on the transfer paper, and the operator can at once proceed to print the required copies, which is done by laying a sheet of ordinary paper on the transfer paper, the impression plate over it, and pressing for a few moments in the copying press, when it will be found that a duplicate or fac-simile of the original document has been produced; and so the process goes on until the impression becomes faint, when it is at once revived by damping the under side of the transfer. If a large number of copies are required, a second, and even a third, transfer may be taken from the original document, and printed from in the same manner as the first. The fac-simile printing process is somewhat analogous in its results to, but far simpler than, lithographic printing, and is being extensively used in government and public offices. It is so simple that the smallest or dullest office boy can work it without any fear of coming to grief; and as a useful adjunct to the counting house it will be thoroughly appreciated by all classes engaged in commercial pursuits.

Blue Glass Photography.

The blue-violet glass mania abroad seems to be confined to the photographers, and the conflict over the deceptive theory is being waged, not on the question of the curative powers of the light transmitted, but regarding the assertion that increased chemical action can be obtained by glazing photographic studios with the cerulean panes. M. Scottelari, the blue glass defender abroad, has fallen into the same errors as his co-believers on this side of the Atlantic: that is, he confounds the blue-violet rays of the spectrum with blue-violet transmitted sunlight; while he also reaches the obvious absurdity that the violet ray, when isolated from the spectrum, possesses greater capabilities than it had when mingled with the other rays. It is perfectly true that the violet ray is more active, chemically, than the other rays; but the latter do not detract from it when combined with it, and the chemical action of white light containing violet rays is precisely as great as that of the violet rays separated and tested alone. Hence it follows, as a matter of course, that a window glazed with white glass transmits the whole of the solar rays which reach it, violet among the rest. A window of the same size glazed with violet glass would transmit one seventh part of the rays reaching it, and these would be violet-colored rays; but it would not transmit one single violet ray more than the other window.

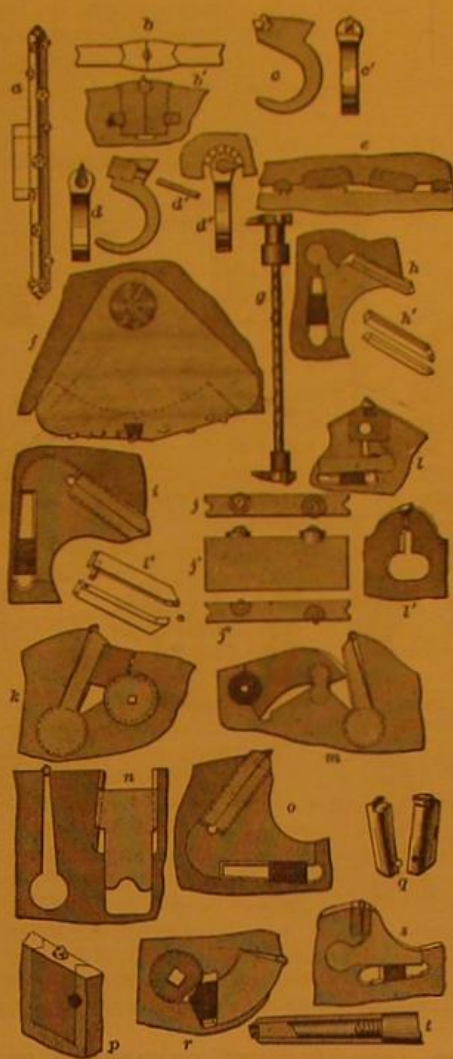
The *Photographic News* adds that, according to Draper and others, all the rays of the spectrum probably possess photogenic power on some substances; and therefore it is but just to M. Scottelari to conceive that he has found that the rays other than violet have an antagonistic influence on that ray, and obstruct its action on bromo-iodide of silver. But Mr. Thomas Gaffield of Boston, has recently made some new investigations on this very point, wherein the inferiority of the violet glass to clear glass is most clearly shown. Mr. Gaffield's conclusion relative to the photographic aspect of blue glass accords with our own relative to its employment for curative purposes. He says: "It is undoubtedly true that violet or other colored screens may be used with advantage in cutting off too much, or in making an even diffusion of, light upon the face of the sitter; but it can never be true, while two from six leave a less number than six, that the cutting off of a third, or any fraction, of the chemical rays of sunlight by a violet glass can enable the photographer to obtain more rapid or effective results."

THE "London" cement for joining broken glass, china, wood, etc., is made by taking a piece of Gloucester cheese, boiling it three times in water (each time allowing the water to evaporate), and mixing the paste thus left with dry quicklime.

STONE-WORKING IMPLEMENTS.

In stone working, as our readers are aware, the carbon or black diamond is now greatly used. The difficulty prom-

Fig. 1.



nently encountered, however, in this particular, is that of fixing the diamond in the saw or cutter head so that it shall not work loose. In Fig. 1 (selected from Knight's "Me-

Fig. 2.

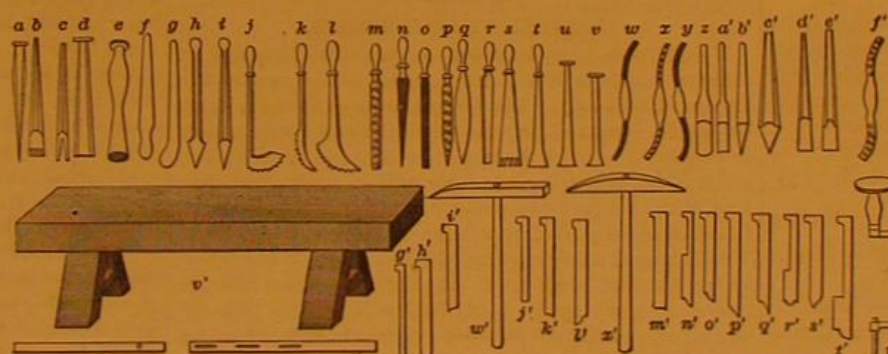
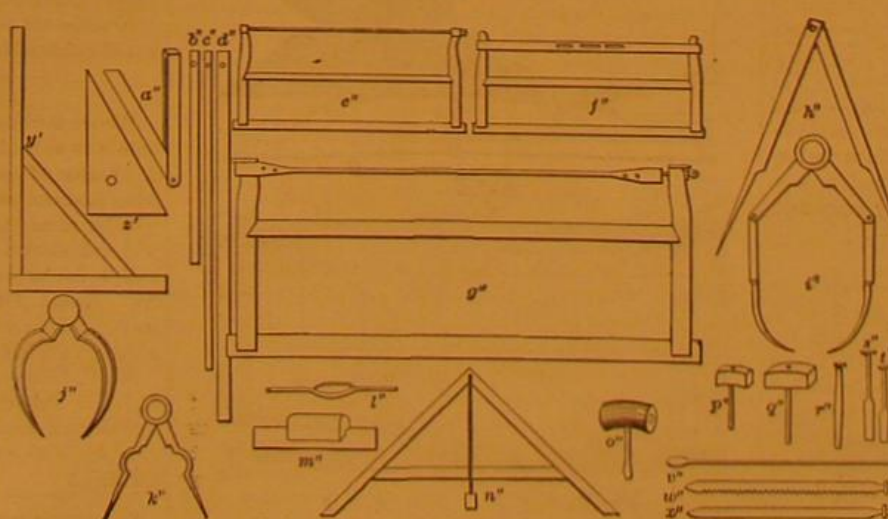


Fig. 3.



chanical Dictionary") we illustrate several modes of inserting the boot in

STONE SAWS.

It will be perceived that some of these imbed the diamond in the saw by sockets, rings, or solder; others grasp it by fingers which are clamped in sockets; others grasp it by

* Published in numbers by Messrs. Hurd & Houghton, New York city.

wedges in the slot, or by clamps which are themselves jammed by wedges, etc.

In Figs. 2 and 3 are represented all the various kinds of

STONE WORKERS' TOOLS.

the names of which are as follows: a, square etching needle; b, marteline chisel; c, toothed chisel; d, marteline chisel; e, puncheon; f, g, scrapers for sinking flutings; h, i, etching needles, called *houguettes*, partly flattened and sharp; j, hook for leveling cavities; k, round-nose chisel, for leveling cavities; l, sharp edged notched scraper, for sinking flutings; m, half-round rasp; n, round file; o, flat file; p, German half-round rasp; q, r, safe-side rasps; s, t, marteline chisels; u, v, puncheons; w, x, y, parting tools, with curved ends in rasp or file; z, a', gravers and burins; b', c', *houguettes* or etching needles; d', e', gravers and burins; f', parting tool, with curved rasps; g' to t', moulding chisels and scrapers, having edges of varying patterns; u', wimble, for drilling; v', stone-worker's bench; w', x', marteline hammers; y, square; z', triangle; a'', bevel; b'', c'', d'', rules and straight edges; e'', f'', g'', saws of various sizes and construction; h'', i'', j'', k'', compasses of various sizes and forms; l'', scabilla, or wooden bowl for holding sand and water; m'', handsaw; n'', level; o'', mallet; p'', q'', sledges; r'', s'', t'', u'', chisels of various sizes; v'', ladle for feeding sand and water to the saw; w'', x'', hand saws.

Contamination of the Air by Artificial Illumination.

In judging of artificial light from a sanitary point of view, we must consider its effect on the visual organs as well as on the other organs, and we have to notice both the effects produced by the products of combustion on the air we have to breathe and the increase of temperature due to the flame. Frederick Erisman has made some comparative measurements in both directions with different means of illumination. The results were published in the *Zeitschrift für Biologie*, xii., 315.

The experiments were made in a portion of the laboratory inclosed with wood and glass walls, and having a space of 353 cubic feet, or 10 cubic meters. The air was drawn out of this space at different heights by means of aspirators. By the use of a forked tube, a portion of the air was conducted directly into baryta water, and another portion through a tube filled with oxide of copper and kept at a red heat, and then into baryta water. The first portion gave the percentage of carbonic acid in the air, and the second the amount of other carbon compounds. The lights used for comparison were obtained by burning stearine candles, rape seed oil, petroleum, and coal gas. They burned for eight hours in this space with as equal flames as possible, and in the experiments with the candles six were burned at a time. The results of the measurements lay no claim to absolute exactness, because a whole series of inaccuracies, difficult, if not im-

possible, to remove, come in here; nevertheless they are of interest for relative comparison. The figures obtained show that, under all circumstances and with all kinds of luminants, the air of an inclosed space contains more carbonic acid and carbonaceous organic substances than in the absence of artificial illumination; yet in Erisman's experiments the quantity of carbonic acid was never greater than 0.6 or 0.7 per 1,000, while the percentage of other carbon compounds was extremely variable, so that the amount of carbonic acid is not a correct criterion for the pollution of the air. The quantity of carbonic acid actually found in the air of this experimental chamber was only a small fraction of that produced by combustion, so that by far the greatest part escaped by natural ventilation.

To compare the relative contamination of the air by the four luminants mentioned, the amount of carbonic acid and hydrocarbons was reduced to the standard of six normal candles. It was shown that with lamps of good construction petroleum contributed less carbonic acid to the air than any other source of light tested; and, what is more important, less of the products of incomplete combustion. Also that by equal illumination stearine candles contaminated the air most of all.

In regard to rise of temperature, Erisman made his experiments at four different places. They show that during the eight hours of the experiment, the lower strata of air, up a height of 5 ft., increased but slightly, on an average 3.5° to 5°, while the temperature of the uppermost strata near the roof increased considerably; for gas, oil, and petroleum this increase was 19° to 19.5° Fah., and for candles only 7.12°.

If we regard the photometric effect of the flames during the experiments, it showed that with equal illumination rape oil and gas increase the temperature much more than petroleum, so that the action of the latter is about equal to that of the candles.

RORES made from sheep's entrails are now made at Oakland, Cal., to be used for hoisting in mines.

NEW LUBRICANT-TESTING MACHINE.

We illustrated quite recently Professor Thurston's apparatus for testing lubricants. We now present another machine for the same purpose, the invention of MM. Deprez and Napoli, which also serves for purposes of comparison of various oils, etc., by giving for each a distinctive trace on suitably ruled paper.

A, in our engraving, is a plate, adjusted perfectly level and polished. It is rotated by gearing from the pulley, G. This plate supports a second plate, B, by the intermediation of three pieces of bronze, S, S', S'', which make an angle of 30° with the vertical, and of each of which the surface in contact with plate, A, is of precisely similar dimensions, namely, one square inch. From this it results that the pressure exercised on the plate, B, by the lever, R, is equally distributed over the three pieces.

In order to measure the co-efficient of friction of any oil, a certain quantity is placed between the two plates; the friction developed by their relative movement tends to draw the plate, B, and this tractive force is as much greater as the lubricating quality of the oil is the less. In order to measure the extent of the drawing, to the plate, B, is attached a very thin steel ribbon, connected at its other extremity to a very easily moved pulley, which is mounted on points, and to the axis of which is secured the pendulum, P. Representing by L the distance from the center of gravity of this pendulum to the axis of suspension, by t the angle which the right line joining these points makes with the vertical, by R the radius of the pulley over which the steel ribbon passes, and by P the weight of the pendulum, the relation between these five quantities is expressed by the equation: (1) $fR = PL \sin. t$, whence (2) $\frac{f}{R} = \frac{PL \sin. t}{R}$

But the rod, R, of the pendulum carries, at any point of its length, a roller which engages upon a vertical piece, V, attached to a carriage, C, the latter mounted on wheels which traverse rails. If we represent by y the displacement of the carriage, corresponding to a deviation, t , of the pendulum, by l the distance of the roller fixed to the pendulum from the axis of suspension of the latter, we evidently have $y = l \sin. t$. This, compared with (2), gives $y = \frac{fR}{PL}$; or, in other words, the displacement of the carriage is proportional to f , that is to say, to the rubbing friction.

The carriage carries a sheet of paper, against which is pressed at will a pencil, F, which has a very slow motion of translation proportional to the number of turns of the platform, A, and the direction of which is perpendicular to that of the movement of the carriage. The curve traced on the paper by the composition of these two movements is then the curve representing the value of the friction in terms of the number of turns made by the platform, A. Simple inspection of the curve, therefore, is all that is needed to determine at once the intensity of the friction at each instant, and its quadrature will give the total work absorbed by the machine. The chart on which the curves are described is suitably divided and marked, horizontally to show number of turns, and vertically to indicate effort in lbs. or kilograms. Each variety of oil gives a clearly distinct curve from other varieties, so that its relative lubricating power may be readily estimated.

Discontent.

How universal it is! We never knew one who would say "I am contented." Go where you will, among the rich and the poor, the man of competence, or the man who earns his bread by the daily sweat of his brow, and you hear the sound of murmuring and the voice of complaint. "The other day," said Freeman Hunt a good while ago, "I stood by a cooper, who was playing a merry tune with his adze around a cask. 'Ah!' said he, 'mine is a hard lot—for ever trotting round like a dog, driving away at a hoop.' 'Heigho!' sighed our neighbor, the blacksmith, in one of the hot days, as he wiped the drops of perspiration from his brow, while his red hot iron glowed on the anvil; 'this is life with a vengeance, melting and frying one's self over the fire.' 'Oh, that I were a carpenter!' ejaculated a shoemaker, as he bent over his lap-stone; 'here I am, day after day, working my soul away in making soles for others, cooped up in this little seven by nine room.' 'I am sick of this out-door work,' exclaims the carpenter, 'broiling and sweating under the sun, or exposed to the inclemency of the weather—if I only was a tailor!' 'This is

too bad,' perpetually cries the tailor, 'to be compelled to sit perched up here, plying my needle—would that mine was a more active life!' 'Last day of grace—the banks won't discount—customers won't pay—what shall I do?' grumbles the merchant; 'I had rather be a dray horse—a dog—anything!' 'Happy fellows!' groans the lawyer, as he scratches his head over some perplexing case, or pores over some dry record—'happy fellows! I had rather hammer stone than cudgel my brain on this tedious, vexatious question.' And through all the ramifications of society, all are complaining of their condition

in a state of compression. On the lower frame of the buggy are represented two parallel longitudinal bars, E, strengthened by a cross girt, F. There are also two metal braces, G, extending diagonally from the corners to the center, these being secured to the lower sides of the hind axle tree and rocker, and also to the cross girt, F, in the center. These prevent either axle tree or rocker from being turned over by the action of the springs and load. On each side of the lower frame, secured thereto and to the body, is a link, H, which prevents the body being tipped sideways on the occupant's

getting in or out. This link is made of metal, and consists of two brackets and an intermediate connection. The brackets are attached respectively to frame and body; and the bolt holes on the link are elongated so as to allow of some freedom of action. The remainder of the body is constructed in the usual way. The device is well calculated to add to the lightness of vehicles, both in appearance and in actual weight; while it is also neat and compact.

Patented through the Scientific American Patent Agency, February 13, 1877. For further information, address the inventor, Mr. Lucius A. Fogg, Parker City, Armstrong county, Pa.

More Mysterious Clocks.

M. Cadot, of Paris, has recently invented a curious clock which deserves a prominent place among the number of similar ingenious devices which we lately described. It has two apparently free hands placed in the center of a double pane, the two sheets of glass composing which

are held in an ornamental frame. The clock is operated by concealed mechanism in the frame, which once a minute causes a slight and nearly invisible motion of one of the glasses. This causes the movement of the minute hand, and a minute train of gearing concealed in the pivot of the latter actuates the hour hand.

Mr. Robert Heller, the conjurer, has lately been exhibiting a clock of his own invention, the mystery of which no one, we believe, has yet fathomed. It is a clear disk of glass, marked with the usual numbers. The hands have no bulb or other enlargement at the center, where it might be imagined mechanism could be concealed, and appear to be simply pivoted to the face. A ring like that of a watch suffices for the support of the clock from two cords suspended from the ceiling. At the command of its owner, the clock marks any hour, moves backward or forward, and otherwise behaves in an astonishing manner. The use of the cord naturally suggests concealed wires and electricity, which is probably the secret of the movement. But this theory is somewhat damaged when the magician removes the clock from its cords, and, holding it with two fingers at arm's length, carries it in the midst of his audience and causes it to continue its performances under the very eyes of the people, allowing the closest inspection. One clock like that would serve as an invaluable aid to an exhibiting spiritualistic medium, and would cause widespread rejoicings among the elect.

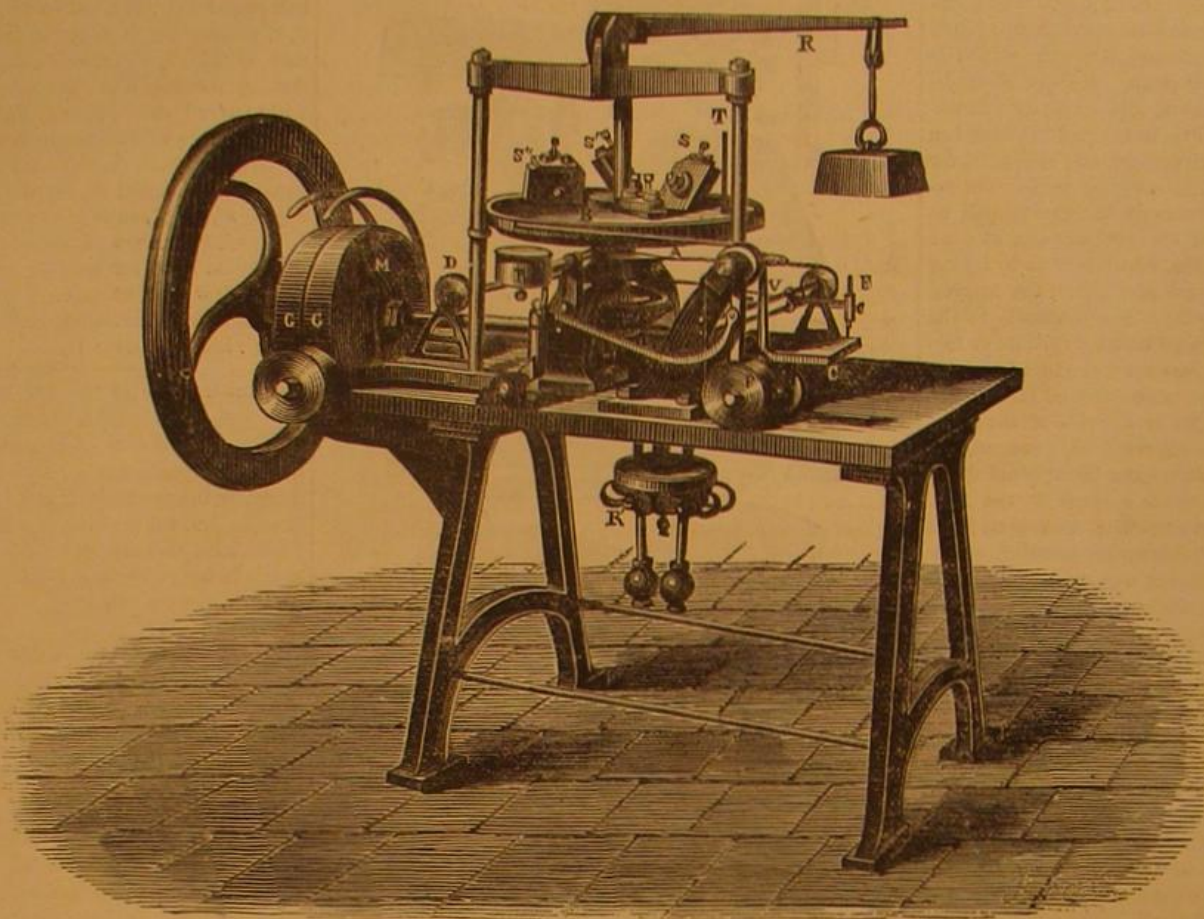
A Dog Show in New York.

We are informed that a dog show of considerable magnitude is to be held at the Hippodrome in this city in May next. A number of sporting and non-sporting dogs are expected from England and Canada to compete for the prizes, which will be numerous and valuable. The foreign contributions will add interest to the exhibition. It is expected that this will be the largest show of the kind ever held in this country. Messrs. Tiffany & Co. head the list of those offering special prizes, which is a guarantee that they will not be of a cheap or inferior quality.

Mr. C. Lincoln, who may be addressed at P. O. Box 2832, N. Y., is Superintendent of the exhibition, and of him all information may be had. Entries are not to be received after April 25, except from abroad. Foreigners are allowed till May 1.

To soften metal castings, bury them in sawdust in an iron box. Make it airtight with clay, and subject to a red heat for several hours. Let the whole cool before taking out the castings.

CUTLER'S cement, for fastening blades of dinner knives in ivory handles, consists of rosin 4 parts, beeswax 1 part, plaster of Paris or brickdust 1 part. Fill the hole in the handle with the cement, heat the tang of the blade, then press it in.



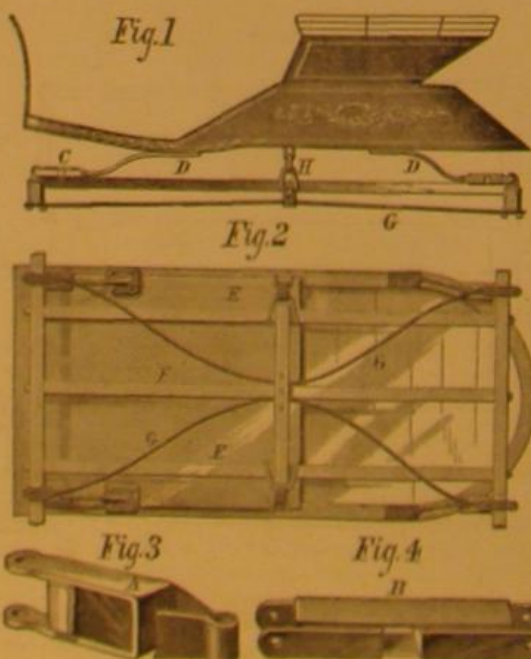
DEPREZ AND NAPOLI'S LUBRICANT TESTER.

—finding fault with their particular calling. 'If I were only this or that, or the other, I should be content,' is the universal cry—'anything but what I am.' So wags the world, so it has wagged, and so it will wag."

IMPROVED VEHICLE SPRINGS.

We illustrate herewith a new construction of springs for vehicles, which is light, easily applied to any style of carriage, and not costly. The springs, we are informed, weigh but one lb. each, and they are connected to the wagon body and frame by a simple arrangement of brackets. The manner in which the springs are made will be understood from Figs. 3 and 4 of the engraving. Fig. 3 consists of two interlocked metal pieces, A, between which rubber is inserted. This is termed a single spring. In Fig. 4, which is a double spring, two half boxes are interlocked with a third piece, B, thus making two spaces, both filled with rubber. The latter may completely fill the space, or may be notched or cut away to regulate the elasticity of the spring.

It will be seen from Fig. 1 that double springs are at-



tached at one end to the upper parts of the hind axle tree and rocker, C, by means of bolts. Their opposite ends are fastened to brackets, D, which are secured to the body so as to support the same; thus holding the rubber in the springs

SOME MEMBERS OF THE LIZARD FAMILY.

We published, on page 295 of our volume XXXIII, and page 311 of volume XXXV., some engravings of typical members of the family of iguanas, a very numerous species of the genus of lizards. The name iguana (says the Rev. J. G. Wood, from the pages of whose admirable "Illustrated Natural History" we select the annexed engravings) is employed loosely to many species of lizards, such as the monitors and varans, which in reality have little in common with the true iguanas. These reptiles can mostly be distinguished from the rest of their tribe by the formation of their teeth, which are round at the roots, swollen, and rather compressed at the tip, and notched on the edge. There are generally some teeth on the palate. All the true iguanas, moreover, are natives of the New World.

Our first illustration shows the marine oreocephale, an animal first discovered by Mr. Darwin on the turtle-haunted coasts of the Galapagos Islands. It is amphibious, and passes a considerable portion of its time in the water. Mr. Darwin says: "It is a hideous-looking creature, of a dirty black color, stupid and sluggish in its movements. The usual length of a full grown one is about a yard, but there are some even four feet long. I have seen a large one which weighed 20 lbs. These lizards are occasionally seen some hundreds of yards from the shore, swimming about, and Captain Collnett says that they go out to sea in shoals, to catch fish. With respect to the object, I believe he is mistaken, but the facts stated on such good authority cannot be doubted."

"When in the water, the animal swims with perfect ease and quickness by a serpentine movement of its body and flattened tail, the legs during this time being perfectly motionless and closely collapsed on its sides. A seaman on board sunk one with a heavy weight attached to it, thinking thus to kill it directly; but when, an hour afterward, he drew up the line, the lizard was quite active. The limbs and strong claws of the lizard are admirably adapted for crawling over the rugged and fissured masses of lava which everywhere form the coast. In such situations, a group of six or seven of these hideous reptiles may oftentimes be seen on the black rocks, a few feet above the surf, basking in the sun with outstretched legs."

The throat of the marine oreocephale is not formed into a pouch, but the skin is loose, and the animal can dilate it at will. The body is covered with sharp, tubercular scales; a crest of longer scales runs along the back. The teeth are sharp and three-lobed, and although, when the mouth is opened, they present a very formidable array of weapons, the creature is quite harmless, and feeds on vegetable diet, seaweeds forming the chief part of its subsistence. The middle toes are united by a strong web, and the claws are large. There is some difference in the aspect of the young and the adult, which is most obvious in the head, where the scales are rather convex in the young, but in the adult are enlarged into unequal and rather high tubercular shields.

Our second engraving is one of a basilisk, an animal mentioned in Scripture and known to heraldry, but whose existence was long regarded as apocryphal. Its name (from the Greek *basileus*, a king) was bestowed on it on account of its supposed authority over other reptiles, which perished, according to ancient writers, in the glance of the basilisk's eye. "This poison," says Topsel, "infecteth the air, and the air so infected killeth all living things, and likewise all green things, fruits and plants of the earth, it burneth up the grasse whereupon it goeth or creepeth, and the fowls of the air fall down dead when they come near his den or lodging." Other writers state that the crowing of a cock would so alarm the reptile that, on hearing the sound, it would fly into the depths of the desert and there conceal itself. Travelers in the deserts of Libya were recommended to carry with them a supply of roosters, to drive away the basilisks from the routes. In all probability, a basilisk, as shown in our engraving, was once found in the East; and its ugliness being exaggerated by successive writers, these fables became

generally believed. The basilisk is a good climber of trees and can swim well; and its food consists apparently of insects and various little creatures which frequent the water and its banks. Its greatest length is three feet; and along

animal was thought to be aquatic in its habits; but it is now known to live on trees, and to employ the membranous expansions to aid its passage from branch to branch, after the fashion of the flying squirrel. Its color is brown above, with a yellowish tinge on the spine, crossed with dark brown lines. Below it is of a whitish gray color.

Cleopatra's Needle.

Through the liberality of an eminent physician and scientist, Dr. Erasmus Wilson, of London, the plan for moving the obelisk—presented to the British Government some years since by Mehemet Ali—to England is about to be carried out. In our issue of March 25, 1876, we published an engraving of this celebrated relic, and stated that plans had been suggested for conveying it to London. The London Times gives the history of the obelisk, from which we extract the following:

It is to the period of Egypt's splendor, the summit of its power, and the reign of Thothmes III., the powerful monarch and conqueror, that the fallen obelisk of Alexandria belongs, and it was one of the triumphal columns raised by that monarch to record his victories over Asia and Ethiopia. The central line of hieroglyphs on each side the original dedication contains the name and titles of the monarch and records that it was erected to the god Ra, or the Rising Sun, and to Tum, or the Setting Sun, on the occasion of the festival of thirty years at On or Heliopolis.

The inscription states that it was capped with gold, but of course it has been stripped of that ornamental portion. How or when it fell is unknown; probably the effects of an earthquake or the undermining of the soil by the sea, to which it lies near, may have caused it to fall. The pedestal is still *in situ*, and at the base was found a dial showing that it had either stood in the Hippodrome or else served as a gnomon to the Caesareum. In the days of Pliny both were erect, and he attributes them to Miphres or Moeris, the classical name of Thothmes III. It was, perhaps, not erected in his reign, for two lateral lines of hieroglyphs, one on each side of the central one, have been added by Ramesses II., more familiarly known as Sesostris.

When the Emperors of Rome began to embellish the Eternal City with these spoils of vanquished Egypt, it is difficult to know why the two obelisks of Alexandria were left behind, except that, as they stood in the Caesareum and were convenient landmarks, they might have been left as a monument to Caesar and a guide to mariners. The last obelisk transported to Europe and set up in the Place de la Concorde, at Paris, was selected for its superior beauty and finer condition, the standing obelisk of Alexandria being rejected on account of its worn state, especially on that side which faces the sea. The idea of removing the fallen obelisk to England,

as a memorial of the departure of the French from Egypt, was entertained at the beginning of the present century, but it was abandoned in consequence of orders from Lord Keith and General Fox, who held command of the naval and military forces in the Mediterranean; and a bronze plate, commemorating the principal events of the campaign, was inserted in the pedestal of the obelisk. Mehemet Ali presented it to the Prince Regent, and the gift was accepted by the British Government. The question of its removal was seriously entertained, but the estimate of the expense deterred the government from the attempt. But the question was again brought forward in 1876 by General Sir J. E. Alexander, and there is now every prospect of its being removed and being placed on an appropriate site on the Thames Embankment. The removal is to be undertaken by Mr. John Dixon, civil engineer, who proposes the following means of transporting this shaft of granite: The sand is to be cleared away, and the obelisk set square, parallel with the existing sea wall. An iron cylinder, finished off to a chisel edge, with sufficient diaphragms to give it strength, is to be constructed round the obelisk, which is to lie in the long axis of the cylinder and to be wedged and caulked where it passes through the diaphragms so as to divide the cylinder into water-tight compartments. The cylinder is to be ninety-five feet

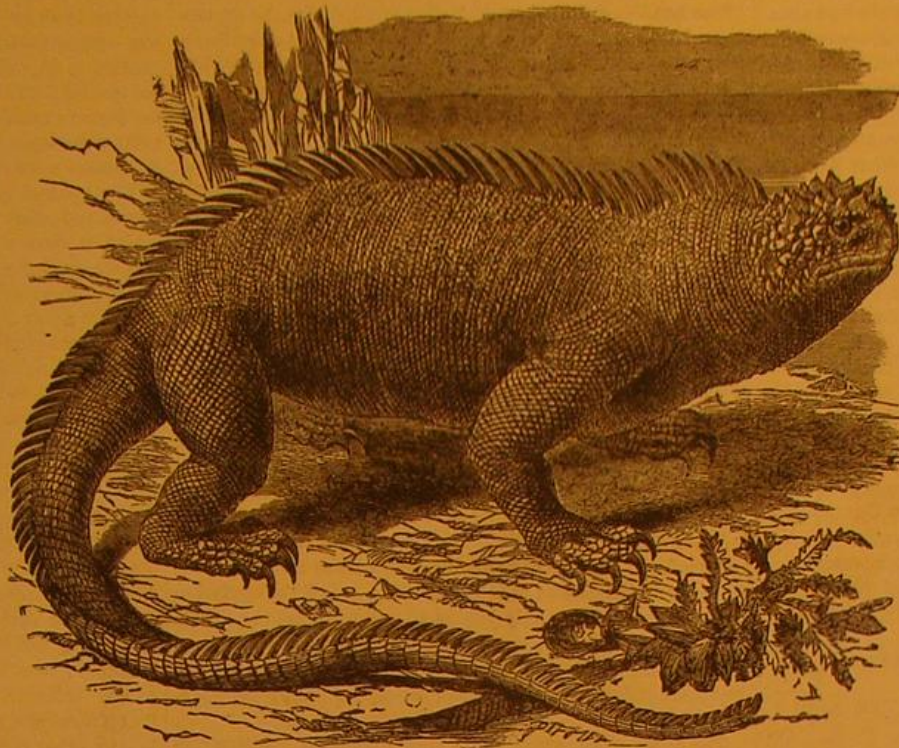


Fig. 1.—THE MARINE OROCEPHALE.

the back, in place of the row of pointed spines usually found on an iguana, runs one crest-like membrane, another occupying the upper surface of the tail. There is a slight pouch on the throat, and the palate is toothed.

Our third engraving is a fringed tree gecko (*Ptychozoon homalocephala*), one of the sub-order of lizards termed *pachyglossa*, or thick-tongued. It is a native of Java, and is worthy of notice on account of the broad membranous ex-



Fig. 2.—THE BASILISK.

pansions which fringe the sides of the head, back, limbs, and tail. On the body this membrane is covered with scales, and waved on its edges; but on the tail, the waves become suddenly deepened, so as to form bold scollops. The toes are webbed to the tips, and, with the exception of the thumb joint, are furnished with claws at the swollen extremity. The scales of the back are smooth and flat, and even the membranous fringes are covered with scales. Formerly this



Fig. 3.—THE FRINGED TREE GECKO.

long by fifteen feet diameter, and will have a draught of nine feet of water when afloat. All being riveted water-tight, it will be rolled into the sea and across the sandy bed of the water until it floats. It will then be turned over and the manholes at the top opened, and about thirty tons of ballast will be put in to keep the ends vertical, so as to act like stem and stern. It will then have two keels, a rudder, spar deck, mast and lug sails attached, and be provided with an anchor and good chain cables, and, if necessary, a pump in case of leakage. The cylinder ship will then be fit to go to any port of the world with its freight, and in any weather.

The cost of this operation will amount to about \$15,000. The obelisk in its case will be towed over during the summer months and laid aside the Thames Embankment on a platform properly prepared for the purpose and lifted high enough to clear the parapet, and the bilge keels and other additions being stripped off, the cylinder will be rolled to the proposed site and then stripped off the obelisk, which will lie ready to be elevated to its pedestal, an operation which will be simply effected by means of a few balks of timber and two small hydraulic rams. The whole cost is not to exceed \$50,000, and that of the obelisk at Paris is said to have been \$400,000.

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 April, 1877.

Mercury.

Mercury cannot be seen early in the month. On April 1, it rises at 5h. 42m. A. M., and sets at 5h. 52m. P. M. On the 5th, it is at its superior conjunction, that is, it ranges with the sun and on the side remote from the earth. On the 30th, Mercury rises at 5h. 49m. A. M., and sets at 8h. 47m. P. M. At this time it should be looked for in the twilight, some degrees north of the point of sunset.

Venus.

Venus cannot be seen. It is approaching superior conjunction, is apparently small, and ranges nearly with the sun.

On the 1st, Venus rises at 5h. 32m. A. M., and sets at 5h. 32m. P. M. On the 30th, Venus rises at 5h. 1m. A. M., and sets at 6h. 40m. P. M.

Mars.

Mars can be seen only in the morning. On April 1, it rises at 2h. 14m. A. M., and sets at 11h. 20m. A. M. On the 30th, Mars rises at 1h. 24m. A. M., and sets at 10h. 56m. A. M.

Mars can be recognized on April 30 by its position relatively to the double star α^2 Capricorni. It is south and east of this well known star.

Jupiter.

Jupiter is coming into better position. On April 1, Jupiter rises at 1h. 2m. A. M., and sets at 10h. 4m. A. M. On the 30th, Jupiter rises at 11h. 6m. P. M., and sets at 8h. 8m. the next morning. Jupiter is very low in the south, but can easily be known by its size. It is among the stars of *Sagittarius*, moving very little through the month, stationary on the 19th, and after that date is retrograde in its motion.

Saturn.

Saturn is visible for very few hours. It rises on April 1 at 4h. 53m. A. M., and sets at 3h. 57m. P. M. On the 30th, Saturn rises at 3h. 6m. A. M., and sets at 2h. 18m. P. M.

Uranus.

Uranus is the only planet in a good position for observations. On the 1st, Uranus rises at 1h. 56m. P. M., and sets at 3h. 48m. the next morning. On the 30th, Uranus rises at noon and sets at 1h. 53m. A. M. of the next day.

Uranus is occulted by the moon on the 21st a little after midnight. The moon passes directly between the earth and the planet, and hides the latter from our view. According to the *Nautical Almanac*, the planet disappears behind the moon at 12h. 31m. A. M. (Washington time), and reappears at 1h. 24m. A. M. of the 22d.

Uranus will be low in the northwest at this time, but it will not set until some twenty-five minutes after two; and as the moon will be just past its first quarter, the observation of the phenomena can be easily made, and cannot fail to be interesting. An ordinary opera glass will render Uranus visible as the moon approaches it, and the difference of color between moon and planet will be very noticeable.

Sun Spots.

The report is from February 19 to March 16 inclusive. The pictures of February 19 and February 21 show the sun's disk free from spots. From February 21 to March 1, photographing was prevented by clouds. The pictures of March 1 and March 3 show, near the center of the disk, a large group, consisting of a large spot surrounded by a chain of small ones, and above this a very small spot. On March 5 the small spot could not be found, and a change was observed in the number and arrangement of the spots in the group. On March 6 the small spots in the group were no longer seen, and only the large one remained, while near the center a pair of large spots was observed which had not been visible on March 5. The observation of March 8 showed the group still visible, but the single spot had passed off. On March 9 the disk was free from spots. On March 10 a very small spot in the midst of faculae was seen on the western limb. From March 10 to March 16, whenever observations have been made, the disk has been uniformly free from these phenomena.

[For the Scientific American.]

THE SEPARATION OF COBALT FROM NICKEL BY COLORIMETRIC TEST.

BY LEONIDAS SCHUCH, PH.D., NEW YORK.

The handbooks of chemistry give methods for the separation of cobalt from nickel which could only be practically used when operated on a large scale, and with a considerable expenditure of time and money. Induced some time ago to seek a practicable method, I herewith give the results of my experiments to the public. The ore used was iron pyrites carrying cobalt and nickel free from arsenic, dispersed in green or black hornblende. This ore is found at Stony Point, Rockland county, N. Y., where a vein of it appears almost on the surface. The mat produced by cupola furnaces consists especially of sulphuret of iron, about 1 per cent of cobalt and nickel, and 3 per cent of copper. The mat is nearly all dissolved by diluted sulphuric acid, copiously evolving sulphureted hydrogen. Iron vitriol stays in solution, and this is crystallized and brought to market, and the remainder is a muddy, black deposit in the form of carbureted iron, bisulphureted iron, and the sulphurets of cobalt, nickel, and copper, slowly and only partially soluble in concentrated acids. The black residuum is separated from the mother liquor by strong pressure, and mixed to a pulp with English sulphuric acid in ample stone jars, and soda saltpeter added (with occasional stirring) as long as red vapors rise. Very remarkable heating of the mixture takes place, and nitrous acid is evolved. The end of the operation is at hand when the pulp begins to solidify, and the whole mass appears of a rather brown color. The mass is then emptied into vats, and cold water under agitation added. The undissolved part, consisting mostly of sandy particles, is deposited there.

The clear supernatant liquid which holds in solution (besides the salts of iron) the salts of cobalt, nickel, and copper, is mixed with a thin pulp of hypochloride of lime, until ferrocyanide of potassa fails to produce a blue color. Finally the iron salts are thrown down with chalk. The liquid separated from the iron salt contains now cobalt, nickel, and copper. After passing sulphureted hydrogen gas through the solution (by which operation the copper is taken out), the liquid, holding considerable quantities of lime salts, is treated with sulphuret of soda (which latter is prepared by boiling together soda, slaked lime, and sulphur). The deposit of the sulphureted metals is washed as much as possible, pressed, and, by additions of concentrated sulphuric acid and soda saltpeter, dissolved. The liquid, brought to the boiling point, is neutralized with soda until metallic carbonates begin to separate, and then treated with a solution of hypochloride of soda (made of hypochloride of lime and soda); and after each addition, a small portion of the precipitated hyperoxyd of cobalt is separated by filtration to observe the change of color.

By the first precipitation, there is a pink-colored solution produced, which gradually, by continued additions of the precipitating medium, turns to a grayish green. When the filtrated liquid stays at a pure green, the point is at hand where all the cobalt is separated. A solution of a pure nickel salt, kept in a test tube of the same diameter as that used for filtration, can serve as a guide.

To ascertain when the separation of the two salts is perfect, it is necessary to make a quick test. A small portion, neutralized with an excess of ammonia until a light blue nickel salt solution is obtained, is filtered through a small paper filter. Change of the color (by the formation of oxycobalt salt) of the filtrate is a proof that the separation is not entirely effected; in which case an additional quantity of the hypochloride of soda is carefully added till no change of color takes place after filtration; the separation is then completed. The liquid now is left undisturbed until the clear supernatant part can be drawn off, the hyperoxyd of cobalt filtered, and the adherent liquid finally separated from the deposit by pressure. The solution of the nickel is now brought to the boiling point and the metal precipitated by a solution of hypochloride of soda, as hyperoxyd of nickel.

Finally, I have to state that, by the presence of cobalt in nickel salts, or vice versa, the color of either one of the salts is rendered grayish green or reddish green, the phenomenon of which explains itself by the complementary action of red and green.

How to Use a Galvanic Battery in Medicine.

Dr. Herbert Tibbits recently delivered an important lecture on the above subject before the Hunterian Society of Edinburgh, Scotland. After discussing the various modes of applying electricity, he explained that, the dry skin being a non-conductor of electricity, dry metallic conductors from an electrical instrument in moderate action when applied to it produced only sparks and crackling, but no physiological phenomena, the electricity not penetrating the skin; but that, if these metallic conductors were replaced with well moistened sponges, very variable phenomena of contractility or sensibility were produced, according as the electricity acted upon a nerve, a muscle, or an osseous surface. That the voltaic current was applied as an interrupted and as a constant current; in the former case, the current being interrupted by gliding over the skin one or both of the conductors, or keeping one stationary and lifting and re-applying the second at intervals; in the latter, by maintaining both conductors immovable, or by the feet or hands of the patient being immersed in tepid water with which the conducting wires of the battery were in contact. Radcliffe's "positive charge"

was then explained, and it was shown that by connecting the negative pole of the battery with the earth, and carefully insulating the patient, the negative electricity passed away, and that the patient remained charged with positive electricity only. Direct muscular electrization, by placing the conductors upon points of the skin corresponding to the muscle, was then contrasted with indirect muscular electrization, consisting in causing muscular contraction by acting upon the special nerve-trunk and branches, instead of placing the conductors upon the muscle itself, and the methods of electrizing the brain, spinal cord, internal organs, and organs of the senses were shown.

The general principles of electro-therapeutics were then considered: that the influence of faradism in those cases in which it does not produce muscular contraction is chiefly stimulant; that where it does produce contraction it acts in addition as an artificial gymnast, imitating natural muscular action in a way quite impossible to any agency but electricity; that the interrupted voltaic current is similar in its action upon muscle to faradism; but that this is complicated by chemical effects upon the animal tissues, and by special influences upon the central nervous system. That the constant voltaic current differs altogether from either of the above; that it consists not only of a current which is continuous, and which does not vary in power during the application, but of this current so applied to the patient by the operator that its flow through that part of the patient's body to which it is directed shall be as continuous as the stream of the current from the battery to the conductors; and it was strongly insisted upon that unless thus applied it is not a constant current at all, and that its therapeutic application will be unsatisfactory; that the effects of the current thus applied are chiefly sedative, restorative, or refreshing and absorbent; that it possesses great power, power sometimes unapproached by any other remedy, in relieving pain; that in its application for the relief of neuralgia the sponges should be so applied as to include the affected nerve in the circuit; that the strength of current should not be sufficiently great to produce pain; and that not only should the conductors be maintained quite immovable, but that care should be taken that the strength of the current should be so gradually increased that no shock is felt, and at the end of the application it must be as gradually decreased. Length of application from five to ten minutes, and frequently, usually, once or twice daily.

Dr. Tibbits believes that in severe and obstinate cases the full sedative effect of the current is only to be obtained by applying it as frequently as the paroxysms of pain recur. The use of electricity in muscular rheumatism and rheumatic gout was next considered, and cases quoted. In cerebral paralysis no support was given to cerebral galvanization, and it was advised that peripheral faradization should not be used until three or four months after the attack, and then only of a strength just sufficient to bring the muscles into full contraction, but that in cases in which the paralyzed muscles were cold, blue, flaccid, and ill-nourished, they should be well sponged with the voltaic current alternately with faradization. Applications to be made daily, or every other day, for from five minutes to fifteen minutes. In spinal paralysis the evidence in favor of direct electrization of the cord was said to be much greater than could be adduced in support of similar treatment of the brain, and when powerless to cure, it not unfrequently relieved some of the most distressing symptoms. Peripheral faradization should not be employed during the early periods of active mischief in the cord, but in the persisting localized paralysis following upon myelitis it is often of the greatest service, especially in relieving symptoms of paralysis of the bladder and rectum: the dribbling of urine, which is so troublesome in some paraplegic cases, being frequently relieved. In locomotor ataxia the constant current was recommended as often relieving many of the symptoms. Reference was made to Dr. Poore's successful treatment of writer's cramp by localizing the voltaic current in the nerves of the affected muscles, and exercising these muscles during the passage of the current by various gymnastic movements; and two successful cases were quoted in which faradization of the antagonists of the suffering muscles, united with the localization in the muscles themselves of Radcliffe's "positive charge" for fifteen minutes daily, had resulted in a cure. The subject of essential infantile paralysis was then discussed, the lecturer saying that the more his experience of this disease extended the more strongly did he feel how lamentable it is that the physiological treatment of the affected muscles in this affection has not yet become the routine treatment invariably directed by the practitioner in attendance, and that within a short time of the onset of the disease. Were it so, he added, an incalculable amount of helplessness and subsequent unhappiness would be spared to children; and if proper treatment is adopted in time, the greater number of cases admit of cure, and where perfect recovery cannot be obtained we have the great authority of Mr. William Adams for the statement that deformity ought never to result.

A case was then detailed which was first seen by Dr. Tibbits in 1869. The child was then suffering from a typical attack of infantile paralysis affecting the muscles of the left thigh and leg. Electrical treatment was recommended, but circumstances only allowed of its administration upon three or four occasions, and the child went to India, returning in June, 1875, with a useless leg measuring some inches less in circumference than the healthy limb. There being complete abolition of reaction to both currents in all the affected muscles, no hope of benefit was entertained; but at the earnest

request of the mother, she was taught how to apply electricity, and recommended to do so daily, in addition to shampooing. The treatment has been carried out almost daily for sixteen months with a result that is surprising. There is now little difference in the appearance of the two limbs; there is reaction in all the muscles but the anterior tibial muscles, and a large amount of voluntary power has returned.

NEW YORK ACADEMY OF SCIENCES.

The regular monthly meeting of the Academy was held at 64 Madison Avenue on March 5, 1877. After some routine business and the election of several new members, Mr. T. O'Connor Sloane, E.M., read an interesting paper on a new and accurate method of

DETERMINING SULPHUR IN ILLUMINATING GAS.

After describing and illustrating the methods usually employed, Mr. Sloane proceeded to exhibit his apparatus, which, he claimed, possessed the following advantages: First, the air which supports the flame is purified to remove any sulphur contained in it, an important precaution when performing an analysis in or near the place where the gas is made; second, no aspirator is required. The burner employed is made by unscrewing and removing the base of the ordinary Bunsen burner, closing all the openings but one, and inserting it in a brass tube 1 inch in diameter. A tapering or funnel-like tube is screwed to the lower end of the latter, thus reducing its diameter to half an inch, so that it can be inserted into the perforated cork of a large bottle. Another tube about 2 inches in diameter and 2 inches long is screwed on the upper end of the latter, and filled with water to form a water joint about the chimney of the burner. A large bent tube of glass leads all the products of combustion into a large tubulated bottle, placed horizontally and containing a solution of permanganate of potash and hydrochloric acid. From the tubulus of this bottle another tube leads into a second bottle containing the same mixture. About 5 cubic feet of gas are burned in a small thin flame. The air which supplies the burner passes through a bottle filled with broken glass and marbles, which are moistened with a solution of permanganate of potash. The sulphur compounds in the gas are burned, forming sulphurous and sulphuric oxides; by contact with the chlorine and permanganate of potash they form sulphate of potash. At the close of the operation the liquid should still have a violet color. The excess of permanganic acid is destroyed by boiling, or by adding alcohol. The sulphuric acid is then precipitated by means of a barium salt, and weighed as sulphate of barium.

The chemical section met at the same place on Monday evening, March 12, 1877, Professor Martin in the chair.

Mr. Amend exhibited a fine specimen of scapolite.

Dr. Bolton then read a paper by Professor Lupton,

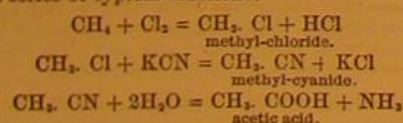
ON THE FISHLIKE ODOR OF POTABLE WATERS.

Professor Lupton ascribes the fishlike odor of some of the waters of Nashville, Tenn., to the presence of *alga* and other low plant forms in the water, since he found that the residue left on filtering the water, and consisting for the most part of *alga*, developed a strong odor of fish when treated with warm water. During the discussion, which arose after the reading of this paper, Mr. Cox was of the opinion that no proof had been adduced to show that the odor arose from *alga*. Professor Leeds remarked that the researches of a French chemist had shown that, as the amount of oxygen dissolved in the water decreased, the amount of lower vegetable life increased. Professor Seely thought it would have been well to have ascertained if the odor did not really arise from the presence of putrefying fish in the water.

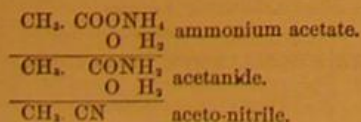
Dr. P. Townsend Austen then read a paper by Drs. Cech and Schwebel, of Berlin, on

A NEW FORMATION OF ISOBENZONITRILE.

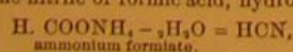
In the course of some introductory remarks, Dr. Austen said that the organic cyanides are particularly useful, since they form the stepping stone from the organic halides to the acids. Thus we are able to pass from marsh gas into acetic acid by a series of typical reactions:



These same cyanides or nitriles, as they are also termed, may be derived by dehydration of the ammonium salt of the acid:

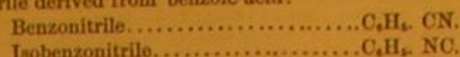


If we examine the constitution of the lowest member of the nitrile series, the nitrile of formic acid, hydrocyanic acid—



we shall see that it contains a tetravalent carbon united with a trivalent nitrogen and a monovalent hydrogen, $\text{H}-\text{C}=\text{N}$. Knowing, however, that nitrogen often appears in the role of a pentavalent element, we can suppose the possible existence of a compound isomeric with hydrocyanic acid, and having the formula $\text{H}-\text{N}=\text{C}$. Although this acid is not known, several of its derivatives are. The first member of this series was discovered by Hofmann, who obtained it by treating aniline with chlorotorm and an alkali. The reaction is $\text{C}_6\text{H}_5\text{NH}_2 + \text{CHCl}_3 = \text{C}_6\text{H}_5\text{NC} + 3\text{HCl}$. This com-

pound is called isobenzonitrile and is isomeric with the benzonitrile derived from benzoic acid:



Lately the class of isonitriles has received the generic name of "carbylamines." The isonitriles of the fat series have in many cases been obtained by treating an organic halide with silver cyanide. The silver cyanide seems to consist of a mixture of AgCN and AgNC . Finally, small amounts of isocetonitrile are obtained in the preparation of the real nitrile by treating potassium ethylsulphate with potassium cyanide. The reactions of the nitriles and isonitriles are different and characteristic. On boiling the acetonitrile, for instance, with an alkali, ammonia is evolved and acetic acid is obtained. On subjecting aceto-isonitrile to the same treatment, methylamine and formic acid are formed.

The paper of Drs. Cech and Schwebel was then read. The authors described the production of dichloroacetic ethyl ether by the treatment of potassium cyanide with chloral hydrate. The dichloroacetic acid was obtained from this ether by treatment with hot concentrated hydrochloric acid under pressure. On boiling aniline dichloroacetate with a dilute solution of caustic soda, the odor of isobenzonitrile was detected. The authors found the products of this decomposition of aniline dichloroacetate were isobenzonitrile, hydrochloric acid, and formic acid.

Cast Steel Without Flaws.

We find in the report of a recent session of the Society of Mineral Industry, of St. Etienne, France, a very interesting communication from M. Pourcel on the fabrication of cast steel without flaws. M. Pourcel stated that, from the day when the different phases of the Bessemer process were explained *a priori*, the means of casting steel without flaws were discovered. It being known that silicon hinders the formation of carbonic oxide, it remained to determine the extent of the applications of the principle; and these are the analytic methods which, at Terre Noire, have led to the production of flawless cast steel. The following are the facts observed:

In the Martin furnace, on softening a gray silicious pig iron by means of successive additions of malleable iron or steel, it is found, by examining samples of the metal after each addition, that at a certain moment the metal is full of flaws. And further, if there be submitted to analysis a sample abstracted immediately before ebullition, silicon is found in combination with the metal exempt from flaws, while the metal may contain interposed scoriae, but not free silicon. Such is the analytic result, the effects of which may be reproduced synthetically, thus: If silicon in the form of silicate of iron be added to a bath of steel entirely formed, the flaws are caused completely to disappear. It is true that this steel is generally red short, a condition attributed to the presence of silicon, not only by steel makers but by many eminent chemists. M. Pourcel, however, doubts the conclusion, and believes that silicon, in the proportions in which it is usually found, does not abstract from the steel any valuable qualities, and does not render it brittle, either when hot or when cold. The flaws which exist in cast steel—as Bessemer pointed out and demonstrated several years ago—are due to the carbonic oxide which is generated in the liquid metal by an intermolecular reaction between the carbon of the metal and the oxide of iron formed during the melting. When the metal remains liquid for a long period of time, the gases escape; but generally, the temperature of steel when run off being but little superior to that of its solidification, the carbonic oxide remains imprisoned, and causes flaws or silvery alveolae disposed symmetrically and perpendicularly to the major axis of the ingot.

Silicon hinders the formation of these flaws, because it is more oxidizable than carbon through intermolecular combustion, the oxidizing body being either peroxide of iron or carbonic acid; but then, in place of the product of oxidation being a gas, it is a solid body which is produced in the mass of the metal, and is found uniformly disseminated among its molecules. It is a silicate of iron, a scoria interposed between the molecules, which renders the metal fragile when hot. The means of removing this scoria is to add a base, which causes it to liquefy; and for this purpose M. Pourcel uses manganese.

Manganese serves in the Bessemer process to remove from the molten metal the peroxide of iron which it holds in solution. It reduces it to its minimum of oxidation by taking one equivalent of its oxygen; and the combination of the oxide of manganese with the silicate of iron which is produced yields a very fluid scoria which liquates.

In lieu of silicide of iron, M. Pourcel has used a double silicide of iron and manganese. The two reducing agents, silicon and manganese, act simultaneously in the mass in fusion to reduce the peroxide of iron, and to prevent the formation of carbonic oxide; and the result of their oxidation is a silicate of protoxide of iron and of protoxide of manganese, very fluid at the temperature of solidification of steel, and which liquates easily. With regard to the silicide in excess, M. Pourcel thinks its effects are not deleterious.

While the process we have described is apparently quite simple in practice, its application is found to be both delicate and complex. Still the difficulties attendant upon it have been in great part resolved, and there is now produced at the Terre Noire foundries cast steel having nearly all the gradations of forged steel, from the hardest to the softest. The perfect homogeneity of these cast steels, a result of their chemical composition and the equilibrium of their mole-

cules (which is produced by a reheating or hardening of varied nature), may, in M. Pourcel's opinion, lead to other results, such as have never been obtained with forged steels.

Transplanting Evergreens.

A correspondent says:

"I am aware that the general opinion and advice are that the time to transplant evergreens, whether trees, shrubs, or vines, is in the spring. I fell in at one time with this idea, and stated that in spring, just as the new growth was forming—just as soon as the buds began to swell—was the time to make a sure thing in the transplanting of an evergreen, no matter what the variety. In a long life of practice in the laying out of gentlemen's places, public grounds, etc., in my way as a landscape gardener, it has come to me that error existed in the aforesaid advice to plant only in the spring. I reason in this way: 1. It is not possible for a large number of those who plant evergreens to have them in the spring just when they should. 2. There is always more hurry of work in the spring than in autumn, and consequently the work of planting is not as thoroughly done as it should be. 3. In the month of September and early October the nurserymen are comparatively at leisure, and can give more and better attention to the digging and shielding the roots from the sun and cold dry winds, before they pack. 4. In the autumn, say from the 1st of September for three months, the evergreen is as near in its dormant state as ever; the ground is warm, and from fall rains is usually moist, without being really wet, as in the spring, and, being warmer than the atmosphere, Nature does what our best gardeners do when they propagate by bottom heat: she furnishes a bottom heat and moisture in sufficiency to cause new roots or rootlets (fibers, if you will) to grow from the wounds made in the work of digging, by which many of the supports of life, to the tree or plant, are lost. This renewal of new roots made in autumn not only aids the tree or plant to support itself during winter, but it goes to work in spring, and supplies food for growth; when the roots of trees planted in spring are struggling to make new fibers in a cold soil with the atmosphere twenty degrees above, and calling through the leaves for food.

"I write not from theory, but based on practical theoretical knowledge, and from practice in removal of thousands of evergreen trees and shrubs in the autumn months. Here let me say, that I prefer from the 10th of September to the 20th of October to do the work; but with due care never to leave the roots half an hour exposed to the sun or dry cold winds. There is no fear of want of success—provided the planter has the ground prepared for planting as it should be, and at the same time knows how to do the work."

A Colossal Organ.

We recently explained M. Montecat's new pyrophone, which consists of tubes of copper in which incandescent pieces of charcoal inclosed in wire gauze are introduced, to create an upward current of air and so to cause the pipes to sound. It is now proposed to construct an instrument on this principle on an enormous scale for the French Exposition of 1878, the tubes being large enough to receive small charcoal furnaces. The inventor points out that his device may be used as a fog signal, as it produces a loud noise and requires scarcely any machinery to operate it.

A New Use for Asbestos.

Some experiments have recently been successfully made in Italy on a new way of burning petroleum under steam boilers. The method consists simply in pouring the oil over a thin layer of asbestos. The petroleum burns with an intense heat; while the asbestos, being incombustible, is not affected, and thus not only serves as a means of retaining the oil, but, being so good a non-conducting substance, the prevention of fire from the volatile oil is obvious. In the experiments, sheets of paper placed beneath the furnace were not injured, despite the fierce incandescence of the oil above.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY AND THE ELECTRIC TELEGRAPH. By George B. Prescott. Illustrated. New York city: D. Appleton & Co.

We have already published in the columns of both SCIENTIFIC AMERICAN and SUPPLEMENT copious extracts from the above work, from which our readers have doubtless derived an idea of the thorough and complete manner with which it deals with some of the branches of the great science to which it relates. Familiar as we are with the progress which has been made in electrical knowledge of late years, we cannot but feel genuine astonishment at the immense advancement evidenced by the volume before us over what was known hardly ten years ago. Here is a book of nearly one thousand pages replete with engravings of devices of marvellous ingenuity, and yet this large volume does not exhaust a subject of which three times ten years ago the world understood scarcely more than a few empirical facts; and even regarding those, few who had studied them agreed. If the 19th century becomes memorable for nothing else, it certainly will be known as the age during which the science of electricity was developed. We have nothing but praise for Mr. Prescott's book. It is the best on its subject not merely in virtue of its being the latest modern work there on, but because it is written by a thorough electrical expert. Mr. Prescott writes whereof he knows, and knows well. He gauges inventions by the rigid rule of practicability and susceptibility to useful ends, and is chary of commendation when he falls clearly to see utility. He is therefore a safe and cautious guide, and the student who follows him will never be landed in doubtful theory or left in perplexity over questionable matters of practice.

A BEAUTIFUL CATALOGUE.—We have received from Messrs. B. K. Bliss & Sons their "Illustrated Gardener's Almanac, and Abridged Catalogue of Garden, Field, and Flower Seeds," for 1877. This is one of the most complete catalogues issued in this country, and valuable both to the practical farmer and florist, as well as to the gentlemen farmers and florists who seek merely to beautify their homes and raise vegetables and flowers for their households. Any one desiring a dollar's worth for 35 cents should remit the last named sum to 34 Barclay street, New York, and obtain a copy free by mail.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED HORSE POWER.

William H. House, Bennett's Cross Roads, N. C.—This invention has for its object to provide an improved horse power for operating cotton gins and other mills.

IMPROVED METHODS OF CASTING CAR WHEELS.

William Wilmington, Toledo, O.—The first of these two patents is for an improvement in the manufacture of cast iron wheels for railway cars, the purpose being to lessen the cost and increase the durability of the wheel. The method consists in casting car wheels from two different qualities of metal by pouring in first the superior metal to form the tread and flange of the wheel, and afterwards the inferior metal to form the central parts of the wheel, and regulating the inflow of both by radial passages, whereby circulating currents and the homogeneous mixture of the two metals is avoided, and the proper disposition of the two metals in the car wheel is secured. The second method here consists of casting car wheels from two kinds of metals, or composition of metals, by first introducing the inferior metal until it shall have attained the level of the barrier formed by the outer raised or swelled portion of the plates next to the rim, then introducing the superior metal to the rim portion through separate channels, and finally continuing the inflow of the inferior metal through its channels to force the superior metal contained in the outer plate portion of the wheel outwardly and upward to cause the latter to fill the upper rim and tread portion of the mould.

IMPROVED METHOD OF CHARGING BLAST FURNACES, ETC.

Charles Hinrod, Youngstown, O.—This invention relates to a method of charging and managing blast furnaces having longitudinal compartments, which consist in feeding ore and flux into one compartment and fuel into the next, and at intervals reversing this mode of charging to distribute the furnace burden, the generated gases being compelled to traverse the compartment in which the ore is uppermost on their way to the exit to their entire exclusion from the ore in which the fuel is uppermost. The means for carrying out the method consists in a longitudinally divided stack having an exhaust pipe that communicates with each compartment of the divided stack through separate pipes with dampers arranged to be alternately reversed and separately controlled.

IMPROVED PNEUMATIC PUMP FOR REFRIGERATING APPARATUS, ETC.

Daniel L. Holden, Covington, Ky.—This invention belongs to that class of pneumatic pumps in which a valve of greater diameter than the bore of the cylinder is used to form the cylinder head. The improvement consists in combining an imperforate piston with a valve of the above construction, and a cylinder having but a single inlet valve, in such a manner that the piston in forcing out the charge of air or gas produces a partial vacuum beneath the same and passes the inlet orifice, whereby the compressed gaseous charge held in said inlet valve chamber is allowed to pass beneath the piston and to expand into and be absorbed by the partial vacuum, so that, upon the downward exhaust stroke of the piston, there will be no charge of compressed air or gas in the inlet valve chamber to expand above the piston and prevent by its elasticity the perfect exhausting stroke of said piston. An outlet check valve is employed in the opposite end of the cylinder from the inlet for the discharge of the compressed charges of the air or gas taken from the said inlet valve chamber.

IMPROVED TOBACCO AND COTTON PRESS.

Allan Talbot, Richmond, Va.—This invention has for its object to enable the operation of compressing tobacco in hogsheads, etc., to be effected with greater convenience and celerity than heretofore. The special feature of the invention is a plunger pivoted to and beneath the immovable head of a hydrostatic, or other form of press, in such manner that, while it is fixed in position as relates to the reciprocating plunger, it may be turned or swung out from under the head of the press in order to facilitate filling the hogshead, preliminary to the compressing operation. A new supply may then be placed in the hogshead, and the compressing operation quickly repeated.

IMPROVED RAILWAY CHAIR AND TIE.

Norman S. White, Millertown, Pa.—Metal ties are employed, and these are joined at the ends to continuous chairs or rail-beds. The ties are preferably T or H-shaped in transverse section, and detachable clamp pieces secure the rails to the beds. The beds or sleepers are grooved to receive wooden strips on which the rails are laid.

IMPROVED SEWING MACHINE.

William G. Cummins, Cookeville, Tenn.—After passing through the fabric or goods to be sewed, the needle is raised a little, to spring the thread loop sufficiently for the point of the shuttle to enter, and is then carried down again, to allow the loop to pass easily on the body of the shuttle, after which it is held stationary, to give the shuttle time to pass through the loop before it is drawn up. The needle is then raised while the shuttle thread is tight, or before the shuttle starts back. The machine is adapted to sew from or toward the operator at will. This function is especially useful when it is desired to double or duplicate a row of stitches, and thereby strengthen or fasten a seam.

IMPROVED SAW-SHARPENING MACHINE.

Parker D. Robbins, Harrellsville, N. C.—This consists of a circular or rotary file having a diagonal groove on its face for carrying the saw forward placed on a suitable mandrel. The said mandrel is journaled to a table which can be adjusted to give the proper bevel to the teeth being filed. The object of this invention is to rapidly file the teeth of a saw at any desired bevel, by rotating the file by means of a crank and suitable gearing, the saw being drawn forward by the diagonal slot in the edge of the file.

IMPROVED MOTIVE POWER.

Jarratt Gross, Catlettsburg, Ky.—Around a large wheel passes a band, which passes around a shaft pivoted to posts, and from which motion is communicated to the machinery to be driven. To the journals of the wheel are pivoted two levers, the outer ends of which are heavily weighted, so that when the levers are raised and allowed to rest upon the shoulders of the projections, attached to the sides of the rim of the wheel, their weight may revolve the said wheel, and thus give motion to the machinery to be driven.

IMPROVED BELT SHIFTER.

William W. Hubbard, Manchester, N. H.—This consists in the combination of a stationary drum, for receiving the belt from the driving pulley, and a follower moved over the said drum by levers or suitable gearing, for forcing the belt from the drum on to the pulley, and also for removing it from the pulley. The object of the invention is to provide a means for shifting belts which shall obviate the difficulties hitherto experienced in using loose pulleys or idlers with the ordinary means for shifting.

IMPROVED ROTARY ENGINE.

Philo A. Knapp and Ira S. Knapp, Danbury, Conn.—This consists of a cylinder having an annular space, in which a rotating piston is placed, and a shaft running through the central portion or core of the cylinder, and connected with the said piston by a thin arm, which passes between annular spring plates, secured in the center of the core of the cylinder. The said plates form a packing, which permits the piston arm to rotate, but closes together after the arm passes, preventing the steam from coming into contact with the shaft.

IMPROVED WIND WHEEL.

George W. Penn, Onawa, and William S. Sharpneck, Missouri Valley, assignors to P. D. Mickel, Missouri Valley, Iowa.—As the velocity of the wheel increases weights are thrown outward by centrifugal force, and mechanism is actuated to turn the fans away from the wind. New means are provided whereby the wheel may be easily adjusted to run at any desired velocity.

IMPROVED DISCHARGE NOZZLE FOR GRAIN ELEVATORS.

Frederick J. Kimball, Philadelphia, Pa.—This is an improved nozzle for the spout of grain elevators, by which the grain may be discharged into a vessel or car in any direction and angle under pressure of air, so as to dispense with the shoveling off and leveling of the heap of grain forming under the spout of the elevator. The device consists of a discharge spout with a valved air blast pipe, and a check plate or telescoping nozzle turning on the spout, and being directed by a forked handle applied thereto.

IMPROVED CAR COUPLING.

James C. Pugh, Ambia, Ind.—This invention consists of a drawhead with recessed and weighted drop gate that bears on the link, which is coupled by a spring hook at the bottom of the car coupling. The spring hook enters through a recess at the bottom of the draw-head. For coupling, the lever is released from the spring hook, the link passing then over the same by raising the gate and coupling automatically by dropping back of the hook.

IMPROVED MACHINE FOR MOUNTING HAIR SWITCHES.

Charles Bourgard, New York city, assignor to himself and Jones Waters, Brooklyn, N. Y.—This is an improved machine for mounting human hair switches, by which one hand may work the machine, while the other hand feeds simultaneously the web of hair in convenient manner, winding it regularly and without danger of taking in or catching any part of the hair. The device consists of a loose cord spool, revolving with a vertical shaft by the tension of the cord, that passes through an end hook of the shaft, and is clamped at the lower end to a tension weight.

IMPROVED EARTH AUGER.

Orson H. Polley and Dwight W. Toles, Plymouth, Mich.—In this device there is an adjustable feed gage, which is slotted vertically, to receive the two bolts by which it is secured to the body, so that it may be adjusted to project less or more, to cause the auger to enter the ground slower or faster, according to the hardness of the earth upon which the auger is operating.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COMBINED HARROW AND CLOD CRUSHER.

William H. Kuhn and Samuel Miller, Albany, Oregon.—This implement is constructed in sections, which are provided with teeth and hinged in such manner that one or all of the sections may be detached as required, or the whole weight of the frame and the driver may be imposed upon any one section when passing over a clod or other obstacle.

IMPROVED PLOW.

Erin D. French, Byhalia, Miss.—This invention consists in an improved point for plows, so arranged that all the various plows ordinarily used in farm labor may be run with the same point.

IMPROVED GRAIN SEPARATOR.

William Edr's, Eugene City, Oregon.—This machine consists of an inner and outer reel located concentrically upon the same shaft, in combination with a trough and spiral conveyor adapted to carry away the impurities passing through the outer reel and a subjacent case connected with the annular space between the two reels by means of a chute, and containing a fan and a set of shaker sieves, which devices effect the new result of eliminating both the large and the small impurities from the commingled wheat and chaff before the latter is admitted to the shaker sieves, which latter, in connection with the fan, separate the chaff.

IMPROVED GANG PLOW.

John R. Cummins, McKinney, Tex.—This gang plow is so constructed that it may be readily adjusted to cause the plows to take or leave land. The wheels may be adjusted closer to or further from the plows.

IMPROVED STRAW STACKER.

William Deetz, Saltillo, O.—The carrier is made of two sections, which are adjustable to different lengths, so that the same may be lengthened or shortened, according to the distance and height to which the straw has to be conducted for storage or stacking. An endless belt takes up the straw and conveys it up along the carrier to the upper end for dropping. Rigid supports at the lower front part secure, in connection with the uprights and brace rods, the rigid position of the carrier in whatever direction the same may be run from the thrasher, the supporting and stiffening rods being merely transposed from one side to the other, and adapted to the position of the carrier when the same is placed in position to run to either side or in straight direction from the machine.

IMPROVED CHURN.

James A. Duryee, Nunda, N. Y.—This churn dasher is so constructed that it may be readily adjusted according to the amount of milk in the churn. It is claimed to bring the butter very quickly, gather the butter thoroughly, to be easily operated, and to work equally well when turned in either direction.

IMPROVED SULKY PLOW.

William N. Riddle, Caddo Grove, Tex.—This sulky plow is so constructed that it may be readily adjusted to take or leave land, and to work at any desired depth in the ground. It may also be readily raised from the ground.

IMPROVED GRASSHOPPER KILLER.

Charles Hoos, Arago, Neb.—This consists of a frame mounted on wheels and having a platform with fingers, which are curved upward, and are designed to enable the machine to pass over obstructions, and to cause the grasshoppers to rise from the ground and fall upon the platform. The platform is grooved and is made highest in the center, and declines toward the front and rear, so that the grasshoppers may be crushed against the shoulders of said rabbets by cross bars attached to endless belts. Rollers are placed at the rear edge of the platform so that any grasshoppers that may not be killed by the cross bars may be crushed.

IMPROVED HAY LOADER.

David F. Roach, Atlanta, Ill.—The construction is such that as the machine is drawn forward one of each pair of toothed bars will rise, carry the hay a little distance toward the wagon, and then descend and move back, while the other bars rise and carry the hay forward a little farther, and so on, until it has been delivered upon the wagon, the alternate bars always moving in opposite directions.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FURNACE.

Edwin Varney, Leavenworth, Kan.—This invention consists in constructing the combustion chamber in a double conical form, and combining it by means of down draft fire flues with the base having side compartments provided with partitions, whereby the smoke and flame is made to emerge from the swelled or enlarged portion of the combustion chamber and pass down the fire flues to the side compartments of the base, and by means of the partition in the same is first directed forward, and then back-

ward, as in a return flue, and thence passes to the exit smokepipe, which arrangement serves to produce a stronger and more compact form of furnace, a better distribution of heat, and a larger radiating surface.

IMPROVED AIR-HEATING ATTACHMENT.

David McAlliston, Walton, N. Y.—The object of this invention is to furnish an improved attachment for hot air or other furnaces, for the purpose of utilizing and economizing the heat which ordinarily escapes into the flue and is thereby wasted. The device is simple and inexpensive in construction, being formed by combining two drums of different size, one being placed within the other, and also provided with partitions or diaphragms of peculiar form for directing the course of the products of combustion in such manner as to most completely eliminate the heat, and thus attain the most economical result. For details of construction and arrangement of parts, see patent.

IMPROVED AIR-HEATING STOVE.

John B. Oldershaw, Baltimore, Md.—This invention covers certain improvements in air-heating stoves of that class in which a drum is arranged in the upper part of the combustion chamber, to which drum air is admitted to be heated and thence escapes into the room. The improvements consist in making the drum detachable, arranging its inlets and outlets to register with corresponding openings in the outer case, and combining with the said drum and outer case detachable sleeves containing dampers or registers, to regulate the admission and escape of the air, which sleeves form break joints to the registering openings of the drum and outer case that prevent the gases from the combustion chamber from commingling with the fresh heated air and escaping into the room.

IMPROVED DRAWER DESK.

Ernest N. Doring, New York city.—This is a desk with a double set of pigeon holes, the whole being so arranged as to shut up and slide into a chiffonier, the back of the pigeon holes being finished the same as the chiffonier front.

IMPROVED TEAPOT.

Ebenezer Oliver, New York city.—This is an improvement in the class of teapots which are provided with a removable perforated or wire-gauze holder or receptacle for tea leaves. The improvement relates to the construction of parts, whereby the tea holder is attached to the bottom of the pot; and also to the combination, with said holder or receptacle, of a device employed for removing the tea leaves subsequent to the steeping operation.

IMPROVED EGG HOLDER.

Pantalon M. Leprohon, Brooklyn, E. D., N. Y.—This consists of clamping leaves or plates, curved to the shape of an egg and supported on spring arms or posts attached to a base plate.

IMPROVED KEROSENE LAMP.

Samuel Dodsworth, Leavenworth, Kan.—This embodies a new arrangement of the oil reservoir and a novel wick tube made with flanges upon the inner surface of its edges, to adapt it to receive a permanent wick, and also the burning wick. The permanent wicks serve to keep the burning wick constantly supplied with oil.

IMPROVED SPRING BED BOTTOM.

John F. Coder, Toledo, O.—This consists of a spring bed bottom made in two sections, one of which is made of thicker strips than the other. It also consists in cross bars for supporting the slats that are covered with chamolite skin, or other material, to prevent noise, and rest in notches in side piece of the bedstead.

IMPROVED LAMP BURNER.

Wirt L. Carter, Monroe, Mich.—This is an improvement in Argand lamp burners, and consists in means for steadying or equalizing the action of the air current to prevent flickering of the flame.

IMPROVED ASH SIFTER.

Thomas H. Badger, Boston, Mass.—This invention consists in placing below the hopper of an ash sifter fingers that are inclined downward from each other, and others that are inclined from the side of vessel downwardly toward each other. The coal is conducted from one series of fingers to the other, while the ashes are screened off and conveyed through the channels to a suitable receptacle.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED VEHICLE AXLE.

Patrick F. White, Westernport, Md.—The body of the axle is T-shaped in transverse section, and blocks are attached to its ends which are bored longitudinally to receive detachable journals. The object is to provide an axle which is strong and light, and which may be easily and cheaply supplied with new journals when required. The axle is particularly applicable for carts, mining cars, etc.

IMPROVED CONVERTIBLE WAGON BED AND HAY RACK.

James M. O'Neill, Fort Worth, Tex.—The body of the wagon is so constructed that it may be readily converted or changed from its ordinary form to adapt it for use as a lumber, wood, cotton, or hay frame, etc. For details, see patent.

IMPROVED SCREW.

James Plenkharp, Columbus, O.—This invention has for its object to provide a cheap wood screw for use in securing the legs of tables to the top or frame thereof; also for securing together other parts where it is particularly desirable or necessary the connecting device shall possess flexibility as well as strength. To this end, the screw is formed of a wrought iron core and cast metal thread or flange, the screw being double ended and provided with a central circumferential flange or rib.

IMPROVED FACING FOR WALLS OF HOUSES.

Thomas Walton, Wheeling, W. Va.—This invention relates to a facing for the outer and inner walls of buildings, also for floors, ceilings, etc. It consists in an ornamental plate of glass, or other suitable material, provided with lugs or projections which enter the spaces between the stones or bricks, and are imbedded in the mortar or cement.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED SCISSORS.

Amos W. Coates, Alliance, O.—This invention covers certain improvements in guarded scissors, or scissors provided with protective end guards, designed for the use of little children, to protect them against accidents which are liable to occur from their careless handling of scissors provided with sharp points. The improvement consists simply in bending the points of the scissors around so as to form a loop, ring, or an eye, which with but little expense secures the desired result in a simple and durable manner.

IMPROVED CALENDER.

Oscar P. Morse, Batavia, N. Y.—This invention consists in a paper card-board having a top ring by which it may be hung up, and a slit connecting with two others at right angles thereto. There is thus formed a flap that can be pushed aside or lifted with the finger. It is provided with twelve monthly calenders with a line to the right of each day of the month, so that memoranda may be noted. After a month has elapsed, a calendar is turned up, passed through slit, and held on the opposite side of card-board for future use.

Business and Personal.

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

Patent Double Eccentric Cornice Brake, manuf'd by Robinson & Co., successors to Thomas & Robinson, Cincinnati, O. Send for circulars.

Safety Linen Hose for Stores, Factories, Hotels and Steamboats, at best rates. Greene, Tweed & Co., 18 Park Place, N. Y.

Two valuable Patents for sale; will take good second-hand machinery in part pay. Address J. R. McCormick, Georgetown, Texas.

Eulerich's Screw Cutting Tools are in great demand. Catalogue free. Frasse & Co., 62 Chatham St., N. Y.

Wanted.—A thorough mechanic and practical man to act as superintendent of a large machine shop and foundry doing general work. Address, with references, R. No. 13 S. William St., N. Y.

A valuable Patent for sale. Address C. A. Corman, Cohasset, Mass.

A Book and Documents giving instructions for Selling Patent Rights; commended by Scientific American, vol. 20, page 377. We sell all kinds of blanks. Circulars free. S. S. Mann & Co., 132 Dolphin St., Baltimore, Md.

Painters.—Send for new prices of Metallic Graining Tools, for "wiping out." J. J. Callow, Cleveland, O.

For the best Galvanized Iron Cornice Machinery for all kinds of work, apply to sole owners, Calvin Carr & Co., Cleveland, O.

For Sale.—Combined Punch and Shears, and Engine Lathes, new and second-hand. Address Lambertville Iron Works, Lambertville, N. Y.

Best and cheapest Glass Oilers. Cody & Ruthven, Cincinnati, O.

Cotton Belting, light and heavy, for Polishing and Carrying Belts. Greene, Tweed & Co., 18 Park Place, N. Y.

Best Scroll and Band Saws. Cordesman, Egan & Co., Cincinnati, O.

Yacht Engine and Boiler, \$300, Box 630, Hartford, Ct. Wanted.—To know whether the Ames Nathan Self-feeding Card Printing Press (Pat. April 22, 1862) has ever been built and sold. Address E. L. Tourret, 236 W. 23d St., New York.

Chester Steel Castings Co. make castings twice as strong as malleable iron castings, at about the same price. See their advertisement on page 221.

Transit and Clock wanted.—Box 913, Springfield, O.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheap by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

The Zero Refrigerator was awarded a grand Centennial medal. Send for book. Lesley, 236 W. 23d St., N. Y.

See Boud's Paneling, Moulding, and Dovetailing Machine at Centennial, B. & S. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Gas lighting by Electricity, applied to public and private buildings. For the best system, address A. L. Bogart, 702 Broadway, N. Y.

For Sale.—One 8 H. P. Portable Engine, \$325; one 10 H. P., \$375; one 12 H. P., \$450. J. Harris, Titusville, Pa.

Catechism of the Locomotive. 600 pages, 250 engravings. \$2.50. Address M. N. Forney, 73 Broadway, N. Y.

Send for James W. Queen & Co.'s Catalogue of Drawing Instruments and Materials; also catalogue of Microscopes, Field Glasses, Telescopes, and other optical instruments. 924 Chestnut St., Philadelphia, Pa.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J. Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

An English gentleman, of many years' experience, who will return to Europe in a few weeks, desires to negotiate with American manufacturers for the sale of their goods in England, France, and Germany. Address Field, care of James Littlejohn, Esq., P.O. Box 2703, New York city.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y. Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 479 Grand St., N. Y.

Solid Emery Vulcanite Wheels.—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 39 Park Row, New York.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

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

Notes & Queries

J. H. P. will find something on images on the retina on p. 193, vol. 36.—R. S. B. will find something on iceboats sailing faster than the wind on p. 107, vol. 36.—S. E. will find something on burning gas as fuel on p. 390, vol. 33.—J. O. C. will find an article on setting wagon axles on p. 299, vol. 34.—J. J. K. will find an answer to his question as to a cannon on a car on p. 273, vol. 34. The pressure is greater on the bottom of the boiler by the weight of the contents than it is on the top.—S. will find a description of the art of taxidermy on p. 159, vol. 32.—C. C. S. will find that waterproof glue will make a watertight joint between cork and cloth. See p. 43, vol. 32.—A. F. B. can copper iron wire by following the directions on p. 90, vol. 31. To nickel iron wire, see p. 156, vol. 34.—T. E. will find a recipe for a liquid bronze for brass on p. 51, vol. 33.—J. A. R. will

find directions for making durable whitewash on p. 133, vol. 34.—F. G. T. will find a recipe for a mullage that will not mould on p. 196, vol. 34.—J. R. will find a description of the manufacture of earthenware on p. 191, vol. 32.—R. S. will find a description of a battery for plating on p. 20, vol. 32.—J. M. W. will find on p. 341, vol. 27, directions for making hydrogen. For making oxygen, see p. 75, vol. 32. To make carbon plates for batteries, see p. 187, vol. 32.—J. A. L.'s queries about a hole and its plug are merely questions of definition. There is nothing to be decided in them.—R. M. C. will find directions for ebullizing wood on p. 50, vol. 33.—E. H. M. will find instances of spontaneous combustion mentioned on pp. 343, 398, vol. 34.—J. W. S. will find directions for preserving eggs on p. 306, vol. 34.—A. B. C. will find instructions for tempering rock drills on p. 202, vol. 31.—A. L. is informed that we cannot answer legal questions.—R. P. P. will find something on wooden railroads or tramroads on p. 324, vol. 29.—G. A. C. will find a recipe for blackboard composition on p. 299, vol. 28.—H. A. will find directions for enameling metals on p. 303, vol. 29.—W. H. B., J. H. W., Y. I. W., J. H. N., J. L. G., G. J. McB., 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) C. A. W. asks: How can light-colored kid gloves, that have become spotted with sea water, be dyed any other color than black? A. They can be dyed to any of the darker shades in the usual way. See p. 166, vol. 28.

What is the best thing with which to clean silver or silver-plated ware that has become black and will not brighten up with whitening? A. Use tripoli powder, mixed with a little olive oil if necessary.

(2) E. A. F. asks: Is there any process by which the liquid that drops from stovepipes can be removed from carpet? A. Use plenty of soap and water.

(3) J. S. S. asks: Is woolen clothing healthy? Fine soft wool, unless colored, will shrink; and cloth made from coarse hairy wool is too heavy to wear in the summer, and will irritate the skin and give those who wear it a cold in the fall when they put it on, and again in the spring when taken off. Clothes made of cotton can be more thoroughly washed and boiled than those of wool, and are they not more healthy? Is not white clothing healthier and more comfortable both in summer and winter than colored? A. As a general rule, light woolen clothing, if clean, is more healthy and a better protection against colds, from sudden changes of temperature, than cotton or other vegetable fibers. In winter, dark or black clothing is best, as it is warmer than light. In summer, light colors should be worn. Some woolen fabrics, dyed with some of the coal tar colors, when permitted to remain for any length of time in direct contact with the moist cuticle, have produced poisonous effects; but not otherwise. It is for this reason advisable to use only undyed fabrics for underclothing.

(4) H. H., Jr., asks: Are there any chemicals by which glue can be made into a paste, to be used (cold) for closing quarter cracks in horses' feet? A. Heat the glue for some time in strongest acetic acid, and evaporate in the air until of the consistence desired. Such a solution of glue will not gelatinize. It dries rapidly, forming a stronger and more flexible joint than ordinary glue.

(5) J. E. M. asks: Why is it that, in a window fitted with alternate panes of blue and white glass, the former become quite warm in the sunshine, while the temperature of the white glass remains almost, if not altogether, unchanged? A. Clear glass permits the passage of all the rays of the spectrum, while blue glass intercepts all the rays except the blue. The destruction of these luminous rays determines their conversion into sensible heat, which is absorbed and radiated from the surface of the glass. The heating effect of this absorption is intensified, from the fact that the sensible heat rays of sunlight preponderate in the lower or red end of the spectrum, which is, in the present instance, intercepted. The darker the color of the glass, the greater will be the amount of heat developed.

(6) L. H. R. says: I have a flute of 8 lever keys that was laid away for about two years; at the expiration of that time I found it so dry that all the joints were loose. I oiled it several times, so that it is now perfectly tight; but I find that I cannot blow the lower notes at all, and can only blow the upper ones with great difficulty. After wetting the inside with water, it fits perfectly easily until dry again; but I am of opinion that this operation will, in time, have a damaging effect. Can you inform me how the difficulty arose? A. The wood has probably become rough on the interior and the bore distorted by excessive desiccation. Free all the cavities from dust, and rub the instrument inside and out with a little warm glycerin.

(7) W. L. D. asks: I dissolved a bit of German silver in nitric acid in a test tube; it gave a greenish blue solution, and after diluting with water I dropped sulphuric acid into it slowly, which threw down a white precipitate. When this was completed, I immersed a copper plate, which threw down a gray metallic powder. What was the chemical action, and what were the several precipitates? A. It is probable that the alloy, or the water you added to the solution, contained lead in some form, which, combining with the sulphuric acid, produced an insoluble sulphate of lead. The deposit on the copper may be metallic arsenic from the impure nickel used in the alloy.

(8) E. C. M. says: I have a walking cane of whalebone about 1/4 inch thick; it was set with little ivory points to represent knots, but these are falling out and the bone cracks and splits. I know that this cannot be helped; but how can I prevent it from further breaking and scaling? A. Try impregnating it with a little warm glycerin.

(9) H. B. C. asks: Can I make a crucible, that will stand a white heat, of water lime or quicklime, either alone or by mixing with something, such as sand or plumbago? A. Small crucibles cut out of pure caustic lime are sometimes used; but if not heated gradually and uniformly, they are apt to crack. A crucible moulded from lime, made plastic by the addition of water, will crack and fall to powder in the process of de-

hydration, by heat or otherwise. Moulded with sand it would fuse into a hard glass at high temperatures. Plumbago cannot be formed with lime into a crucible.

(10) J. S. says: Balsam of fir will render paper translucent. Pitch does the same in a pine plank. Why is this? A. For the same reason that water, filled with bubbles of air, loses its transparency. Neither paper nor wood is a homogeneous substance; but both become nearly so by impregnation of the fibers, and filling the interstices with translucent resin.

(11) J. R. A. says, in reply to E. A. W., who asks how to remove the clinkers from stove linings: When you have a good fire, cover the coal with three inches or more of oyster shells, and let the fire burn out, and burn the shells; you will be able to remove the clinkers, without the aid of mechanical means or injury to the firebricks, on the following morning.

(12) B. H. S. asks: 1. Of what is lightning composed? A. As to the precise nature of electricity, nothing definite is at present known, other than that it is a peculiar motion, analogous to that of heat, of the atoms in their molecular groupings, within the body which is electrically excited. In the case of lightning, the clouds, the air, and the moisture which it contains, and the surface of the earth, constitute the bodies excited. It has been shown that the cause of the electrical excitation in our atmosphere is due to a disturbance of the normal static equilibrium by the translation of aqueous vapor from the earth's surface, and its subsequent condensation in the form of clouds and rain in the cold upper regions of the atmosphere. 2. Why are metals conductors? A. The metals are generally better conductors of electricity than the non-metals, owing to some, not yet well understood, arrangement of their molecules, which facilitates the transmission of the motion throughout the material. 3. Which is the positive pole, and which the negative, of a battery? A. The positive pole, or electrode, of a galvanic battery is the upper end of or connection with the negative plate of the cell—in the Daniell's, gravity, and similar zinc-copper batteries, this is the copper; in the Bunsen, or bichromate cell, it is the carbon plate. The negative pole, in all present forms of batteries, is the zinc.

(13) L. C. J. says, in answer to J. H. W.'s query as to ice in a sand mould: I wish to inform him that the ice under his loose sand had melted to some extent, and the hot coal and iron came in contact, or his sand was insufficient, or not well packed or rammed. The safest plan is to have the floor beneath the cupola dry or comparatively so; but in the event of water or ice being under the cupola, put under the dry sand just before dropping the bottom.

(14) J. S. M. says: Having accidentally broken a small cast iron gear wheel, I tried to solder it with soft solder, using muriatic acid (diluted with an equal quantity of water, after having taken up all the zinc it would) as a flux, but the solder would not unite with the iron. I then added some sal ammoniac, but with the same result. I also tried to make a mat joint with tinfoil, clamping the parts together, but it all ran out. I heated the wheel in the stove and also with the blowpipe; and after several attempts I gave the job up as a failure. Can you tell me what the trouble is? A. A. You will find it impracticable to solder your wheel together unless you galvanize the surfaces.

(15) W. H. H. says: 1. Your paper of February 10, says: "Dissolve crude rubber and shellac in naphtha." I put them separately in bottles, and set them in warm water. The rubber dissolved, but the naphtha did not. What is the reason? A. We do not understand you. Coal tar naphtha is a volatile liquid. The powdered shellac may be dissolved in it by heat and agitation. 2. How are the rubber bands sold by stationers joined together? A. By pressing the ends of the rubber band together before vulcanizing.

(16) B. F. asks: 1. The iron won from waste tin plates, even when absolutely free from tin and acids—which after chemical analysis contains no tin—gives in the blooming forge a cold short iron of little value, though the material employed for the plates must have been a very good one. Can you give reasons for this singular experience? A. A determination of the percentage of carbon in the iron would very probably reveal the cause. 2. Is there any way of treating this iron differently, so as to obtain a better material? A. It may be improved by re-puddling.

(17) R. E. B. asks: How can I prepare paper so that, when burned, it will leave a perfume similar to that from pastilles or fumigators? A. Take cascarilla bark 8 drachms, gum benzoin 4 drachms, yellow sanders 2 drachms, styrax 2 drachms, oil of cinnamon 2 drachms, charcoal dust 6 ozs., nitre 1 1/4 drachms, mucilage of gum tragacanth, sufficient quantity. Reduce the substances to a fine powder, form into a paste with the mucilage, coat the paper with this, and dry in an oven.

(18) F. G. H. says: I have 25 gold fish in a bath tub. What steps shall I take to make them breed? A. The gold fish (*Cyprinus auratus*) seldom deposit spawn when kept in vases or aquaria. In order to secure a supply, the young healthy fish must be placed in reservoirs of considerable depth, in some places, at least, shaded with water lilies and constantly supplied with fresh water. When the spawn is deposited, it rises to the surface, and should then be collected and exposed to the sunlight until vivified by the heat. Care must be taken to collect the spawn as soon as it rises to the top of the water, as otherwise it will soon be destroyed by the fishes themselves. The spawning season of the fish is usually in or about the month of May. The Chinese, who bring gold fish to great perfection, feed them with small balls of paste, which they scatter into the water occupied by the fish, who greedily devour them. Large quantities of gold fish spawn are annually collected along the banks of the "great river" (Yang-tse-kiang) by throwing mats or hurdles across the current.

(19) J. J. K. asks: What is used to color maps pink, yellow, green, and pale blue? A. Use water colors diluted to the required degree of paleness, with a little ox gall mixed with them.

(20) C. A. H. asks: How can I make a galvanizing surface smooth, and crystallize it after it comes from the kettle? A. The *motté* appearance of galvanized iron is produced by first tinning the sheet,

Half fill a wooden bath with dilute solution of muriate of tin, prepared by dissolving metallic tin in concentrated hydrochloric acid; this will take two or three days. Use 2 quarts of this solution to 300 quarts water for the bath. Put in the bottom of the bath a thin layer of finely granulated zinc, and then on it a cleaned iron plate, then a layer of the zinc and another iron plate, and so on alternately till the bath is full. The zinc, the iron, and the solution constitute a galvanic battery, and a coating of the tin is deposited on the iron plates in about two hours. Have ready a wrought iron bath containing molten zinc, covered with a layer of powdered sal ammoniac mixed with some earthy matter. In the bath, beneath the surface of the zinc, arrange two iron rollers, tightly compressed together, to be turned by a crank attached to one of them. Take the plates out of the tinning bath one at a time, drain them, and pass them while wet between the rollers in the zinc.

(21) A. E. D. asks: Can you give me any information concerning the putting up and mode of application of Turkish baths? A. The theory of the Turkish bath is to relieve the body of foul matter by creating a profuse perspiration, and then washing the skin in the usual way. Tepid water, used in the washing, closes the pores, and a cold shower or plunge bath creates a glow on the skin and stimulates the whole body. The perspiration is produced by the bather sitting in a room heated by hot dry air till moisture exudes from every pore. The matter brought to the surface by this means is frequently large in quantity.

In the SCIENTIFIC AMERICAN SUPPLEMENT, p. 774, you give an illustration of a pneumatic pen. How is the ink or color spread? A. The ink should be spread with a small brush, such as is used for marking linen with a stencil plate.

(22) J. C. asks: What isthmus, if any, connects Nova Scotia peninsula to New Brunswick? A. There is an isthmus 15 miles wide between the two countries. It has no specific name that we know of.

(23) H. M. C. asks: Given the three sides of any triangle, what is its area? A. Construct the triangle; let fall a perpendicular from the apex to the base. Base $\times$ half the perpendicular = area.

(24) B. A. F. asks: What would be the pressure in a steam boiler when the heat indicated by a thermometer is 320° Fah.? A. Seventy-five lbs. to the square inch.

(25) C. H. A. S. asks: Does the exact center of an iron shaft turn, if it be placed in a lathe? A. The center of a shaft is an imaginary line, which is stationary. Any part of the shaft that has breadth or thickness rotates.

(26) A. L. W. asks: Please give me directions for brazing small pieces of thin brass together? A. Use a solder composed of copper 1 lb., zinc 1 lb. Or one of copper 32 lbs., zinc 29 lbs., tin 1 lb.

(27) G. T. asks: What is the easiest and quickest way to make small electrotypes? A. Mould the object, previously brushed over with plumbago, in a wax made of wax 3 parts, and stearin 1 part. Brush the mould with plumbago with a soft camel's hair brush. Then deposit a coating of copper by electricity as described on p. 405, vol. 32. Back the copper deposit with type metal.

(28) J. L., of Manchester, England, asks: What are the compositions and mode of use for japanning or black enameling tea trays, coal vases, etc.? A. To make good work, the metal plate should be primed with stiff size mixed with whiting. Clean the plate, and brush the priming on, let dry, polish with fine glass paper, and apply another coat; let dry, and then smooth with a moist sponge. For a black japan ground, use shellac varnish with ivory black, using finally, for a polishing coat, seed lac varnish. Harden the varnish by means of a hot oven.

(29) J. W. B. asks: How do glass sign writers give a mirror-like finish to gold and silver letters? A. Use gold and silver leaf. Take a little fine isinglass, as much as will lie on a five cent piece, and dissolve in a little boiling water. Add as much alcohol as there is water, and strain through silk. Paint the letters on a sheet of paper with Brunswick black; fix the paper, with the writing reversed, on the glass. Use the isinglass solution as a mordant, laying it on with a camel's hair pencil, and then apply the gold leaf. Place the glass in a warm room; and when the gilding is dry, rub over with a piece of cotton wool. Pass a flat camel's hair brush, moistened with the isinglass solution, lightly over the gold letters; let the solution be hot for this operation. A second coating of gold leaf will improve the work.

(30) W. F. P. asks: How can I keep lice, etc., off geraniums? A. If the plants are in a greenhouse, fumigation with tobacco smoke is the best remedy. Tobacco stalk refuse can be used for the purpose.

(31) C. C. H. asks: How can Babbitt metal be united with cast iron in a journal box, so that it will not be loose? Can it be soldered? A. You may solder your box with ordinary solder, and then pour the Babbitt metal. A better plan is to drill small holes at various angles in the box, then pour your Babbitt in, and it will be firm. It is not unusual to rivet the Babbitt by hammering it when cold.

(32) W. H. asks: 1. How are slots in common wood screws cut? A. By special machinery. 2. Are they cut before the screws are threaded, or after? A. After they are threaded. 3. How many can be done in a day? A. It depends upon the size and the kind of machine used: from 2,000 to 30,000 per day.

(33) W. H. M. says: I have a common tinner's fire pot in which I burn common nut coal, as there is no charcoal to be had here. Placed horizontally through the fire pot are two sheet iron tubes about 1 1/4 inches in diameter, into which I place my soldering irons to be heated. I find, after heating them two or three times, that a scale forms on the copper tips, so that they have to be tinned several times a day. Can you tell me the cause of the scale forming on them, and how I can prevent it? A. Your soldering irons either get too hot, or else your solder is not fine enough.

(34) J. C. K. asks: Which is the most economical motor to drive a small

wood, a steam engine or an electrical machine? One horse power will be sufficient. A steam engine is more economical than an electric engine.

Which is the best oilstone, Arkansas or Turkey? A. It is a disputed point as to which is the best. Of Arkansas stones, the most transparent are usually the best.

(35) H. H. P. says: I am manufacturing solid cast steel cultivator shovels, and want the best recipe or preparation to harden them in so as to not warp and crack them, and to harden at as low a heat as possible. A. In tempering, all depends upon the nature of the steel. You will probably find brine at about 100° Fahr. answer your purpose. The brine may be made of 14 lb. salt per gallon of water. Dip slowly edgewise and deep, and then hold the shovels still in the water.

(36) A. T. says: I have a small steam pump and have cracked one of the steam ports, which is of cast iron. Can I stop that crack so that it will not leak? A. Fill the crack with fine cast iron filings well wetted with water and sufficient sal ammoniac (powdered) to just cause the mixture to heat. If the crack is large, caulk the mixture in; if not, a thin sheet plate may be screwed on in addition to using the mixture.

(37) C. R. H. says: I have a casting of brittle type metal to which I wish to give a light brown color. Is there any acid or pickle in which I could dip it? A. Try a strong solution of sulphide of soda or potassa in hot water. 2. Can you give me a good recipe for copperplating type metal? A. Clean the type perfectly, attach it by means of a copper wire to the negative or zinc pole of a strong battery, and immerse the type in a strong solution of sulphate of copper in water. Place a small sheet of clean copper in the sulphate of copper bath with the type (they must not touch), and connect this by means of a copper wire with the other pole of the battery. Under the above conditions, the type will speedily become covered with a film of metallic copper. Great care is necessary in cleaning the type to remove every trace of oil and rust, otherwise the deposition will be unequal or will drop off.

(38) P. L. D. asks: 1. Which size of locomotive cylinder is best for passenger traffic, everything else being equal, a cylinder 17 inches in diameter and of 22 inches stroke, or 16 inches in diameter and of 24 inches stroke? A. The 16 x 24 is generally considered preferable. 2. Which is the best for both freight and passenger traffic, everything else being equal, 16 inches diameter of cylinder, 24 inches stroke, and 5 feet diameter of driver, or 17 inches diameter of cylinder, 24 inches stroke, and 5½ feet diameter of driver? A. The 16 x 24 inch cylinders with 5 feet driving wheels.

(39) J. R. McN. says: I have read your article headed "Bell Metal." How are the metals melted and mixed? A. Use a blacklead crucible and a small crucible furnace with a good draught. Fuse the copper first, then add the nickel in small grains, and proceed as directed in the recipe. Stir the fused alloy from time to time with a stick of green wood.

(40) H. A. W. asks: 1. How fast is an iron turning lathe required to run when turning 1 inch wrought iron? A. At about 150 revolutions per minute? 2. How fast should a wood turning lathe run when turning 2 inch hard wood? A. It may run at speeds varying from 200 to 4,000 revolutions per minute, but about 1,000 is usual on an ordinary lathe.

(41) J. G. says: We have been making a few board rules for our own use. What is the best stuff to blacken the figures with? A. Use black japan varnish. It is usually applied with a stencil and brush.

(42) J. B. C. asks: What is the best method of testing the value of precious stones? A. Precious stones are usually recognized by color, shape, hardness, specific gravity, etc.

(43) S. & R. ask: Which would be the simplest and most durable way to raise a column of water, 1 foot in diameter, to the height of about 40 feet, and how much power would it take? A. We think a pump would be the cheapest and simplest device. The power will depend upon the amount of water lifted. The pressure per square inch will be about 17½ lbs., exclusive of friction.

(44) E. H. says: I am about to build a boat on the following plan: She is to be a double ender propeller, with 40 feet keel, of 12 feet beam and 5 feet hold, with a shaft running through the whole length and a wheel on each end, to be used as a ferryboat. Her draught is not to exceed 4 feet. Do you think a boat on that plan and those dimensions will succeed? Will she steer well, and will the engines work all right, the shaft running the whole length of the boat? A. We do not see any impracticable features in the plan, although we are not sure that it is the best that could be devised.

(45) M. B. says: 1. We have a well 10 feet deep and 100 feet from the house; we want to draw the water from this well by a cast iron cistern pump and a 1½ inch lead pipe; this lead pipe has to make a bend upward under the house of 10 feet to connect with pump. Can we draw water such a distance by said pump? A. With a good pump the plan is practicable. 2. Would a lead pipe of the above size collapse? A. Make the bends with as large radii as possible, and be careful to straighten the pipe before laying it. It will, of course, be desirable to use heavy pipe.

(46) E. R. says: We are building a steam yacht 60 feet long and of 8 feet beam, for which we have a double engine with cylinders of 5 inches bore and 6 inches stroke. We would like to know the size and form of boiler best adapted for the engine. A. You can use a vertical boiler, 40 inches in diameter, and 6 feet high.

(47) J. S. says: Since the Ashtabula bridge disaster, there is a great deal said about iron becoming crystallized from repeated vibration, caused by jars, strains, etc. In that sense, is the term "crystallized" used correctly? Is not iron in all conditions crystallized? As I understand it, the strength of iron depends on the perfect cohesion of the crystals which compose it. By jar, vibration, strain, and constant use, the cohesion of the crystals becomes impaired, and the strength weakened; and in that condition I think it wrong to call it crystallized. A. The term is correct as describing the appearance of the iron. Good iron when broken looks

fibrous, or somewhat as if it were made up of very fine wires.

(48) J. L. N. says: We have an engine with cylinder 28 inches in diameter and of 6 feet stroke, running 28 revolutions per minute, geared (with cog gearing) into a countershaft running 56 revolutions per minute. We increase the speed of our engine to 46 revolutions per minute, allowing the countershaft to remain at the same speed (56 revolutions), shall we consume more or less fuel? A. Without knowing more particulars, we cannot answer this question positively; but the chances are greatly in favor of a less consumption of fuel, if the change is made.

(49) W. D. C. says: I have a waterfall of 75 feet of a constant stream of water that will fill the space of 1½ inches square. Is there any kind of arrangement by which I can get power from said waterfall, and how much? A. Probably a water wheel will be the most convenient machine for utilizing the power of the water. You will find the advertisements of reputable manufacturers in our columns.

(50) D. H. says: On p. 241, vol. 33, you give 6 angles for slats of a windmill, and there are but 5 slats or slats on each arm of the mill. Please explain. A. You cannot have examined the article very carefully, as the figure shows 6 slats or arms, and the proper angle for each is given below.

(51) W. F. W. asks: What is the correct definition of the word compound, as applied to steam engines? Does it include simply that class in which the exhaust steam from one cylinder is utilized in a second, or would two high pressure engines, connected with a common shaft, and whose cranks were keyed at right angles with each other, also come under this head? A. Your first definition is the one commonly applied to compound or two-cylinder engines. The other describes what are usually called double engines.

(52) R. E. McC. says: Some mechanics and I have disputed about a dead center in a revolving shaft. I claim that there is no such a point in existence; but we cannot agree on it, so I appeal to you for an answer. A. If you speak of the ordinary piston and crank connection, it is well known that there are several points called dead centers, for the reason that at these points a pressure applied to the piston produces no effect on the revolution of the shaft.

(53) C. E. H. says: In small yacht engines, running as high as 300 revolutions per minute, can the feed pumps be advantageously worked from the cross-head as in slower moving engines, or is it necessary to work them slower by means of intermediate gearing? A. The pump can be worked at this speed, but it generally requires larger connections.

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

J. E. S.—It is sandstone, containing crystals of millerite, a sulphide of nickel.—T. D. H.—It is a poor variety of fireclay, containing much sand and iron. It is probably worth about \$3.00 per ton in New York.—J. R. B.—It is an impure clay, silicate of alumina.—D. A.—It contains mica and sesquioxide of iron.—F. E. S.—The soft argillaceous material contains clay, carbonate of lime, and magnesia, colored with sesquioxide of iron and chromium, and mixed with sand. The other is Niagara limestone, and may be employed for building purposes or as a source of lime.—F. A. S.—It is a piece of red jasper containing a small quantity of gold. It would require a quantitative analysis to determine the percentage of metal in the ore.—W. R. L.—It is graphite of good quality; graphite and plumbago are different names for the same substance.—J.—Your specimen contains manganese and iron.—C. J.—It is sesquioxide of iron with clay.

A. B. asks: How is the cut which runs around the tops and backs of violins made, and how is the wooden thread inserted in the same? How is the deep staining varnish put on, so that the grain of the wood may be seen?—H. A. asks: Please give a recipe for making paste for whitening leather military belts?—C. F. S. asks: How can I keep goats from peeling the trunks of apple trees?—W. S. G. asks: How can I press hay into small blocks, to burn in a stove?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:
On Electrical Experiments. By J. D. W.
On the Steam Engine of the Future. By J. C. S.
On Materialism and Spiritualism. By J. T.
Also inquiries and answers from the following:
L.—C. H., Jr.—M.—C.—C. Y. G.—C. C. D.—W. C. F.—R. B.—J. T. S.—C. H. W.—R. K.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells plumbago, for stove polish? Who sells a steam engine, small enough to run a single sewing machine? Who rolls weldless steel tyres? Who makes earth-boring tools? Who makes paper barrels? Who sells small water wheels for running sewing machines, and who sells electric motors for a similar purpose? Who exhibited dental suction disks at the Centennial? Who sells small engines, suitable for pleasure boats? Who sells electric batteries, for plating?" 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

February 27, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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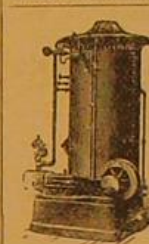
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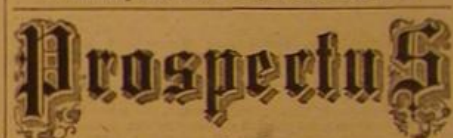
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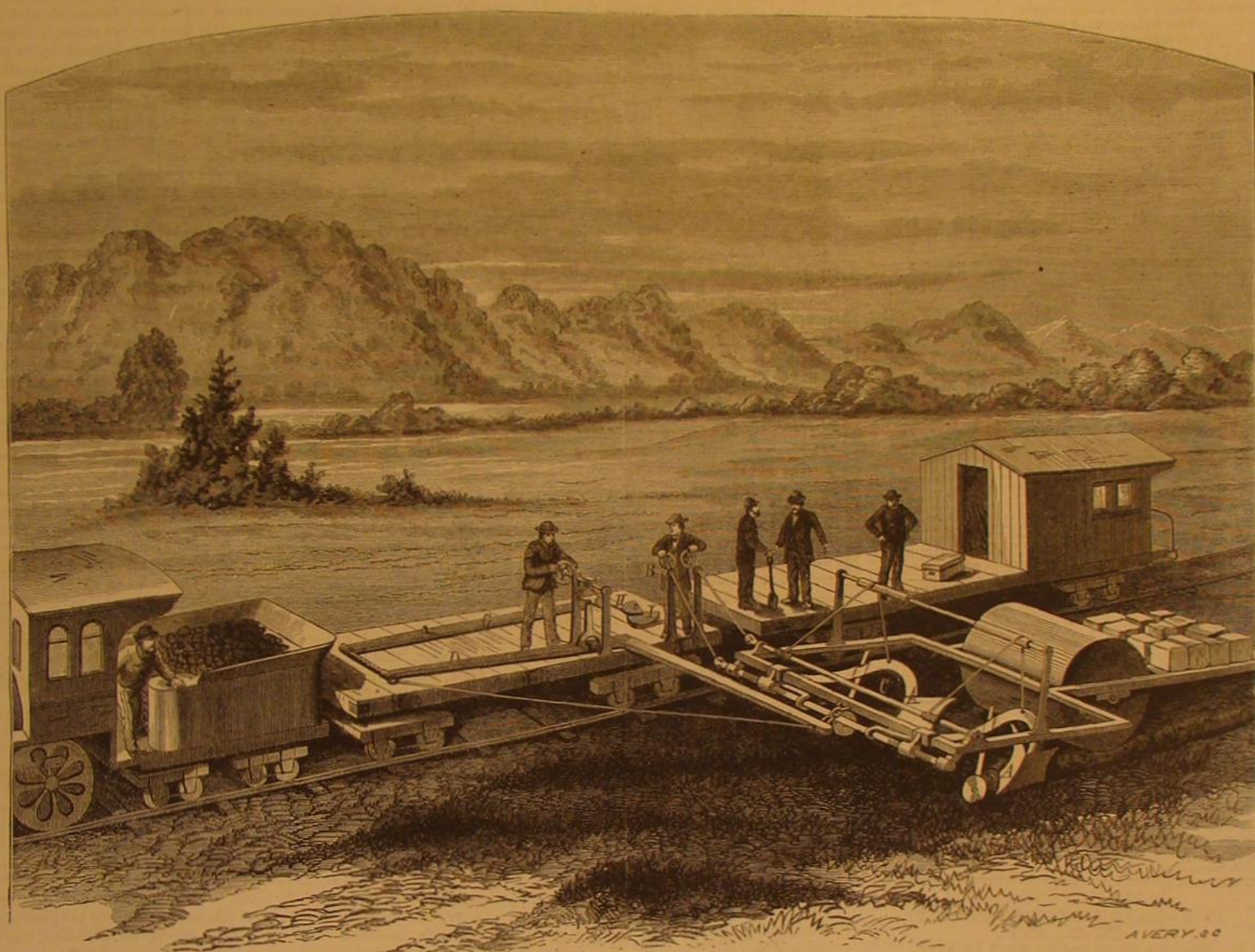
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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVI.—No. 15.
[NEW SERIES.]

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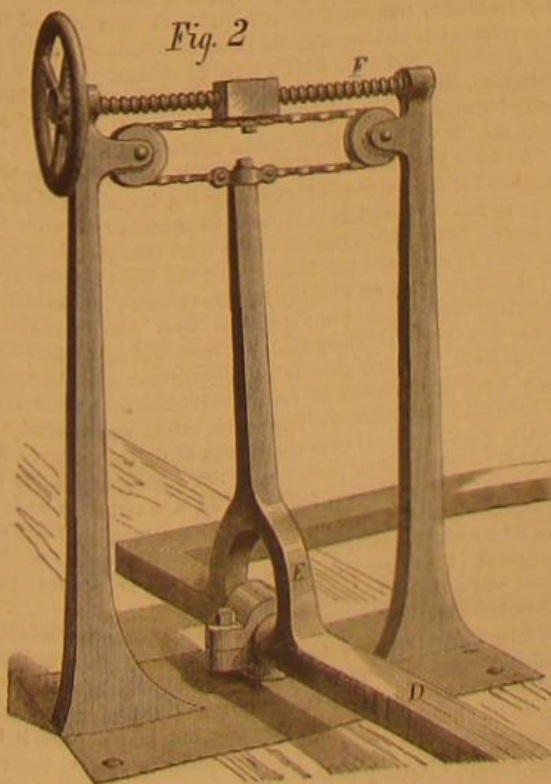


HARDEN'S RAILROAD GRADER.

IMPROVED RAILROAD GRADER.

The accompanying engravings represent a novel device for expeditiously grading railroads. It is mainly intended for use on Western prairies and watersheds, and will, it is claimed, promote the construction and extension of railways by rendering the same less costly, thus aiding in the development of regions now unopened to commerce.

In using the invention, it is first necessary to lay a temporary track over the designated line, to accommodate a locomotive, one platform car, and a caboose, the latter serving as quarters for the workmen and also playing a part in the operation of the device, as will be described further on. The appearance of the grader at work is represented in Fig. 1, and in Fig. 2 are given details of two important portions. Two plows, A, respectively right and left handed, are secured to curved beams which are attached to sleeves moving on the front bar of the heavy rectangular iron frame. Said sleeves are connected to nuts which travel on horizontal screws, placed in bearings on the same bar. By operating this screw (the threads of which are in reverse directions) through the wheel, B, on the platform car—the shaft of said wheel being attached to the screw by a universal joint—the plows can be moved nearer together or further apart. Arms connected to the plow beams pass around the middle portion of the screw shaft and serve to steady the plows. Above and near the front portion of the frame is another shaft, C, also rotated in similar manner by a wheel on the platform car. Chains or cords attached to this shaft lead over a roller and are fastened to the plows. By this means, by revolving the shaft, C, in either direction, the plows may be raised or lowered to cut shallower or deeper furrows as desired. To the rear of the rectangular frame is attached another and smaller frame,



in which works a large roller. In rear of the latter is a platform which is weighted heavily or lightly, as desired. This is all there is of the machine proper.

The plows, of course, turn furrows in opposite directions, throwing the earth inwards, and making a bed of the necessary width. The loose soil is then leveled by the weighted roller. The grader is drawn by the locomotive, and upon the platform car other devices are arranged, the uses of which we shall next explain. D is a heavy bar, one part of which lies lengthwise of the deck of the car, and the other part, extending out at right angles, forms the point of attachment of the machine. Between the ends of arms a strong brace is fastened. The apparatus, which is represented as being operated by the workman on the car, is shown in detail in Fig. 2, and its use is to lift the whole grader out of action while traveling, or so that obstructions may be avoided. Formed upon the arm of the bar, D, which lies parallel to the axis of the car, is a crotch, E, Fig. 2, between the arms of which the bar is rounded and the cylindrical portion is received in a bearing as shown. Said bearing is pivoted below so that it does not prevent lateral motion of the bar. Above the crotch a single arm extends upward, to each side of the summit of which are attached the ends of a chain, which passes over pulleys journaled in the two standards shown. Also attached to the chain is a nut, which travels on the screw shaft, F. It is evident that, when the latter is rotated by the hand wheel, the crotch arm serves as a lever to turn the bar in its bearing, and thus to raise and lower the forward portion of the machine. A device, H, Fig. 1, is used for equalizing the draft. As already stated, the direct arm of bar, D, is pivoted at the base of the bear-

[Continued on page 228.]

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VOL. XXXVI, No. 15. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, APRIL 14, 1877.

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Steel Making by a New Process.
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How to Build Cheap Boats, by PADDLEFAST. Drawings and Description for the construction of a Thirty-three Foot Sloop Yacht, Rigging, etc., with 9 illustrations.—Ice Boats on Land; how to work them.—Design for Carved Buffet, 1 engraving.
III. CHEMISTRY.—Remarkable Oxidizing Action of Animal Charcoal, by WILLIAM THOMPSON, F. R. S. E.—On the Transport of Solid and Liquid Particles in Sewer Gases, by E. F. FRANKLAND, F. R. S.—Composition of Petroleum, and the Proper Standard of Safety.
IV. ELECTRICITY, LIGHT, HEAT, ETC.—Apparatus for Illustrating the Interference of Waves.—Arrangement for determining the Vapor Tension of Water, by Professor GUTHRIE.—Polarization of Heat Rays.—New plan for Holtz Electrical Machine.—Theory of the Hunsen Lamp.—Novel experiment with the Singing Flame.
On the Minute Measurements of Science, by ALFRED M. MAYER.—Article VI: The Application of the Compound Microscope to Measurements of Minute Length, with 2 engravings.
The Electrical Conductivity of Water.—Compressibility of Air and Gases.—Dr. Crooke's recent Radiometer experiments.—Specific Heat of Boron.—Practical Information for Telegraphers, on Magnets, Magnetism, etc., by Mr. SPRINGER, of the Western Union Telegraph Company.—The Electrical Shunt, by W. H. PREECE. An interesting and useful paper.—Electro-Magnetic Induction.—Induced Currents.—Maximum and Minimum Effects of Electro-Magnets.—Static and Dynamic Induction.—An Electrical Clock Setter.—Electrical Phenomenon at Sea.—Production of Rain by Human Agency.
V. ASTRONOMY.—Meeting of the Royal Astronomical Society. Theory of the Horizontal Photoheliograph. Discussion on the bright ring of statement and interesting observations made thereat, by Professor TACCHINI.
VI. NATURAL HISTORY.—The Portuguese Man-of-War.—Microscopic Insects in the Skin.—Spider Lines.—On the Eyes of Worms.—Appearance of Snow Flies.—The age of the Rocky Mountains in Colorado.—New staining fluid.—Cleaning Distances with Glycerin.—Microscopic Examination of the Walls of Hospitals.—Examination of Volcanic Dust, by Professor NORDENSKIÖLD.
VII. MEDICINE, HYGIENE, ETC.—School Life and Its Influence on Sight, by GEORGE READING, M.D., Surgeon in charge of the Maryland Eye and Ear Institute, Baltimore. A valuable and important paper, showing the general formation of the human eye; the causes of myopia or near-sightedness among school children; directions for prevention of the disease; the use of glasses; care and preservation of the eyes, etc.
Dr. L. A. Sayre's method for the Safe Administration of Chloroform.—Croton Chloral for Whooping Cough.—Microscopic Researches on the Hair, by Professor VON ERNER.—Cure for Sea sickness, by T. SKINNER, M.D.

THE PROPERTIES OF LIGHT AND COLOR.

The idea that anything can be added to light by passing it through colored transparent substances, or by reflecting it from colored surfaces, is utterly erroneous, and proceeds simply from ignorance of the nature of light. It has been proved by Isaac Newton, and since his time by innumerable experiments of various kinds, that pure white light, such as comes from the sun to us, contains all the colors, as well as heat and chemical activity, and that they may be separated, or the light analyzed, by simply passing it through a prism of a transparent substance. The possibility of such a separation has been understood only since the adoption of the vibratory theory, which also explains the nature of the caloric, luminous, colored, and chemical rays. According to this theory, the vibrations, when at comparatively low velocity, manifest themselves as heat only; when the vibrations are rapid enough to produce four hundred and fifty billion waves per second, they become visible as red light. Five hundred billions produce the sensation of orange, five hundred and fifty billions that of yellow, and so on through green, blue, and violet, the latter resulting from eight hundred and fifty billions of vibrations per second. Vibrations still more rapid are invisible to the human eye, but their existence is demonstrated by their chemical action, in the same way as the invisible vibrations below four hundred and fifty billions per second manifest themselves as heat only.

Densely transparent media retard the light, and this retardation will affect the rapid vibrations more than those of slower velocity; and under certain circumstances such media will cause light to be deflected from its course in such a way that the most rapid vibrations will be most deflected and the slowest least. This is the principle of refraction, by which light can be separated into its caloric, chemical, and luminous rays, of different colors. The refraction of light, permitting the examination of the colors into which it has been split up, is the fundamental principle of the spectroscopy, by which the nature of various luminous and illuminated substances can be determined.

The apparent colors of objects are caused by their reflecting rays of vibrations of certain velocities, and neither reflecting nor absorbing others; and the hues of transparent colored objects are similarly produced. They pass only certain rays, and absorb the others; and the reflected or transmitted color is then called the color of the object. In order to perceive such a hue, it is essential that the light by which it is illuminated contains that color; and this is directly demonstrable by illuminating objects with light of one color, when objects of all other colors will appear black or gray. Such a light can, for instance, be produced by burning alcohol in which common salt has been mixed; this produces a pure yellow flame, and objects of whatever color, when seen by daylight, if illuminated by such a flame, will only show this color. Human faces, for instance, have in this light a ghastly, death-like appearance.

An ordinary gas, lamp, or candle light is not a pure white, being deficient in blue rays, and has an excess of red, orange, and yellow; a white object cannot, by such a light, be distinguished from a yellow one; light blue cannot be distinguished from green, and dark blue looks almost black.

In regard to the nature of colored objects, whether painted or dyed, and of transparent media, such as colored glass or liquid solutions, the analysis of their colors by means of the spectroscopy shows that what we call simple colors are in most cases complex. Only those colors are pure and simple which we obtain by the prismatic refraction, namely, the spectroscopic colors. The blue cobalt glass, for instance, which is now called mazarin glass, is proved by the spectroscopy not to owe its violet shade to the very refrangible and chemically active violet rays at the extreme end of the prismatic spectrum; but on the contrary, this part of the spectrum is totally absent from light passed through blue glass. The special shade of the mazarin glass is caused by the fact that its blue is tempered by a considerable quantity of the less refrangible red rays at the other or caloric extremity of the spectrum, and even with a trace of orange. Its blue is, therefore, of less chemical activity than the prismatic blue, and of course in all its functions, such as heat, chemical action, etc., is far below the original unchanged solar light.

We have gone into the details of these rather elementary matters for the purpose of exposing the ignorance of those who ascribe to the glass a special chemical or curative influence. Some photographers have used blue glass long ago, in order to moderate the intensity of the light for the eyes of the sitter, without robbing it of too much of its chemical activity; and those photographers who possess common sense or experience know that, far from adding to the effect of the light, the blue glass is an impediment, and the necessary time of exposure is rather extended by its use than otherwise. It is strange that such errors can prevail for years, when a simple experiment can settle the matter. All that is necessary is to photograph the solar spectrum, to do the same with a surface painted with a number of various colored pigments, and also to expose a sensitized surface under a series of colored strips of glass. The writer of this article did this more than thirty ago by the Daguerrean process, and satisfied himself about the following points: 1. The chemical effect of the prismatic spectrum extends, for iodide of silver, from beyond the violet to the blue. 2. When bromine is used in connection with the iodine, it extends to within the green, while the yellow and red rays appear to have no effect on silver compounds, but may possess it for other substances. 3. In photographing pigments there is the utmost diversity in the results, according to the nature

of the pigment: much greater than the differences in shade would lead us to expect. As a general thing, the pure reds, orange, and yellow, such as are produced by vermilion and chromates of lead, are photographically inert, and give blacks. The blues are the most active, most of all being being ultramarine, next the violet lakes. But even the red carmine takes well, as it has a violet shade; but among the blues, those bordering on green take least, and hence foliage tends to give dark effects, which are only slightly corrected by using bromine. 4. In using as negatives strips of colored glass to print in sunlight, much depends on the shade and intensity of the color. In general, the chemical effect follows the prismatic series from red to blue; but the most effective blue glass is always found to be far inferior to the sunlight alone, pure and simple. And this fact is sufficient to settle the question about the special virtues claimed for blue glass: it cannot possibly have any not already possessed by sunlight. However, if people are induced by its pretended curative properties to take sun baths, which they otherwise might neglect, they may be often benefited by the salutary influence of the radiation of the mighty orb, an influence which cannot sufficiently be appreciated; but the blue glass would probably get the credit which exclusively belongs to glorious old Sol.

THE AMERICAN EXHIBIT AT THE COMING PARIS EXPOSITION.

Thirteen months now remain between the present time and the opening day of the French International Exposition. We believe that our manufacturers, from their experience at the Centennial, and at previous world's fairs, fully appreciate the value of these exhibitions as advertising mediums; and therefore it is unnecessary for us to dwell upon their advantages in that direction. The prominent consideration now relates to speedy preparations of exhibits; and as the intervening time is short, and a large amount of work must needs be done, those who propose to contribute should realize the fact that there is no time for delay. Our people have a proclivity for leaving things to the last moment, and then doing prodigies of execution. While perhaps many individual displays are thus produced, fully as good as they might have been had more time been taken to their elaboration, still, collectively, a nation's exhibit organized in a hurry is apt to be but a poor show. The American display at Vienna is an example directly in point; and it is certainly to be hoped that the country will not be misrepresented in Paris after a similar fashion. The matter is one which appeals to every manufacturer or inventor who intends to exhibit, and to him individually. It relates to work which every exhibitor should see to himself, and not wait in the expectation that the government is going to boost him into the show by paying for his transportation, or otherwise misdevoting the people's money to his benefit.

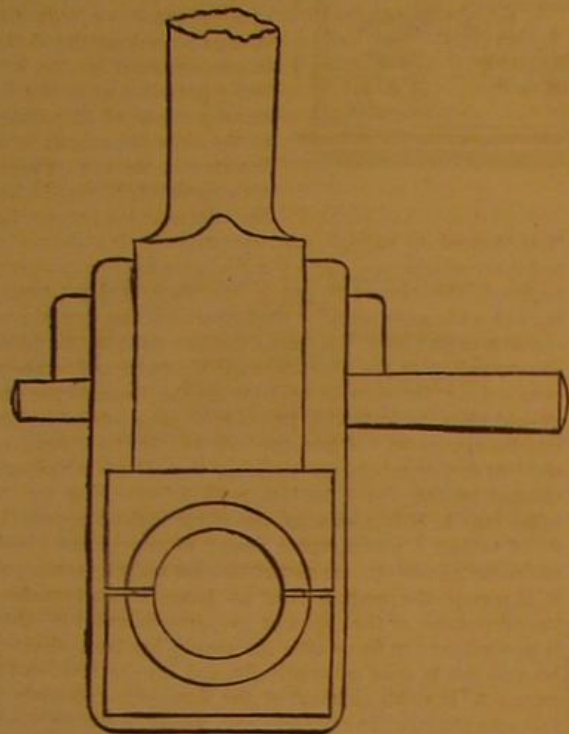
There is much being said about the necessity of a large appropriation from Congress, and the organization of a cumbersome body of officials to secure a suitable exhibit from this country. We need neither. The gentlemen who prepared their display at our Centennial can do it again, and need no official help. Our diplomatic officers in Paris should be able to look after the interests of American exhibitors there; and the organization of the national contribution, so far as it may be found conducive to timely despatch and compliance with the regulations of the Exposition officials, may be done on this side of the ocean. There is no need of any appropriation, save the small sum requisite for the purposes above specified. It is an agreeable assumption, doubtless, that our manufacturers are actuated by high patriotic motives in sending their productions across the Atlantic, and that consequently such self-abnegation should be fostered and rewarded. But, unfortunately, such is wide of the fact. Those who contribute do so because they believe that, directly or indirectly, they are going to gain by it; and therefore, if the people are to pay under such conditions, it is just as sensible for Congress to pass a bill for the liquidation of the expenses incurred by manufacturers for advertising in this journal, or in any of the other mediums which they select for informing the public as to their business. The mistake—too commonly made—is that, because foreign governments appropriate large sums and appoint commissions headed by high dignitaries, this country must follow their example. The distinction is ignored that, in the old world, the paternal government acts for the people, and that the government orders that such a display be gathered, and pays for it all of its own motion. Here the people are the rulers; and if any display is made, it is done by the people for their own benefit. It is for the people to say what part they will take in the Exposition, and to act thereon; and therefore for our contemporaries to spur the government on in the matter, as if the people's servants were absolutely in control of the people's actions, is both contrary to the spirit of our institutions and radically absurd.

It is urged that, because France made a good show at our Centennial, international comity requires that we should make as fine a display at her Exposition. Let those who hold this view, then, see that such an exhibit as they will be proud of is made, and let them pay for it. If money is necessary to help inventors who have not the means to forward their productions—and that is the least objectionable use to which pecuniary assistance can be devoted—let it be raised by popular subscription. A display thus prepared will be more truly representative than any other which could be gathered; and every subscriber will have a direct personal interest in its excellence.

ADJUSTING CONNECTING ROD BRASSES.

P. D. H. says: "I inclose you a drawing of the connecting rod end, to connect with the crank pin on a tugboat engine. In trying to adjust the brasses, I drive the key hard in, then mark it, and draw it back about an inch. The idea of leaving the brasses apart is that, in case of heating and wearing, the lost motion may be taken up. I have asked many engineers as to the advisability of keeping the brasses butted and the key driven tight, but I receive no answer."

This is one of those minor details of mechanical construction in which there is much difference in practice, and which is of considerable importance. The cause of the trouble in our correspondent's case is easily perceived on referring to his drawing; for the key has a taper of only $\frac{1}{8}$ inch to the



foot, and therefore would of its own weight alone place sufficient pressure upon the brasses to cause them to heat and abrade. In many cases, however, it is a difficult matter to adjust brasses that have the joints left open, for the following reasons: If the flanges of the brasses do not quite fit the length of the journal, as is very commonly the case, it is customary to tighten the key until the rod end can just be moved by hand so as to force the brass flanges against, first one, and then the other, end of the journal. This is an approximate adjustment; and if the journal heats at all, the key is slackened back a trifle: whereas if it pounds, the key is set up a little. As a matter of fact, then, nothing is actually known of the precise fit of the brass to the journal; and while looseness may be detected by the pounding, the brass may be tight enough to cause undue wear without very sensibly heating the journal, especially if the latter is freely lubricated. If, however, the brasses fit the length of the journal, and do not butt, as it is called, when the joint faces of the brasses meet it is usual to drive the key in till the brasses bind the journal, and to then slack the key back to the necessary amount. What that amount should be cannot be stated, because it varies with the taper of the key and the force with which it is driven home. As a result, then, the operation is left to the judgment, or, in other words, to guess-work, of men, many of whom are not well experienced in the operation; while under any circumstances the actual fit is not positively known. A plan not infrequently adopted is to insert a piece of lead wire of small diameter. After inserting it between the brasses, the key is driven tightly home; then the key is slackened back until the lead wire is just freed. It is estimated that the adjustment will then be correct; there is no actual certainty of the fit, however, even in this case.

If it be desired to insure a perfect fit, the brasses must be made to butt or meet together when the key is driven home; and in this case the brasses may be adjusted in position in the rod and upon the journal, with the other end of the rod free, so that it can be moved; and the fit can then be felt by moving the rod. If the rod is a heavy one, the brasses may be placed in the strap and tried in connection with the rod, as explained, so as to ascertain if the rod leads true to the other journal; then the fitting may be done with a half round file and scraper, and the brasses tried in the strap independently of the rod. The adjustment being nearly completed, the rod should again be applied to assure that it leads true to make any necessary alteration during the finishing of the adjustment. The journal having a faint coat of red marking, the brasses must be fitted until the fit can scarcely, if at all, be felt when the key is driven lightly home. The key should be marked with a line to show how far it was driven in during the adjustment; so that, in putting the work together, it may be driven in to the same distance. By this method, any number of bearings may be fitted, with the certainty that neither heating nor undue wear will take place; and if the bearings are properly proportioned to the duty, and if the metal of which they are composed is of suitable quality, the bearings may, if kept properly lubricated, be left to take care of themselves, even when quite new.

A compromise between these two methods is to put a strip of sheet brass between the brasses, and to file it down as the

brasses wear; and this is most desirable for brasses the position of which is such that it entails much labor to take them out to let them come together. The wear on brasses butted together is not, as a rule, more than one half as great as upon those left open. In English and in a majority of American locomotives, and in small stationary engines, the brasses are made a butt joint; and in English shops, in all engines and machines, open brass joints are interdicted unless the position renders it difficult to take them out for adjustment.

THE ENGINEERS' EXAMINATION OF THE NIAGARA SUSPENSION BRIDGE.

The suspension bridge over the Niagara river was constructed by John A. Roebling in 1855. It has a span of 821 feet, and a deflection of 59 feet; 14,560 wires are employed in the cables, the ultimate strength of which is 12,000 tons. Since its completion, in the year above mentioned, the bridge has been subjected to the almost constant strain of heavy railroad trains; and thus for a period of 22 years it has undergone a trial of the greatest severity. Quite recently, it was deemed advisable to overhaul the structure thoroughly in order to determine whether any repairs were required, or whether the jarring or straining to which the wires had been submitted had—as some theorists believed possible—impaired the quality or tenacity of the iron. Accordingly the bridge was closed to travel; and to Colonel William H. Paine, Assistant Engineer of the East River bridge, was assigned the duty of critically inspecting the structure. We are indebted to Colonel Paine for an account of his investigations, which have resulted in his conclusion that the safety of the bridge is in nowise lessened. The detailed report of the engineer will be looked for with great interest, as it will undoubtedly add much to our knowledge relative to the durability and strength of the suspension system of bridge building.

The anchorage cables were imbedded in masonry and cement, which it was necessary to remove in order to admit of their examination: a task of no small difficulty, as the masonry was like solid rock. It was found that out of the 14,560 wires less than a dozen were seriously corroded, and these were in the first anchorage. The metal on the other wires showed the original grain with distinctness. Not content, however, with this highly favorable appearance, Colonel Paine proceeded to experiment upon the wire, in order to discover whether the means provided to allow of its expansion and contraction—namely, the placing of the bed plates which receive the cables on top of the towers, on rollers—had been sufficient to prevent the longitudinal stress upon the filaments destroying their elastic quality. An apparatus was used capable of marking a stretch to $\frac{1}{1000}$ of an inch; and this being adjusted, a heavy freight train was moved upon the bridge. The elongation of the wire was found to be very nearly equal to that which the formula, used by engineers for ascertaining such results, showed the stretch of a perfect cable, similarly made, should be under like strain: so that not only had twenty-two years' service not resulted in any corrosion of the wire, but the elasticity of the same under the enormous strains had not been impaired.

In the second experiment, a single wire from one of the main cables was tested. A strand of 520 wires was selected, and the binding removed, so that every wire was perfectly free. Three wires were then chosen, and across them a knife mark was made. The middle wire of the three was cut at the mark; and on testing it by the delicate instrument above noted, it was found to have contracted to within a small fraction of what it should have reached when relieved from its portion of the weight of the bridge. In experiment No. 3, a single wire was detached and weighted until it broke. The object here was to see whether the nature of the metal had been altered; for if the iron had become granular and had lost its cohesiveness, the fracture would be a straight one, similar to that of cast iron. On the contrary, the wire, when subjected to the stress, extended until its diameter was reduced fifty per cent before it broke.

A cable guy was next selected and made to sustain a dead weight. The construction estimate places the maximum burden which that guy would ever be required to bear at 15 tons. The guy parted at 53 tons. To show how perfectly the wire had retained its original characteristics, Colonel Paine, having observed that the wire, on being removed from the cable, tended to coil in a circle of about 5 feet in diameter, sent to the person who had originally prepared the wire for its place for information as to the size of its former coil. He learned that it had been wound on a drum 2 feet in diameter, and that it had been subjected to a straightening process which took about half the curve out of it. Certainly no more remarkable proof could be adduced to show that the spring of the wire had in no respect been overcome.

Although the bridge has thus been shown to be thoroughly safe, and to have wonderfully withstood wear, still more elaborate examinations are to be made, and the structure will not be open to traffic until these are completed. We shall publish further extracts from the complete reports of the engineers either in these columns or in those of the SUPPLEMENT at as early a date as possible.

SINGULAR EXPLOSION OF AN ELECTRICAL MACHINE.

Professor A. E. Haynes, of Hillsdale College, Mich., sends us the following account of the explosion, 20th ult., of an electrical machine:

"While our Holtz electric machine was being used it suddenly exploded, blowing the fixed and revolving plates into thousands of pieces. It was in fine order, was working nicely at the time, with a student on the insulating stool,

while the revolving plate was being turned quite slowly. Did you ever hear of a similar occurrence?"

"During the evening of the same day, we had very much thunder and lightning, quite a rare occurrence when the snow is so deep, some 18 inches. The machine seemed to gather itself for an instant before the explosion, as does the battery of jars, sometimes charged by it. The report was as loud as several rifles. Please give your opinion of the explosion."

REMARKS: The cause of this explosion was, probably, the imperfect annealing of the glass, producing unequal strains, the stronger of these strains, assisted by vibratory impulse, at last overcame the cohesion of the plate, and it burst into fragments. Such examples are not infrequent. Last year we gave an account of the sudden shivering at Troy, N. Y., of a sheet of plate glass, eight feet square, from this cause. The glass was leaning against the side of a building at the time, when it suddenly exploded with a loud noise, breaking into a thousand pieces. One of the fragments struck a workman in the leg, and inflicted a serious wound.

Professor Hagenback has suggested that when plates and other glass objects are examined by polarized light, they will exhibit the prismatic colors if under the influence of unequal strains; and in this way defective glasses may be readily detected.

THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

The work of arranging, testing, and preparing for the laying the wires of the main cables is steadily progressing, and is watched with much attention by engineers and others interested in this remarkable work. As a matter for convenient reference, we subjoin the following epitome of principal facts and dimensions:

Construction commenced January 2, 1870.
Length of river span, 1,595 feet 6 inches.
Length of each land span, 930 feet (1,860 feet).
Length of Brooklyn approach, 971 feet.
Length of New York approach, 1,562 feet 6 inches.
Total length of bridge, 5,989 feet.
Width of bridge, 85 feet.
Number of cables, 4.
Diameter of each cable, 15½ inches.
Each cable consists of 6,300 parallel (not twisted) steel wires, No. 7 gauge, closely wrapped to a solid cylinder.
Ultimate strength of each cable, 11,200 tons.
Depth of tower foundation below high water, Brooklyn, 45 feet.
Depth of tower foundation below high water, New York, 78 feet.
Size of towers at high water line, 140 x 59 feet.
Size of towers at roof course, 136 x 53 feet.
Total height of towers above high water, 277 feet.
Clear height of bridge in center of river span above high water, at 50° Fah., 135 feet.
Height of floor at towers above high water, 119 feet 3 inches.
Grade of roadway, 3½ feet in 100 feet.
Size of anchorages at base, 129 x 119 feet.
Size of anchorages at top, 117 x 104 feet.
Weight of each anchor-plate, 23 tons.
Estimated total cost of bridge, exclusive of land acquisition, \$9,000,000.
Estimated cost of land, say, \$3,500,000.
Total estimated cost, \$12,500,000.

Mortification and Water.

Professor J. M. Merrick, writing to the *American Chemist*, says: "In *Hoffman's Manual*, and doubtless in many other chemistries, directions are given for exhibiting the decomposition of water by sodium, the hydrogen gas being collected in a tall, narrow jar by pushing pellets of sodium under its mouth with a wire gauze spoon, etc. In both cases I used very small bits of sodium. Having blown an expensive glass tube to fragments in my own laboratory by this process, and having, in the presence of a large class, blown into minute atoms, with a noise like thunder, a large tube and porcelain cistern, covering myself with mortification and water, and cutting gashes in my hand, I venture to suggest that possibly there is a risk in this experiment, as laid down in the books."

You are right, Professor. There is certainly a "possibility of risk;" indeed, we are willing to go further, and say that there is absolute danger. Lucky that your eyes escaped injury. Such experiments should be banished from the lecture room.

School Life and Its Influence on Light.

Under this title, Professor George Reuling, M.D., surgeon in charge of the Maryland Eye and Ear Institute, Baltimore, contributes to the current issue of the *SCIENTIFIC AMERICAN SUPPLEMENT* a large amount of valuable practical information concerning the human eye. He explains its general construction, the operation of controlling its muscles; points out how school children become near-sighted; shows the proper remedies; and gives many particulars concerning the uses and care of the eyes that ought to be read and remembered by everybody.

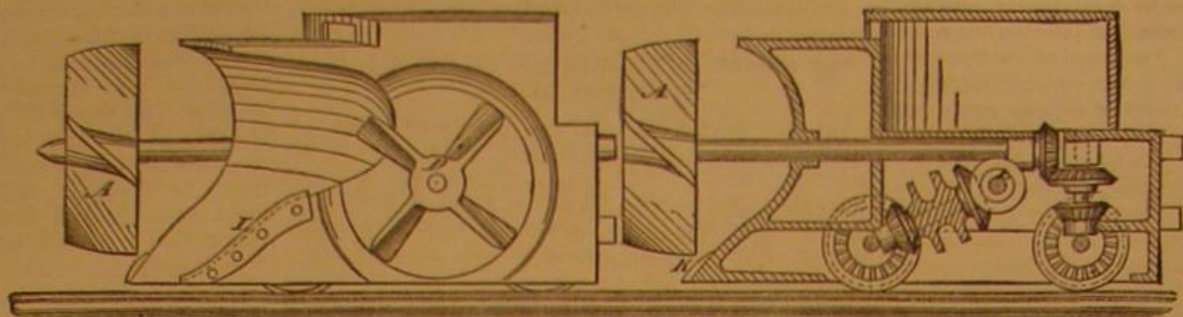
Hursting of a Reservoir Dam.

Recent heavy rains in New England resulted in the breaking down of the dam of a reservoir at Staffordville, Conn. A body of water covering over 400 acres was freed, and rushed through the valley, overthrowing smaller dams in its path and devastating a portion of the valley of Stafford Springs. The flood moved slowly, so that time was afforded to people to get out of the way, but the loss of property was great, amounting, it is estimated, to over \$350,000.

BELGIAN anti-friction metal is composed of copper 20, tin 4, antimony 1, lead 1 parts. Mix all the other ingredients before adding the copper.

A SCREW SNOW PLOW.

Mr. Robert G. Little, of Halifax, Nova Scotia, is the inventor of the novel snow plow herewith illustrated, which was patented through the Scientific American Patent Agency, January 30, 1877. The new feature is the screw fan, A, projecting in advance of the plow on a horizontal shaft, which assists in throwing the snow off at and back along the sides of the plow. On each side of the plow there are fans, D, to receive the snow from the front and project it off at the sides, said fans being turned by a shaft arranged transversely of the machine. The side fan shaft is geared by countershafts with the front axle of the plow. If preferred, an engine may be mounted in the cabin of the plow specially for driving the fans, steam being furnished to it from the boiler. K and L are cutters attached to the plow for cutting the snow when packed hard.

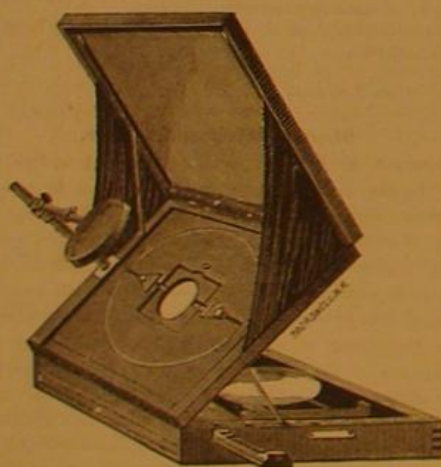


LITTLE'S SNOW PLOW.

PHOTOGRAPHER'S RETOUCHING DESK.

This is a desk for artists' use, which enables the retoucher to see perfectly his work, get at it with ease and facility, and continue working with precision and comfort, and it must materially tend to excellence in result. It is the invention of Messrs. Burrows & Colton, and is manifestly the outcome of experience, the invention of one who has felt what was wanted. The engraving will give an idea of the general arrangement.

The retoucher may as easily sit upright to the work as in a leaning, round-shoulder-inducing position. The base contains a drawer for holding loose portions of the desk, pencils, etc., and is provided with a pencil sharpener in a handy position. The desk proper can be placed at any suitable angle. It is provided with a circular revolving inner frame, with clamping screws, sliding in a groove to permit them to hold firmly negatives of various sizes. Behind a central aperture in this revolving table or stage is an attachment on the principle of a series of revolving diaphragms, containing three apertures, any one of which can, on revolving the disk in which they are contained, be brought immediately behind the aperture in the desk, over which the negative rests during retouching. This affords facility for modifying the lighting through the negative. In this revolving disk, in each of the three apertures, is a different kind of glass—one plain, clear glass, one fine ground glass, and one opal glass. This arrangement enables the manipulator to judge with ac-



curacy as to the effect of his work on the negative, and guides him in modifying the amount or style of the work he is applying. Placed underneath the desk is a concave silvered reflector, for throwing up a satisfactory light on the negative; this is of great value, either for daylight or artificial light. As the circular table or stage in the desk readily revolves, the artist is enabled to bring the negative in a moment into a satisfactory position for working on. By no means the least important adjunct to this desk, says the *British Journal of Photography*, is the magnifying glass, attached to a steady, movable arm of brass, with adjustment to place it in any position and at any focus to suit the artist. The importance of steadiness in the position of the magnifier cannot be over-estimated in saving the eyes of the workman.

A Large Snake at the Zoo.

That enthusiastic naturalist and writer, Frank Buckland, describes (in *Land and Water*) the recent arrival in London of an anaconda from South America. He says:

"This immense snake is now safely housed in the snake house in the Zoological Gardens, under the parental care of Holland, who has for many years so ably managed the snakes, poisonous and non-poisonous. Our visitor arrived at Liverpool in a large box. Intelligence was given to Mr. Bartlett, who proceeded to Liverpool to inspect him, a matter of considerable difficulty. It will not do to buy an expensive snake of this kind without a warranty. Snakes are very liable to canker in the mouth. The gums get swollen and flabby, and completely conceal the teeth, so that the beast cannot feed. Again, if snakes are injured in the capture, they frequently die in consequence. It was necessary to

examine the snake as to these two points. Having been shut up for several months without food, and in the dark, the anaconda was not in a good temper. When the lid was opened Mr. Bartlett caught him tight round the neck with both hands; it was not necessary to open the mouth, as the savage snake did that soon enough of himself, in true anger. A moment's inspection showed he had no disease of the

gums. It was with some difficulty that Mr. Bartlett got his head back into the box, without letting out more than a foot or two of his body. The anaconda has not poisonous teeth, but has great and dangerous powers of crushing. The box with the snake weighed over 2 cwt. It was with much dodging that Anaconda was conducted by two keepers to his new quarters, where he at once retreated into a bath of warm water, from which as yet he has only emerged once or twice. It is difficult to give the exact length of the snake, as he is not to be measured with as much facility as a fathom of rope. He is now lying in three parallel folds in his bath; we know the length of the bath, and we calculate his length to be between eighteen and twenty feet—a tremendous fellow! It was impossible to get a tape measure round him; but having measured his diameter in his thickest part, we conclude that he is over two feet round the body. At present he is thin, and his skin fits him very loosely. It is hoped that he will soon begin to feed. Mr. Bartlett, with his usual ingenuity, has found out how to make Mr. Anaconda feed. He covers his bath over at night, and puts therein with the snake a duck. The duck is always gone in the morning, and the snake appears fatter. Anaconda is decidedly nocturnal and aquatic in his habits. Like our own British snake, it is found in marshy, damp places, and he feeds upon animals which come down to drink at night. Mr. Bartlett has ascertained that the last meal of this snake had consisted of a young peccary, the horny part of the hoofs having been discovered in the stones at the bottom of the cage; there are also the hairs of another animal, which has to be diagnosed by microscopists. This tropical American snake is also called the *aboma*. The provincial name is *el traga venado*, or the deer swallower. He never interferes with men, although of course he will take his own part if attacked. It is greatly to be hoped that this magnificent snake will in time get an appetite and recover from his travel-worn appearance. His color may be described as buff, with very dark markings on the upper parts. His companion in the cage is a magnificent reticulated python (*ular saeva*), caught at Penang. He has been at the gardens since August, 1876, and has not eaten anything since he arrived. He shed his skin recently, and is now most lovely to behold. It would be impossible to describe the tints of the new skin (a splendid lacing of bronze, blue, gold, and black), except by saying that they are quite as gorgeous as a peacock's plumage.

"I have had some snake skins tanned, a lady having promised to wear a dress ornamented with them. Eve dressed in snake skins is too good a point to be overlooked."

A Fountain on a Spire.

The Virginia (Nev.) *Enterprise* of March 6 says: "Last evening, about 4 o'clock, the eyes of hundreds of persons on the streets were directed towards the top of the spire of the new Catholic church, where was seen a fountain spouting numerous jets high in the air. A large iron pipe is carried up through the steeple and up the large cross surmounting the same. The pipe then takes the form of the cross, behind which it is hidden, and from holes perforated at proper intervals the jets are sent up. From the top of the cross and from the end of each arm large streams ascend to the height of about 25 feet, and between these are thrown up a great number of smaller jets. The height of the top of the cross from the ground is 170 feet, and last evening, the air being calm, the numerous jets spread out in the shape of a fan. The rays of the declining sun fell upon the jets and spray at just the proper angle to light up and bring out the whole in a beautiful roseate glow which surrounded the top of the cross like a glory. This novel fountain was not constructed for mere ornament. It is intended for use, in case of the breaking out of a large fire, as a protection to the spire and roof of the church. It is but the work of a moment to turn on the water and drench the spire. The height to which the water is thrown above the cross shows the great force of the water works of the city."

Now is the time to purify your chicken houses to prevent disease. Burning sulphur in the houses; sprinkling with carbolic acid; whitewashing with hot lime; cleaning out frequently; providing new nests; providing liberally, ashes, charcoal, burnt oyster shells, lime, gravel, pure water, will all aid in stopping or warding off disease.

How to Photograph Microscopic Objects.

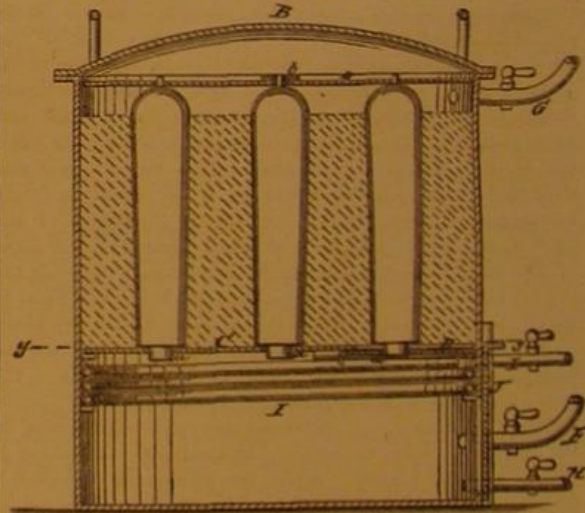
Dr. Fayel lately presented to the Academy of Sciences, Paris, the details of a new method of micro-photography. He placed upon a window sill the microscope he employs for the purpose, which had over the top a small wooden box supported on a tripod. This wooden box is the camera, which can be fitted and removed at pleasure, and has a plano-

convex lens inside the camera, moved by a screw. By calculation the author had determined, first of all, and noted upon the exterior, the different heights that the camera, should occupy, in order to secure enlargements with the various powers employed, the image refracted by the lens being projected upon the focussing screen of the camera of the same size exactly as it is seen with the eye. Matters thus regulated, M. Fayel takes the microscopical preparation

it is desired to enlarge, and reproduces and examines it under the microscope; and when the latter has been properly focussed, the camera is put in its place, without touching either the microscope or the preparation, the eyepiece remaining in its place. He brings the lens down to the point corresponding to the scale referred to above, and, without even taking the trouble to look at the image upon the ground glass, he forthwith proceeds to put a sensitive plate into the apparatus. When the exposure is at an end, the *cliché* is developed in the ordinary way. The advantages claimed by Dr. Fayel for this mode of operating are the following: 1. It furnishes to the physiologist the possibility of taking a photographic image of any object visible under the microscope, no matter to what scale it is enlarged. 2. It permits the production of an image without touching the microscope or the object or preparation under it—there is no need even to focus after the camera has been adjusted, because this is done automatically, and always remains the same. 3. It yields an image of the dimensions precisely of that seen through the eyepiece; and, finally, it allows one to transfer to a competent operator all the photographic labors connected with the affair. The micro-photographs presented to the Academy of Sciences as the fruits of this apparatus were of a most interesting and remarkable character.

A NEW SODA-CARBONATING APPARATUS.

James McCloskey, of East Cambridge, Mass., has patented through the Scientific American Patent Agency, January 30, 1877, a new apparatus for carbonating soda, which we illus-



trate herewith. It consists of a chamber, A, having a horizontal perforated partition, C, near its base, and a number of removable shouldered pins, E, that rest in the perforations of the partition, and are removed when the chamber is filled with soda ash, leaving corresponding openings in the contents of the chamber. F and G are gas pipes, and H is a steam pipe, for introducing steam into the chamber for facilitating the process of carbonizing. I is a coil of steam pipe for heating and drying the soda, should it become too moist to grind.

The manner of using the apparatus is as follows: The cover being removed, and the pins, E, being in their places, chamber A is filled up to the rounded portion of the pins, E, with soda ash. The pins are then removed, leaving openings through the soda ash above the perforations in the partition. The cover, B, is placed and sealed, and carbonic acid is introduced through either or both of the pipes, F and G, and more or less steam is also admitted through the pipe, H. The openings left by removing the pins, E, expose a great amount of surface to the action of the gas; hence the process is facilitated.

The advantages claimed for the apparatus are that, with it the process is completed in much less time than by the ordinary method, and the discoloration commonly produced by the wooden trays is entirely obviated.

BODY COPAL VARNISH FOR COACHMAKERS' USE.—FUSE 8 lbs. fine African gum copal, add 2 gallons clarified oil, boil slowly until quite stringy, mix with 3½ gallons turpentine, and strain. The boiling will take 4 or 5 hours.

THE PROPAGATION OF NERVE EXCITEMENTS.

Physiologists differ widely on the question as to whether motor and sensory nerves are identical or different in their formation and capabilities: in other words, whether a sensory nerve may conduct excitations having for their result a bodily movement, or *vice versa*. It is not even definitely known whether an excitation of a nerve near the middle of the latter propagates itself simultaneously in both directions, centripetal and centrifugal. In order to obtain some data on this interesting subject, M. Paul Bert has recently made some curious experiments, an account of which, with the accompanying illustrations, we find in *La Nature*.

If at any point of its length, says M. Bert, a sensory nerve be pricked, the pain experienced indicates quite clearly that the excitation is propagated in centripetal direction. We have no similar certain knowledge that centrifugal propagation occurs, for the simple reason that at the terminal extremity of the nerve there is no perceptive nervous apparatus. Now if we can succeed in placing that extremity in connection with a perceptive center—that is to say, with the brain—then, if we find sensation, it must follow that centrifugal propagation takes place.



FIG. 1.—M. BERT'S EXPERIMENTS ON THE NERVES.

A rat was the subject of the experiment thus indicated. The skin was removed from the end of the tail of the animal for a distance of nearly an inch; and an orifice being made above the spine, the exposed end of the tail was inserted in the cellular subcutaneous tissue. A few sutures sufficed to keep the parts in place, and eventually complete adherence was obtained.

At the end of eight months the tail was cut at about the middle; so that the animal had two tails apparently—one growing out of the back, the other in natural position. Immediately after the section, the dorsal portion was manifestly sensitive; as, when it was pinched, the rat squealed, and at tempted to escape. It was therefore evident that, in this fragment of the tail, excitation of the sensory nerves was propagated from the large to the smaller end—that is to say, in inverse direction to the supposed normal course. What had occurred?

The sensitive nerves, says M. Bert, which extended to the end of the tail, wounded by the removal of the skin, united with the nerves of the dorsal region, which had likewise been cut in making the necessary orifice. After a sufficient period, the nervous cicatrix became capable of passing vibrations. Then, when the end of the dorsal tail was pinched, the vibration traveled in the excited caudal nerve, traversed the cicatrix, and followed the dorso-cutaneous nerve to the spinal marrow, which conducted it to the brain, which organ translated the vibration into a sensation of pain. This will be clearly understood from Fig. 2, in which M E is the spinal marrow, and N C one of the nerve filaments passing to the end of the tail, the extremity of which was exposed. G is its ganglion, N one of the nervous filaments in the back exposed when the orifice was made, C the nervous cicatrix formed when the nerves united, S the point of section of the tail, and a b arrows indicating the two directions in which the excitations which determine sensibility are propagated.

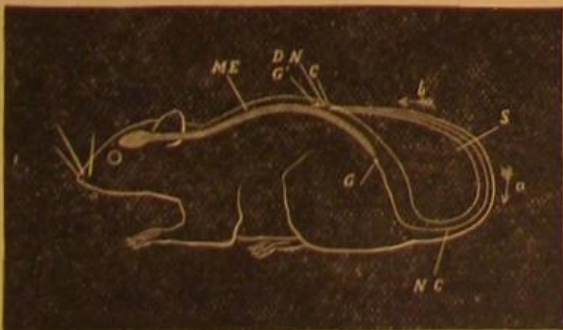


FIG. 2.—M. BERT'S EXPERIMENTS ON THE NERVES.

On the second day after the section was effected, the sensibility of the dorsal tail diminished and finally disappeared altogether. Examination with the microscope showed that the nerves of this portion had undergone the usual alterations of nerves separated from their trophic centers, and that this had taken place in part under the skin as well as that outside, although the appendage had grown to the animal and seemed healthy and vigorous. The nerves in the true tail were, on the contrary, perfectly free from degeneration.

M. Bert's conclusions are that an excitation in a sensory is propagated simultaneously both centripetally and centrifugally; and he thinks the same holds true for motor nerves. It is also very probable that, as Vulpian has shown, nerves are simple conductors, which are differentiated only by their mode of working, which depends upon the apparatus existing

at their air extremities: namely, nervous motor cellule and muscular fiber for motor nerves, receptive nervous cellule and impressionable termination for sensory nerves.

Clothes Pins.

The Newark *Advertiser* says: Insignificant as the common wooden clothes pin is itself, its manufacture forms no mean part in American industries, and the numerous factories in New England and other States furnish employment to thousands of people. There are several large clothes pin manufactories in Pennsylvania and Ohio, and one in the vicinity of Saratoga, N. Y., each of which is capable of turning out a thousand boxes, or 72,000 pins, per week. There are several small factories scattered throughout Massachusetts, New Hampshire and Vermont, and all are run by water power. As a rule, those engaged in the manufacture of clothes pins are Quakers. Beech, white birch, and poplar are the woods used in making the article, the birch and poplar being considered the best. The machinery employed is very simple. The wood is first sawed into logs four feet in length, and then cut into small square sticks by means of a cutting machine. Each stick, after being rounded in a lathe, is passed into another machine which throws out a number of perfectly formed pins at one cut and with great rapidity. The pins are then thrown into a large revolving cylinder and smoothed by friction with each other. New York and Boston are the principal markets for this ware, and hence they are shipped in large quantities to the West, and to England and Australia. Over 100,000 boxes of pins are annually sent to England, and a corresponding number to Melbourne, Sydney, New Zealand, and the Sandwich Islands. Owing to the depression in business, during the past two years prices have fallen off 25 per cent, and some of the manufacturers in New England have ceased operations because they could buy cheaper from the West than they could manufacture themselves, besides saving the expense of packing and transportation. The price depends entirely upon the finish and number in a box.

An Observatory on Etna.

Professor Tacchini sends us a note read before the Genoese Academy on September 23, 1876, entitled, "On the Convenience and Utility of Erecting an Astronomico-Meteorological Station on Mount Etna," in which, after describing his experiences during a brief ascent on September 15 and 16, he expresses his views with regard to the establishment and most desirable fitting of an observatory on the mountain, to be mainly devoted to spectroscopic and meteorological observations.

Professor Tacchini ascended on the morning of September 15 from Catania to the station occupied by a party of the English and American expeditions on the occasion of the total solar eclipse of December, 1870, and found there a diminution of temperature of 73°-8° Fah. He had taken with him a Dollond telescope of 3½ inches aperture, a spectroscope of strong dispersion by Tauber, a small spectroscope of Janssen, an aneroid barometer, thermometers, and a polariscope. At 10h. 30m. A.M., on the 16th, a few detached clouds only being present, he remarked that the blue of the sky was much deeper than at Palermo or Catania. The solar light had a special character, it seemed whiter and more tranquil, as though due to artificial illumination by magnetism. Viewing the sun rapidly with the naked eye, it was seen as a black disk surrounded by an aureola of limited extent, projected on the blue ground of the sky. On interposing an opaque body before the disk the aureola was seen better, but always limited, and the pure blue sky terminated the same, which extended to rather more than half the solar radius; with the naked eye it was difficult to judge if the aureola was of equal breadth all round the disk, and the only thing well marked was the difference from the view obtained at the level of the sea; while the sky is ordinarily whitish about the sun, on Etna it remained blue, and the aureola acquired a better defined contour. With a helioscope the aureola was much better seen, and its border appeared irregular, and as though it were rather more extended at four points, which, at noon, corresponded to the extremities of the vertical and horizontal diameters of the disk. At 3 P.M., after interruptions from clouds (which in passing rapidly at short intervals produced a striking effect by the formation of a stupendous series of colored rings round the sun, containing all the gradations of color in the spectrum, a phenomenon new to Professor Tacchini), the Tauber spectroscope was applied to the telescope for examination of the solar spectrum, and the observer expresses his surprise at the fine definition of the lines and the extraordinary distinctness of the whole; the chromosphere was bright.

In the evening, at 10h., the spectacle of the starlit sky was novel and enchanting. Sirius appeared to rival Venus, the finer constellations acquired an altogether special aspect, and the appearance of the *Via Lactea* was astounding. The image of the planet Saturn was admirable, and the peculiarities of the ring and belt were seen to much greater advantage than at Palermo, shortly before leaving. Venus afforded remarkable proof of the rare quality of the sky of Etna. The planet shown with a powerful light, which cast shadows during the ascent of the mountain; it scintillated frequently like a star. The telescope showed, on the northern part of the phase, an oblong space, less illuminated than the rest of the disk, which Professor Tacchini says was "sicuramente una macchia del pianeta."

Spectroscopic observations were renewed on the following morning, when the sun had attained an altitude of 10°. The

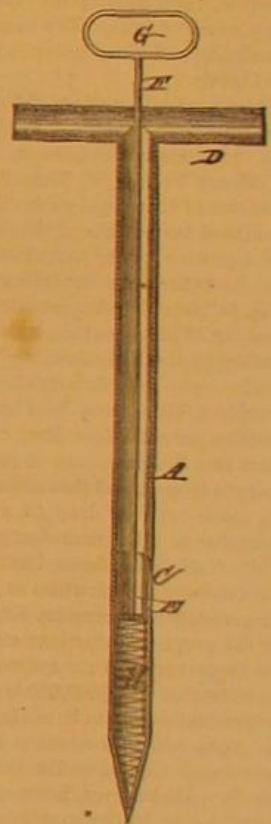
chromosphere was magnificent; the inversion of the magnesium and of 1,474 was immediately evident, which was not seen at Palermo with the same telescope.

With regard to the proposed observatory, which Professor Tacchini is desirous should be an accomplished fact before the meeting of the scientific bodies at Rome in September next, he proposes that it should be erected at the *Casina degli Inglesi*, and should be named after Bellini, and that it should belong to the University of Catania. He suggests that it ought to be provided with a refractor of first-rate quality and of at least about 6-8 inches aperture; and he advises that, while the meteorological instruments, which should be adapted to the requirements of the day, as indicated by the London Congress, would remain constantly at the Bellini Observatory, a duplicate mounting might be provided for the refractor at some spot within the University of Catania, with its proper dome, the other being fixed on Etna: so that, while from June to the end of September astronomical observations could be carried on upon the mountain, during the winter they might be made at Catania, where the sky is a very good one; the astronomer would thus have only the object glass with its tube to transport to and fro. Professor Tacchini further suggests that accommodation for visitors should be provided, with the view to increasing their numbers, and that a certain payment should be made by them, to go towards the maintenance of the Observatory and its custodian.

We wish every success to the scheme thus energetically brought before the Italian authorities by Professor Tacchini, and have no hesitation in predicting important gains to Science from its adoption.—*Nature*.

IMPROVED GRAIN SAMPLER.

We illustrate herewith a simple device for sampling grain in bags or in bulk. A is a pointed tube, which is provided with an aperture, C, in one side. A tubular handle, D, is attached, and a valve, E, is provided for closing the aperture. A rod, F, is centrally attached to the valve, E, and runs through the handle, D, and is provided with a handle, G. A coil spring, H, is placed in the tube, A, between the coned end and the valve, E, for closing the said valve. When a sample from the interior of a body of grain is required, the tube, A, is forced into the grain as far as may be desired, when the valve, E, is pushed back, opening the aperture, C, allowing the grain to run into and partially fill the tube, A. The rod, F, being released, the spring, H, returns the valve to its normal position. The instrument is removed from the bulk of the grain, and the contained sample is poured through either arm of the tubular handle. The conical end permits the insertion of the tube in bags by displacing the meshes of the material of the bag as the tube is forced in.



Patented through the Scientific American Patent Agency December 5, 1876, by Mr. J. F. Gent, of Columbus, Ind.

A Salmon's Endurance.

Land and Water relates the following, concerning a remarkable battle lasting for sixteen hours, between a plucky sportsman and an obdurate salmon, before the latter was conquered: "On Friday, at four P. M., Mr. A. Crawshaw hooked a fish below Houghton Castle, but did not land him till Saturday morning, the 24th inst., at eight A. M. Immediately after being hooked, the fish went down the river, taking out upwards of 100 yards of line. The water being strong and the fish determined, it was impossible to get him back. A wood by the water side made it equally impossible for Mr. Crawshaw to follow his fish, and so things remained until a boat was brought at daylight next morning from some distance, by which means the wood was passed, and the fish at last landed on a gravel bed, in the presence of many spectators, some of whom had passed the night with the angler. The fish was a splendid male, forty inches long, and twenty-two inches girth; weight, 25½ lbs."

Portland Cement.

Mr. I. J. Mann, assistant engineer, Port and Docks Office, Dublin, has made experiments upon the qualities of Portland cement, which prove that coarsely ground cement when used neat (without sand) is stronger than finely ground cement; but when used with sand, as in concrete and mortar, it was found that cement containing only twenty-five per cent of coarse cement particles had but half the strength of mortar mixed with fine cement, the cement used being in each case four weeks old. On the other hand, extremely fine sand diminished the strength of the mortar to less than one half of that which was mixed with coarse sand.

[Continued from first page.]

ing above mentioned. Its forward end is suitably connected to a second pivoted bar, G; so that, when the first bar has a lateral movement, that motion is, through the connection, transmitted to the second bar. To the rear extremity of the latter is attached a chain which passes around and is secured to the small cam, H, Fig. 1. I is a larger cam, rigidly attached to and hence working on the same pivot as cam, H. Around cam, I, and secured to it, is another chain, which passes over a guide pulley at the rear end of the platform and is fastened to the caboose car. The peripheries of each of these cams, or rather eccentrics, gradually increase from the point of connection of the cables, so that the caboose is thus made to serve as a counterweight to the resistance of the plows and drag, adapting itself readily to increased or decreased strain.

The present invention is one of a series designed for grading railroad beds in all situations, except through stone, and also to keep the same in repair. Two other machines have been devised, one to make a "cut" and a "fill," and the other for ditching purposes.

Parties who will interest themselves in the securing of contracts for use of the device above described are invited to address the inventor, Mr. J. J. Harden, 83 West Van Buren street, Chicago, Ill.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Notwithstanding the general stagnation of business, the issue of patents still keeps on, the hard times appearing to have sharpened the wits of our inventors, thus proving, in more senses than one, that "necessity is the mother of invention," and causing the business of the Office to increase very much of late. The issue of March 6 was about four hundred, including patents, reissues, designs, trade marks, and labels.

An examination of the list of the acts of Congress of the last session that received the signature of the President shows but three relating to patents, namely, the acts for the relief of Henry Voelter, T. Bussell, and W. W. Hubbard. The first two of these is to authorize the Commissioner of Patents to extend the patents of the two gentlemen named, the first for a process for the manufacture of paper pulp from wood and the other for a car spring. The last act, according to the title, is "to make compensation for the past making, using, or vending of his patent explosive shell fuses and percussion exploders by the United States." There were other patent extension cases passed, but failed to meet the approval of the President, and hence have not become laws. No sewing machine patents have been extended, and it therefore appears that the monopoly of the sewing machine combination is about to end, and that about May next the prices of sewing machines will drop to a reasonable figure, or as soon thereafter as other manufacturers can supply the market.

Mr. Nathan Appleton has been in consultation with the late Centennial authorities at Philadelphia, and, as a result, has presented to Secretary Evarts a sketch of an organization for the proposed American exhibit at the next Paris Exposition, together with an estimate of the necessary expenses. He estimates that \$300,000 is the least amount with which a proper exhibition can be made, and this on the supposition that the goods will be received at New York in government warehouses and shipped to Havre in United States Government vessels. He believes, however, that \$500,000 should be appropriated to do the country credit at Paris. The gentlemen who are shaping the present movement entertain strong hopes that the President will be able in some way to accept the invitation of the French republic at an early date, as they find there is a general desire among Americans to take part in the Exposition.

I hear of no changes worth noting in the officials of the Patent Office, although rumors of the proposed removal of the Commissioner and his assistant have been flying around of late; but I have been unable to trace these rumors to any reliable source, and it is generally believed there is no foundation for them, as the new Secretary of the Interior is said to be a strong believer in civil service reform, and he would have to stultify his past record to make these removals. He is said to be now engaged in framing his views in relation to the civil service into the form of a code of rules to govern the department over which he presides, and which will, it is believed, form the basis of the government of the other departments in the matter of appointments, etc. It is reported that he has signified his intention of making no removals where the incumbent proves qualified, diligent, and efficient, and it is therefore hoped that all the trustworthy officials in the Patent Office will retain their positions.

The Post Office has invited tenders for the contract to manufacture postal cards for the next four years, from which it appears that, during the last fiscal year, 150,815,000 cards were issued; and it is expected that the issues for the current year will be about 180,000,000. It is thought that the number required during the next contract term will reach the enormous number of 1,000,000,000 at least.

Washington, D. C.

OCCASIONAL.

Friction of Slide Valves.

To the Editor of the Scientific American:

In your SUPPLEMENT, No. 62, there is an article by Mr. Hill on the friction of slide valves, which, while it contains

some truth, is yet enough in error to deserve notice. Allow me to say in the beginning that I am not one of those "semi-mechanics" who, to use Mr. Hill's expression, have been "peddling" balance slide valves. I am simply a mechanic who, in common with a great army of similarly situated men, contrive to gather up from year to year considerable information from the columns of the SCIENTIFIC AMERICAN, and it is because so many young mechanics make that paper their textbook that I venture to offer objections to Mr. Hill's conclusions. There are in the country mechanics who have invented, and no doubt to some extent "peddled," balance slide valves, and who, in point of ability, might not suffer in comparison even with Mr. Hill himself, and it certainly does not assist his argument to disparage these men at its commencement. Some of these inventors have, as is well known, supplemented fair scientific attainments by exhaustive practical experiments; and while they do not claim to save "25 to 50 per centum" they do claim to show a slight saving in fuel, a very material saving in eccentric and connection to valve, and undoubtedly considerably more than the highest figure named by Mr. Hill in the wear of valve and seat and consequent "blowing." Mr. Hill is certainly to be commiserated if, in all his varied experience, "there is not a single relieved valve in use" that does not leak to the extent he indicates; and he may be assured that he can find several of them in this section which have been running from two to five years without any repairs whatever. All the leak from the packing of these valves passes directly into the engine room without becoming a nuisance at that. So much for Mr. Hill's gratuitous attack upon the vendors of balance valves.

In regard to that very useful and somewhat intelligent class, engine builders, whom he tells with so much modesty that they have always been in the wrong as to the pressure on a slide valve, it is to be presumed they will hold their "erroneous ideas" notwithstanding the demonstration which makes the case much clearer to Mr. Hill than to men who know better by experience. There need be no question in any one's mind, if he obtain his data for balancing slide valves from these conclusions, that it will not require even a "very short time" for them to become so leaky as to be voted a nuisance. In fact, were Mr. Hill to construct a valve of the dimensions indicated in his article, deducting as constant counterpressure his steam post and additional area, which at full steam chest pressure shall be the equivalent of the highest pressure reached by compression acting constantly upon the exhaust cavity of the valve, allowing besides a liberal margin for holding the weight of valve, there is no doubt any of the "half mechanics" would guarantee his valve to stay anywhere else in the chest rather than in its proper place against its seat.

Troy, N. Y.

NOT A PEDDLER.

Facts in Nature.

To the Editor of the Scientific American:

I read in your journal for March 17 an article entitled "Do Snakes Catch Fish?" Perhaps it is not a generally known fact, but most of our water snakes are expert fishers. Especially so is our common species, *tropidonotus sipedon*, Linn. Last spring my brother witnessed the capture of a water snake in a small stream flowing into the Schuylkill. The stomach of the snake was observed to be greatly distended, and on being cut open, to ascertain the cause, a large catfish, apparently just swallowed, was extricated. The snake measured two and a half feet in length, and the catfish seven inches. The fish was fully armed with the long sharp spines common to the genus, and must have proved a reluctant dinner, dying "game to the last."

I once saw a water snake in full chase of an eel. I was sitting on a small rock, quite near the surface of the stream, and observed them well. As they passed me, the eel led by about two feet; and as far as they were visible, the snake seemed to be gaining ground. But although I dropped my rod, and soaked my lower extremities considerably in the attempt, I was unable to see the termination of the affair. The snake appeared to be three feet in length, and the eel about the same size, certainly not more than two inches less. Professor Allen once saw a water snake hauled from the water and killed, that had a live pickerel in its mouth a foot in length.

The common water snake does not always capture its prey by a fair chase. I have several times seen it lying in wait among rocks and stones, with its head and part of its neck only visible; and when a fish or tadpole swam by, it would instantaneously dart forward and seize the unknowing trespasser.

Philadelphia, Pa.

C. F. SEISS.

Patterns for Fret Saw Work.

To the Editor of the Scientific American:

Those who wish to duplicate the above named patterns find the use of impression paper tedious and inaccurate. My method is as follows: Take two pieces of wood of proper size, cut any number of sheets of common writing paper to the same size as the wood, place the sheets on one piece and tack the other piece of wood to it with the paper between. Paste your design on one side and saw through paper and all. Saw the holes first and then the outlines accurately; and when done you will have as many beautiful designs as you wish with the least possible labor.

McLean, Ill.

FRET SAW.

The Frost Plant of Russia.

To the Editor of the Scientific American:

In your issue of February 24, I see a picture of what is entitled "The Frost Plant of Russia." I have seen the identical phenomenon on a certain kind of weed stalks in Fayette county, Tenn. While teaching a country school in that county, in 1873-4, my school children and I gathered the "frost flowers" frequently. They were most beautiful in the morning, and usually melted away during the day when the sun shone. I do not think that snow had any influence over them, and am of Dr. Darlington's opinion as to their formation.

Fall River, Mass.

T. R. VESTAL.

Beavers in California.

The Stockton (Cal.) Independent publishes the following: "As the fables of this vicinity abound in beaver, numbers of hunters and trappers have made an excellent living in capturing them for their pelts. The latter are worth \$2.50 each, and an industrious trapper can catch from 30 to 50 a month. In the equable climate of California the time of year seems to have no especial effect on the excellence of the beaver fur, it being equally good in summer and winter. The trapper can, therefore, pursue his avocation uninterruptedly the year through. With the beaver he can catch and the other game he can send to market, an industrious man can make \$100 a month and live as his own master. The trapper's outfit for the San Joaquin tules is a peculiar one. Two hunters usually join together in the outfit of an ark, or floating house, with which they paddle out through the innumerable sloughs that intersect the pathless jungle of tules. The ark affords one small room or cabin, provided with sleeping bunks, and furnished with a stove and complete culinary outfit. In this ark the hunter lives in comfort, always having a shelter, while its compact shape and size allows it to float in the smallest stream, thus bringing the hunter and his home in the very midst of his game."

A New Fire Extinguisher.

A new fire-extinguishing chemical compound has been lately devised, which, in its application for extinguishing fires, is quite different from the fire annihilators in general use. The new composition is a mixture of chemicals which, on being ignited, evolve sulphurous acid and carbonic acid gases, which fill the apartment or building, producing an atmosphere which smothers combustion. A successful trial of the invention was recently had in front of the City Hall in this city.

A board shanty, 13 feet square and 10 feet high, was erected to represent an apartment, and furnished with a door, window, and a stovepipe coming through the roof. The interior was coated with tar. On a bench were placed seven basins containing benzine, coal oil, and naphtha. In one corner was a 10 lbs. box of the extinguishing compound, with a fuse attached to it running round the walls, on the self-igniting plan. The combustibles were set on fire, and in an instant the interior was one sheet of flame, bursting out through the door, window, stovepipe, and every aperture. A few moments after the compound was ignited, the gases that were generated therefrom instantly subdued the flames; and in less than half a minute the fire was entirely extinguished.

The new substance is called "Reec's Compound Fire Extinguisher." G. J. Crikelair, of 263 Broadway, is the general agent for New York, New Jersey, and Connecticut.

Good Forgers.

The question has often been asked us, says the *Carriage Monthly*, "How is it that some smiths are able to make better forgings than others?" or "How is it that — is always so successful with his welds?" The secret of all this is in first knowing how, and after knowing how, in doing, or trying to perform, what we know. The knowing smith so lays out his work at the close of the day that his first work in the morning will be the heaviest, and such as requires but little welding. By doing this he not only leaves the lighter portion of his labors for the waning of the day and also the tiring of his arm, but he removes the chill from the anvil and other tools to such an extent as to prevent the iron from becoming chilled before the weld is properly made. His fire is always clean. His tool rack is always in order, thus enabling him to grasp the required tool at the proper time. He never places his iron in the fire a second time until, with a file, he has removed all the scales. The ice-cold anvil will chill the thin part of the "scaff," and prevent the welding of that portion. It is impossible to take a clean heat with a fire full of slag. If you have to hunt five minutes for a tool, your iron has become cold, and unless you remove the scales and other matter, your forgings will not be perfect.

Sawdust in Rough Casting.

Siehr recommends very highly the use of sawdust in mortar, as superior even to hair for the prevention of cracking, and subsequent peeling off, of rough casting under the action of storms and frost. His own house, exposed to prolonged storms on the seacoast, had patches of mortar to be renewed each spring; and, after trying without effect a number of substances to prevent it, he found sawdust perfectly satisfactory. It was first thoroughly dried, and sifted through an ordinary grain sieve, to remove the larger particles. The mortar was made by mixing one part of cement, two of lime, two of sawdust, and five of sharp sand, the sawdust being first well mixed dry with the cement and sand.

Progress of Rinderpest.

In view of the renewed and alarming appearance of this fearful malady in Europe, the Treasury Department has lately issued the following instructions to collectors and other officers of the customs:

"The prevalence of the rinderpest in Germany, and of that malady and the foot and mouth disease in England, has led this Department to prohibit the importation of neat cattle and the hides of neat cattle from those countries into the United States. By reason of the proximity of Holland and Belgium to Germany, and of Ireland to England, the prohibition is hereby extended to embrace such importations from those countries.

"The Department is informed that the rinderpest is infectious as well as contagious, and that sheep, horses, and swine may be media for its communication. It is also understood that the litter upon which these animals sleep spreads the disease. While the Department has no authority under the law to prohibit the importation of horses, sheep, and swine, it desires that all measures practicable be taken on the arrival of such animals from the countries named to prevent the possibility of contagious diseases being communicated thereby to stock in the United States.

"It is suggested that horses, sheep, and swine, coming from any of the countries named, be examined by experts, and, if necessary, quarantined for a reasonable time; to which it is apprehended that importers, as a rule, will offer no special objection, as it is to the interest of all concerned to prevent the spread of this disease in the United States. Blooded stock coming from the countries named may be admitted when accompanied by a consular certificate of non-infection, as authorized by Department's letter of the 16th of March last, it being presumed that such stock is selected with care, and that it would not be taken from herds which are infected with the diseases mentioned."

Cotton Seed Oil—Its Manufacture and Uses.

Among the great number of special industries created by cotton is the manufacture of oil from the seed. And although this product does not compare in value with sheeting, shirting, yarn, thread, and the remarkable variety of other cotton goods, yet the oil has even a closer connection with our bodies than the shirts on our backs. But, not to begin with the end, it is better to describe its manufacture before stating its destination.

Probably there ought not to be a cotton seed oil mill in the country, for the seed is valuable as manure and as food. Its seed is a strong fertilizer when crushed and composted, or when rotted alone; or even when plowed under whole, it is a material return to the earth for its generosity. The dried plant itself has but little strength, but it helps to loosen stiff soils, and therefore is plowed under or allowed to rot on the surface when the field is prepared for a new planting. The seed, when prepared as a fertilizer by crushing, rotting, or by grinding the dried oil cakes, is used as guano, in hills of corn, in drills of other grain, or spread broadcast on meadows and gardens. Another profitable use of the seed on a farm is to boil it with corn or meal and give it to cattle. It is excellent feed for milch cows in this form, or as meal made from the pressed oil cake.

The farmers who will sell their cotton seed at \$7 per ton, delivered at the railroad, are few in Alabama, happily for the improvement of the country. In Louisiana and Mississippi, where the soil is rich and stock is scarce, the mills get enough seed to be profitable factories. There are about 10 in those two States. Here there are but two, and they cannot get sufficient seed for continuous work. Georgia, which is said to use now more fertilizers than any other State in the Union, has no oil mill. This should be counted a great addition to her thrift, if the bull can be pardoned.

The cotton seed as it comes from the gin has still some cotton lint. It looks like a white cocoon, about one third of an inch long and half as thick. In a mass the seeds adhere slightly together and look like a lot of dingy cotton waste. From such a heap they are shoveled into a hopper, in which a screw, revolving in a trough, divides them into small bunches and empties them into elevating cups on a belt. This elevator empties them into a revolving screen with meshes smaller than the seeds. Here the sand, dust, and other small particles of extraneous matter are sifted out and the seed passed into another elevator that empties it into a second revolving screen. This has meshes large enough to pass the seeds, but too small to pass the cotton husks or bolls, sticks, stones, jack-knives, and horseshoes, that often come with the seed. From there the seed passes into a gin, made expressly for the purpose, to remove the short lint left on it by the first gin. An elevator takes it to a huller for removing, or rather breaking, the shell. The huller is a heavy cylinder, provided with knives, that pass between teeth so close together that the seeds are cut in two or three pieces. The cotton ginned from the seed passes to a carding machine, and is there carded for use. If it is available for butts, and other materials not requiring long fiber. It is used with success in the manufacture of cotton blankets, which, it seems, are highly recommended in this country.

The cracked seeds pass from the huller to a revolving sieve, or separator, that allows the meats to fall into a trough, but retains the shells. These shells are passed by a chute to the engine room for fuel. The meats go from the separator to a reciprocating sieve, which passes the pure meats through it, but retains the few shells with meats that were not separated, and sends these back to the separator for a second sifting. The meats pass between two heavy

iron rollers of great force, and are pressed into thin flakes, making a meal of yellowish-green color. This meal is placed in the heaters, which are iron tanks about 4 feet in diameter and 15 inches deep. These are double, the inner vessel being surrounded by steam at a pressure of 35 lbs. to the inch. The meal is stirred and heated, being dry, for five minutes. This dry heat frees the oil from its envelope. The meal is then scooped into strong sacks about 2 feet long and 10 inches wide, and placed between boards hinged together as the covers of a book are. Several of these sacks are then piled under a hydraulic press of great force, and squeezed for five minutes; they are then passed to a second and heavier press for the same length of time, and then to a third press. The oil runs from the presses to a tank and settles during 12 or 24 hours. It is then barreled for shipment. The cake of cotton seed meal is taken out of the sack and stood on its edge in a rack to dry during three or four days. The cakes are then packed in strong sacks or are broken up and ground into meal again to ship in bags. The most of it goes to England for cattle food and as a fertilizer. Some of it is sold in this country as a fertilizer at \$20 to \$23 per ton. A ton of seed produces about 20 gallons of oil, worth from 30 to 35 cents per gallon.

The crude oil thus made is sent to refiners in New Orleans, Cincinnati, and New York. It has a yellow color and a sweet taste of nuts. It is used, crude, for painting, and mixed with lard oil for lubricating. It is also mixed with some lighter oil or spirit for miners' lamps, for which its non-explosive quality makes it valuable. When refined it is difficult to tell all its uses. It is mixed with many other oils and passes for them. Here in the South it is much used for cooking in place of lard; and many a bottle bearing an assuring French or Italian label for olive oil is filled with this product of the cotton plant.—*Letter from Alabama in New York Times.*

Cheerless Workshops.

There are scores of workshops in this and other countries that are far from attractive in regard to their surroundings and interior arrangements. Many of them are dark, crowded, dreary places, where a stated stint of labor is performed according to a prearranged agreement, for which a stipulated price is paid; and were it not for the daily call of want, there would be no incentive to labor. We have seen workshops that were dark and damp, destroying the health and buoyancy of the spirits of the operatives, when a small sum perhaps would add not only warmth and light, but fill the place with pleasant surroundings. The surroundings of the place of labor have more influence upon the operative than many are aware of. Give a mechanic clumsy tools to work with, a rough, dirty bench to work upon, imperfect light, scarcely elbow room, and but little care exercised respecting proper ventilation and warmth, and he will become careless, his work partaking of the character of his surroundings; he will think more of getting his wages at a certain time than of the completion of his work. A few years of this experience will spoil almost any workman, no matter how good he may be.

But give him, on the contrary, good tools to work with, and a nice place in which to perform work, and he will insensibly take more pains with it than in a badly arranged apartment. In a pleasant room he will, of his own accord, keep his tools and work in good order, and more cheerfully perform the task assigned to him. A kind of magnetic influence of the surroundings will infuse itself into the operative, and his work will partake of that and go from him stamped with the impress of the influence thus created.

The above is from one of our exchanges, the name of which, we regret to state, has been mislaid. The article contains sensible advice, and we are sorry we cannot credit the source of it.

The Smithsonian Institution.

Professor Joseph Henry says that he has been trying for years, in regard to the Smithsonian Institution, to get the government to understand that the great testator never intended, by his magnificent gift, to accumulate a mere deposit of scientific works, but to collect all manner of new information for distribution among the nations of the earth. He has at last accomplished this. Chief-Justice Waite takes the same view, and the Institution is now sending contributions of American discoveries, science, art, antiquities, history, and inventions generally, to more than 2,000 universities and colleges in every civilized portion of the globe, and these in exchange return to us the printed evidence of their own successful researches in all these various studies and inquiries. Both these contributions from us to distant nations and from the distant nations to us are delivered free of cost, by order of the respective governments. Owing to careful investments in United States securities, there remains to-day to the credit of the Institute \$714,000.

A Small Flower Garden.

A writer in the *Western Farm Journal* recommends for a small flower garden the following list, as they do not require treatment, are good sturdy varieties, will stand neglect, yet do well: Asters, balsams, dianthus, petunias, phlox, calliopsis, verbenas, sweet peas, mignonette, cinnias, marigolds, and portulacas. The same writer again says: "The plants I have named will afford a profusion of flowers from June to October. Phlox will be the first to blossom, and then petunias will come on, and both of these flowers continue to increase in beauty until hard frosts come. Asters will be in perfection in August and September. Calliopsis begins to

blossom in July, and nearly all the others come on early in that month. If old flowers are removed and not allowed to go to seed, you will have a much greater profusion of bloom. If you do not remove faded flowers, but allow them to perfect seed, you will soon see that your plants are losing a large share of their former glory. You can't expect a plant to ripen seed and blossom profusely at the same time."

Photo Magic Lantern Slides.

At a recent meeting of the photo section of the American Institute in this city, during a discussion on the above subject, Mr. Roche said that, for lantern slides, emulsion plates gave the finest films, good bath plates next, and carbon last; that silver pictures for transparencies gave brilliancy and more contrast, and that many of the pictures exhibited were under-exposed and over-developed, thus giving too great a contrast and lacking in detail. Pictures for the lantern should be full of detail, soft and brilliant. Anything approaching a veil or fog over the picture is fatal. The high lights should be almost clear glass. The opinions of other members coincided with the remarks by Mr. Roche.

Mr. Newton, the President, remarked that he presumed it was not generally known, even by emulsion workers, what an increase of sensitiveness to the action of light was produced on an emulsion plate by the application of the alkaline development. In this respect it differed entirely from the action of an acid iron developer on an ordinary bath plate; whereas the iron developer on an ordinary bath plate nearly destroys its sensitiveness to the action of light, the effect of an alkaline developer on an emulsion plate increases its sensitiveness at least a hundredfold. He also stated that he had fogged an emulsion plate during development with the light of a kerosene lamp turned low and protected with manilla wrapping paper. This was occasioned by simply holding it a little too near the light to determine the stage of development. The fog commenced nearest the light, and diminished in the ratio of its distance from it. In the center of the plate, beneath the rubber of the pneumatic holder by which it was held, and where it was entirely protected from the action of light on the back, it was wholly free from fog and remained perfectly clear. By exercising more care, in removing the lamp to a greater distance and protecting it with more thicknesses of paper, he met with no further difficulty. He gave it as his opinion that much of the trouble experienced by those trying emulsions arose from developing in too strong a light.

Mr. Roche stated that, in working some good emulsion, the plate during development fogged. He therefore stopped out all light possible in the dark room, and then the plates developed clean and perfectly free from fog, confirming the remarks of the President on that subject.

Chemical Prizes.

Among the prizes offered by the German *Verein zur Beförderung des Gewerbefleißes*, the following may prove of interest to our readers:

A silver medal, or its value, and 900 marks (about \$200) for an opaque red enamel for gold, silver, copper, and bronze.

A gold medal, or its value, and 3,000 marks, for a substitute for caoutchouc, the same for a suitable substitute for gutta percha.

A prize of 1,000 marks for a concise, critical, and practical treatise on cements; also 1,500 marks for the best investigation of the cause of a change in the zero point of thermometers, with a method of preventing or remedying it.

A prize of 2,000 marks for the best series of iron and manganese alloys, at least twenty samples to be prepared, containing from 0.5 to 5 per cent of manganese.

Comparative Health of Cities.

The Health Bureau of the German Empire reports that during the week ending on the 27th of January last, the number of deaths to every hundred thousand of the inhabitants in the cities enumerated were as follows:

Berlin	43	Copenhagen	58
Cologne	51	Stockholm	55
Magdeburg	50	Christiania	45
Strasbourg	50	Warsaw	45
Munich	49	Naples	28
Augsburg	49	Turin	43
Dresden	48	Bucharest	39
Leipzig	48	London	39
Brunswick	47	Liverpool	40
Frankfurt	47	Glasgow	39
Vienna	47	Dublin	38
Potsdam	47	Edinburgh	41
Amsterdam	46	Alexandria, Egypt	75
Rotterdam	46	Madras	121
The Hague	44	Bombay	121
Basle	44	New York	65
Brussels	43	Philadelphia	32
Paris	43	Boston	47
		San Francisco	37

Five Thousand Dollars Reward for a New Invention.

The Directors of the London General Omnibus Company offer to award a prize of £1,000 for an invention or a scheme for effectually recording or checking the receipts of their passengers' fares, and which may be accepted by them as being so effectual. But the acceptance of any invention or scheme is to be entirely in the discretion of the directors, who will not be bound to accept any invention or scheme at all, nor to give any reason for non-acceptance.

To Polish Watch Wheels Without Injuring Them.

Take a flat burnishing file, warm it over a spirit lamp, and coat it lightly with beeswax. When cold, wipe off as much of the beeswax as can be readily removed; and with your file thus prepared, polish the wheel, which should rest on a piece of cork. The finish will be of the finest kind, there will be no clogging, and the edges of the teeth, etc., will remain perfectly square.

NEW MODE OF STOPPING LEAKS IN BOILER TUBES.

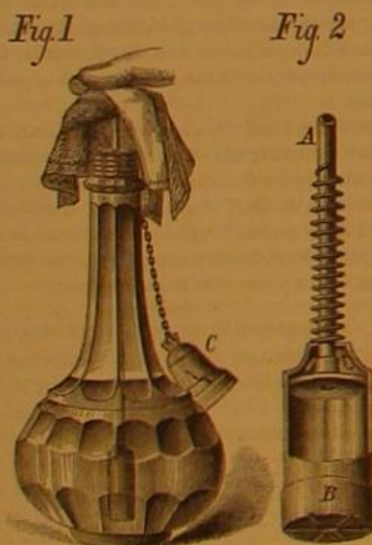
Mr. John McConnell, of Glasgow, Scotland, has patented through the Scientific American Patent Agency a device for stopping leaks in boiler tubes, which he claims may be placed in the tube when the boiler is under full working pressure, and without impairing the efficiency of the tube, as shown in the engraving. A is a tube of iron or other suitable material, which is bell-shaped at each end, *a*, and is provided with the collars, *b*, which surround the tube at the juncture of the bell-shaped and straight portions, and are somewhat less in diameter than the interior of the tube to which the stopper is applied. B B are gaskets of rubber, which have a form adapted to the space between the bell-shaped portion of the tube and the inner surface of the boiler tube, and are provided with a V groove, C, in their thicker or inner edges. The stopper is applied to the boiler tube by moving it by any convenient means to the leak, and placing it so that one of the collars, *b*, is on each side of the leak, as shown: when the pressure of the steam or water will force the rubber rings, B B, outward, and throw the lips or flanges formed by the grooves, C, against the inner surface of the boiler tube and the stopper, thus confining the leakage to the small annular space that surrounds the stopper.

Hydriodate of Morphine.

This new compound, which permits of being used in medicine, has been prepared by Ernst Schmidt both by dissolving morphine in hydriodic acid and by the action of acetate of morphine on iodide of potassium. The product in both cases was identical. Both crystallize in long needles, with silky luster and grouped in rosettes. The composition is represented by the formula $C_{17}H_{15}NO_4HI$, and $2H_2O$. When heated to the temperature of boiling water, it loses the two molecules of water, but recovers them on exposure to the air. It is but slightly soluble in cold water, more so in hot water. The hydrobromate of morphine is very similar to the above, crystallizes like it, and the crystals also contain two molecules of water.

A NEW PERFUME BOTTLE.

The annexed engraving represents an ingenious little novelty designed for attachment to perfume bottles. It is not an atomizer, but rather a miniature submerged pump, which, on being operated, forces up a small jet of the liquid against the hand or handkerchief. The stopper of the bottle, Fig. 1, is arranged in any convenient way to allow the passage of a hollow piston rod, A, Fig. 2, which terminates in a piston inclosed in the case, B. The latter is simply struck, in two portions, out of their metal, and has apertures above and a simple valve below. The piston rod is sustained by a spiral spring, and terminates above in a hollow button in which a



hole is made. On pressing on the button, the piston is forced down, the valve in the bottom of the case, B, closes, and the liquid beneath the piston is driven up through the hollow rod and emerges in a fine jet from the button. There is a screw thread on the bottle or stopper to receive the cap, C, for covering the button during transportation.

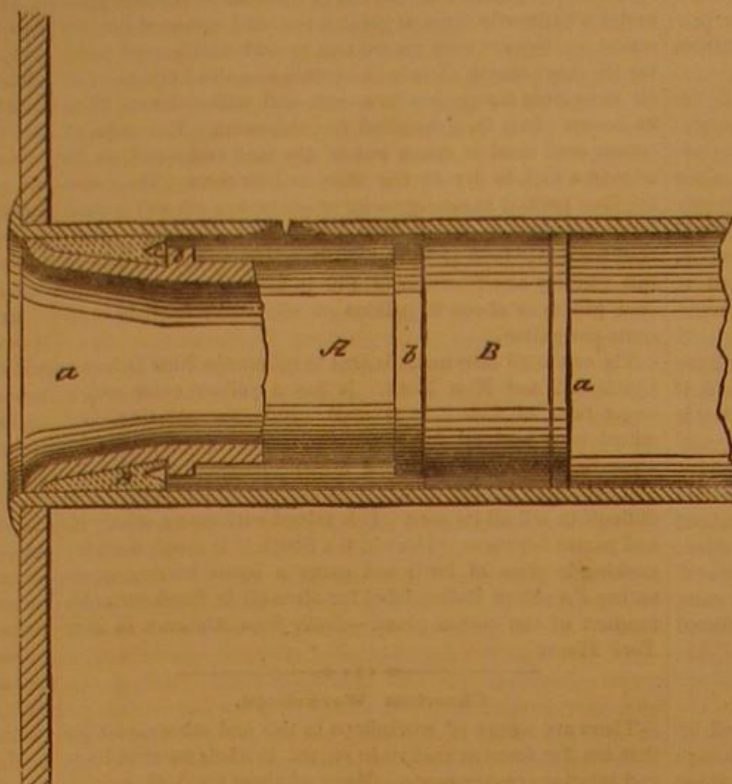
The advantage of the device is that it prevents waste of the perfume, which is the case when the contents of a bottle is shaken carelessly on the handkerchief, or when the bottle is left unstoppered. It is also a convenient arrangement for the toilet table, as a slight touch on the button causes the escape of a supply without lifting the bottle. The metal parts can be cheaply made by machinery, so that the dealer can sell bottles of perfumery provided with the device at quite a small additional price.

Patented through the Scientific American Patent Agency, January 14, 1873. For further particulars relative to sale of patent, address the inventor, Mr. W. S. Ward, P. O. Box 4,175, New York city.

PROFESSOR MARR, of Yale College, has received from the Geological Society of London a medal known as the Bigsby Medal, accompanied by a letter speaking in flattering terms of his recent discoveries among the fossils.

Learn the Value of Money.

A silver dollar represents a day's work of the laborer. If it is given to a boy, he has no idea of what it has cost, or of what it is worth. He would be as likely to give a dollar as a dime for a top or any other toy. But if the boy has learned to earn his dimes and dollars by the sweat of his face, he knows the difference. Hard work is to him a measure of values that can never be rubbed out of his mind. Let him



McCONNELL'S TUBE LEAK STOPPER.

learn by experience that a hundred dollars represents a hundred weary days' labor, and it seems a great sum of money. A thousand dollars is a fortune, and ten thousand is almost inconceivable, for it is far more than he ever expects to possess. When he has earned a dollar, he thinks twice before he spends it. He wants to invest it so as to get the full value of a day's work for it. It is a great wrong to society and to a boy to bring him up to man's estate without this knowledge. A fortune at twenty-one, without it, is almost inevitably thrown away. With it, and a little capital to start on, he will make his own fortune better than any one can make it for him.—*Hunt's Merchants' Magazine*.

ROBERTSON'S CRADLE ATTACHMENT FOR BEDSTEADS.

The annexed engraving represents a novel mode of attaching an infant's cradle to a bedstead. One form of the invention consists in the use of a bracket, Fig. 2, attached to the inside of the bedstead rail or other convenient place, and provided with holes at top and bottom, through which passes the lower end of a rod having its top curved so as to support the cradle, as shown in Fig. 1. When arranged in this manner with a single rod, the cradle may swing either lengthwise or sidewise; or, by allowing the rod to turn in the bracket, the cradle may have a horizontal, rotary, or semi-



rotary motion imparted to it. By means of a spring interposed between the curved arm and the ball, a jumping motion may be given to the cradle if desired; or the ball or support may be made flexible for the same purpose.

Instead of the single vertical support shown in the main figure, a forked one, such as is shown in Fig. 3, may be

used, in which case no ball is required for the cradle, thus leaving it entirely clear at the top; or two supporters—one at each end—may be employed, as in Figs. 4 and 5, when the child grows too heavy for a single support.

One advantage possessed by the single or forked standards is that they may be readily turned so as to swing the cradle either over the bed or on the side of the bedstead, or crosswise, as desired. When in the last position the cradle may be tipped on one side and so held by a hook (not shown), and the child may then receive its nourishment without the mother feeling its weight or heat, which, in warm weather, is a great relief to mothers.

Instead of attaching the brackets to the side of the bedstead they may be fastened to the footboard, and the cradle is then entirely out of the way in getting into bed, and takes up little space that can be occupied by other furniture.

It is often desirable to remove the cradle from the bed room to some other. This may be readily done by attaching to any convenient woodwork, such as the chair or base boards, wainscoting, etc., a bracket or brackets, as shown in Fig. 5; or the bracket on the bedstead may be readily slipped from its fastenings and as easily secured in the desired position. The bracket and rod may be further utilized by hanging a baby-jumper from it when the cradle is removed.

This invention was patented September 17, 1876, by Mr. T. J. W. Robertson, 820 F street, Washington, D. C., to whom applications for further information, or for State, county, or shop rights, or licenses to manufacture on royalty, should be made.

Make Something: Produce Something.

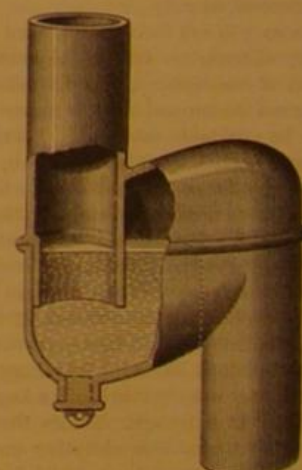
Half the people of the world are idle for want of some overseeing eye to set them to work. The advice which Haydon gave to the erratic poet Keats, to settle down to some definite purpose, needs be given to almost one half of mankind. There are very few persons but would find themselves comfortably well off if they would take hold of any one of a hundred

pursuits and stick to it. Industry and economy will make a most wonderful change in many households. So says one of our exchanges, and we believe it is the truth.

ADEE'S IMPROVED TRAP.

In the annexed engraving is represented a very simple trap for soil pipes, drains, etc., which is claimed to completely prevent the backing-up of sewer gas. The ordinary bent pipe trap is not, as a rule, an efficient protection against this exceedingly dangerous emanation, because the discharge of the contents of the drain frequently creates sufficient suction to draw the water which forms the seal below its proper level in the bend. When this occurs, no obstacle whatever is presented to the escape of gas, and the trap may as well be absent altogether.

In the present device the body is made about two and a half



times as large in capacity as the part of the outlet pipe which enters it. Hence the weight of the water contained prevents the seal being broken by suction or siphonage, because it requires a greater force to lift the water than it does to draw air through it. In event of back pressure, the trap will resist about two and a half times as much as the old bent pipe trap. This is evident from the fact that the pressure is distributed over so large a surface of water. If the level of the latter is depressed one half inch in the trap, as a matter of course the level in the upper limb is raised one and a quarter inches. In this way the depth of the seal is increased instead of diminished; and when the pressure is withdrawn, the water naturally falls back to its original depth of seal, which, in this trap, is always one inch.

Patented June 13, 1876. For further particulars, address Messrs. Frederick Adee & Co., 275 Pearl street, New York city.

BITUMINOUS MACADAMIZATION.—In the Faubourg Poissonnière an experiment new to Paris is being tried in road making. The road is laid with broken stones and pebbles, and the whole held together with asphalt or bitumen. The asphalt is allowed to cool, and the material is subjected to a powerful pressure from a steam roller.

THE CITY OF FLORENCE, ITALY.

No city in Italy is more attractive to the tourist than Florence. Rivaling Rome in its art galleries and libraries, it has the renown belonging to the commercial metropolis of the middle ages; and the spirit of independence of its citizens long kept the city free from princely and ecclesiastical tyranny, and made it the seat of culture, learning, and refinement for the whole peninsula.

We publish herewith views of two of the most celebrated buildings in Florence. The first is the Palazzo Vecchio, erected in the year 1298 for the use of the Gonfaloniere and Magistrates of the Republic of Florence. For many ages, it formed the center of the political life of the Florentines. A magnificent staircase leads from the court to the vast hall where Savonarola convened the citizens in his futile attempts to restore to them their ancient liberties. This hall, now somewhat dilapidated, was used for the meeting of the Italian deputies before the removal of the seat of government to Rome. The Palazzo Vecchio contains a large collection of pictures, among which are numerous portraits of great historical interest; and in front of the building, in the open air, are several of the finest statues that the Renaissance period produced. Among them are the David of Michael Angelo (considered by many to be his masterpiece), the Rape of the Sabines by John of Bologna, and the Perseus of Benvenuto Cellini.

Our second engraving shows the Cathedral with the Campanile designed by Giotto. The great dome, the largest in the world, is the creation of Brunelleschi; and Michael Angelo, when on his way to Rome to undertake the erection of the basilica of St. Peter, is reported to have said that it was not possible to surpass the great work of Brunelleschi. The interior of the Cathedral is at first view disappointing, as the walls are sombre and colorless. But by degrees the simple purity of the proportions and the grand sweep of the dome impress the spectator; and the richly jeweled windows, which at first are overlooked on account of their smallness, soon attract the eye and add to the general effect.

The Campanile is the pride of Florence, and concerning it Mr. Ruskin says: "The characteristics of power and beauty occur more or less in different buildings, some in one and some in another. But all together, and all in their highest possible relative degrees, they exist, as far as I know, only in one building in the world—the Campanile of Giotto, at Florence. I remember well how, when a boy, I used to despise that Campanile, and think it meanly smooth and finished. But I have since lived beside it many a day, and looked upon it from my windows by sunlight and moonlight, and I shall not soon forget how profound and gloomy appeared to me the savageness of the Northern Gothic, when I afterwards stood, for the first time, beneath the front of Salisbury Cathedral. The contrast is indeed strange, if it could be quickly felt, between the rising of Salisbury's gray walls out of their quiet swarded space, like dark and barren rocks out of a green lake, with their rude, mouldering, rough-grained shafts, and triple lights, without tracery or other ornament than the martins' nests in the height of them, and that bright, smooth, sunny surface of glowing jasper, those spiral shafts and fairy traceries, so white, so faint, so crystalline, that their slight shapes are hardly traced in darkness on the pallor of the eastern sky, that serene height of mountain alabaster, colored like a morning cloud and chased like a sea shell."

The wonderful tower which has drawn such commendations from the most captious, acute, and sensitive of art critics, was the work of an artist whose early life was passed in the fields, herding sheep. Cimabue was his preceptor, having seen a rough sketch drawn by the shepherd boy. It was simply the figure of a sheep, scratched upon a piece of slate; but it showed such acuteness of observation and ability to portray expression that Cimabue took the young artist into his house and taught him painting. Giotto lived to eclipse his master and to assist Italian art to free itself from the trammels of the Byzantine style. Many of his works are now lost; but his skill and penetrating observation are shown in those which remain, and it is easy to account for his influence over the artists of his time, from Padua to Naples.

There is in St. Peter's, at Rome, a wonderful mosaic picture of Christ stilling the waves of the sea, by Giotto; but it has been so much repaired that little of the original now remains. In Padua he executed a series of paintings, forty-two in number, illustrating the life of the Virgin Mary. To his friendship for Dante may be attributed the allegorical tendency of many of Giotto's works. The wonder and en-

thusiasm which his works excited has not been paralleled, even in the history of Italian art; and his influence in the art world lasted for a century after his death.

Near the Duomo in Florence is the Baptistery of St. John, in which are two bronzed doors, by Ghiberti, which are marvels of art. Michael Angelo declared them worthy to be the gates of Paradise. Not far off is the church of San Lorenzo, with the Chapel of the Medici, in which are Michael Angelo's statues of Day and Night, and of Giuliano and Lo-



THE PALAZZO VECCHIO, FLORENCE.

renzo de' Medici. Probably in no city in the world are so many masterpieces of genius and skill to be found within a few feet of each other.

Titanium Chloride for Prisms.

In optical experiments and in spectroscopic work, hollow glass prisms filled with bisulphide of carbon are frequently employed because of the high refractive power of the bisulphide. It possesses, however, several disadvantages, among which are its odor and its wonderful solvent properties. The hollow glass prisms employed are nicely ground to the proper angle and plates of glass cemented thereon. The bisulphide of carbon attacks the cement, whatever it may be, and in

has, however, the property of remaining in a bottle or other vessel, even when loosely stoppered, for the reason that the fumes of oxide and oxychloride collect about the cork and in all other crevices, completely closing them.

Titanium chloride is prepared in a manner totally analogous to that employed in the chlorides of silicon, aluminum, and some similar substances, namely, the action of dry chlorine gas upon a mixture of titanium oxide and lamp black at a high temperature. Although a difficult laboratory experiment, it might be produced on a large scale almost as easily as chloride of aluminum, if the demand for it were sufficient.

Potassium Xanthogenate as an Antiseptic.

Not long since we recorded the discovery of remarkable antiseptic and conservative properties in the well known bisulphide of carbon. Unfortunately this substance is exceedingly offensive to smell and taste, poisonous, combustible, and even explosive if mixed with air. If, however, it be mixed with an alcoholic solution of caustic potash, it combines with these substances to form a crystalline substance known as xanthogenate of potassium. This latter salt is quite as powerful as the more offensive bisulphide of carbon.

Zoller, in a letter to Professor Hofmann, states that the antiseptic properties of potassium xanthogenate are certainly not surpassed by those of any other known substance. Even human urine was protected from mould and putrefaction for a long time by the use of a small amount of this substance. A very small quantity of it has kept plant juices and extracts for eight months, whether closed or open, no mould or decomposition taking place, nor is the taste affected, and they can be taken without injury. At the beginning of October, Dr. Grote added some of this salt to wine must, and at the end of three months the must preserved the flavor and sweetness of the fresh juice. Several persons partook of considerable quantities of this preserved drink without suffering any inconvenience. Dr. Zoller expresses the belief that the xanthogenate will become naturalized in every household on account of its cheapness, ease with which it can be used, non-poisonous qualities, and the small quantity required for the purpose.

Xanthogenate of potassium may be employed in medicine, both externally and internally; and to avoid the action of potassium on the system, the xanthogenate of sodium could be used for medicinal purposes.

How to Make Printing Plates by Photography.

M. Boivin, who is perseveringly pursuing his labors and interesting researches, has written a description of a very facile process to obtain engraved plates capable of being printed in an ordinary printing or engraving press. Unfortunately it is impossible, so far, to reproduce half tones by these means; but nevertheless, the process will be valuable for reproducing linear designs and sketches. When it is desired to produce a block or printing plate in relief, a sheet of zinc or copper is taken, $\frac{1}{4}$ or $\frac{1}{2}$ inch in thickness. After having grained the surface, it is coated, in a warm condition, with a light film of wax.

To this film you transfer a carbon print by ordinary means, and having developed it, it is dipped into alum solution, and dried. Then the plate is plunged into some solvent of wax—benzole, for instance—and in this way those portions of the metal surface not covered by the image are laid bare, ready to be etched with acid; the layers of wax and carbon in the other parts are sufficient protection against any mordant that may be used. It need scarcely be said that, when blocks for the printing press are desired, a negative cliché must be made use of; while in that produced off a plate to be printed in an engraving press, a positive image must be employed. Nevertheless, an ordinary negative may also be employed in the latter case; only, if this is done after having produced the carbon picture, the plate must be covered with a film of copper by the electrotype process. The image may be removed by hypochlorite of lime and boiling water, and then the wax with benzole, and finally acid is employed

to etch. In the latter case the copper constitutes the reserve, while the bare zinc plate is etched by the acid. The success of this process of photo-engraving is assured, according to M. Boivin, if use is made of very clear negatives, presenting opaque blacks and whites free from fog. It is indispensable, also, that the pigmented tissue has never been exposed to light previously. M. Boivin finds that the employment of wax is more facile than that of asphalt dissolved in the benzole, recommended by M. Markl for an analogous process.—*E. Lucan, in Photographic News.*



THE DUOMO AND CAMPANILE, FLORENCE.

most cases soon causes the prism to leak. This necessitates the removal of the liquid after using and refilling the prism each day when it is to be used. Cannot some other dense and highly refractive liquid be substituted for it?

It is our wish to call attention to another liquid of very high refractive power, almost equal to bisulphide of carbon, that may perhaps be substituted for it, as it is free from this solvent action, at least on some substances. Titanium chloride fumes in the air, sending off great clouds of white smoke, and is consequently a disagreeable substance to handle. It

The Treatment of Iron for the Prevention of Corrosion.

Professor Barff recently discoursed on the above subject in a lecture delivered before the Society of Arts, London. He said: "While experimenting, two or three years ago, with my friend, Mr. Hugh Smith, on different methods for preventing incrustation and corroding of steam boilers, I was led, through the failure of all the processes employed, to believe that, if it were possible to convert the surfaces of iron plates into the magnetic or black oxide of iron, in such a manner that the particles of black oxide formed in the position of the original particles of iron could be rendered perfectly adherent to the iron surface, which does not become peroxidized, and perfectly coherent with one another, the object would be effected. I do not intend to enter into the chemistry of the oxidation of iron to its full extent; it would take too much time, and it would rather tend to confuse than to enlighten those who are not well up in their chemistry, and would raise questions which would bring on prematurely a collision with the views of some of my brother chemists: which collision, under suitable circumstances, at some future time not very remote, I look forward to with considerable satisfaction, as it will be the means of solving many phenomena which have never yet been explained. A piece of dry iron, its surface being polished, may be exposed for any length of time to dry air without rusting, but it begins to rust at once as soon as the slightest moisture comes in contact with it. We have to consider only two oxides of iron: one containing 56 parts by weight of the metal to 16 parts of oxygen, and the other containing twice 56 parts of iron and three times 16 parts by weight of oxygen. We speak of these oxides as the protoxide and sesquioxide, or as ferrous and ferric oxide.

"Immediately the protoxide is formed, it being more moist, it unites with oxygen and becomes gradually converted into the ferric oxide. Now, let us suppose a moist iron plate to come into contact with oxygen. It is clear that the protoxide will be first formed, and this rapidly becomes converted into the higher oxide. Now, suppose you take a solution of the salt of the higher oxide and put into it metallic iron; in time, the air being excluded, this higher salt will become converted into a salt of the lower oxide. Let us now see how this bears upon the rapid oxidation of iron in the presence of moisture. We have seen that when oxygen comes in contact with moisture the first oxide is formed and becomes rapidly oxidized into the higher one. But this higher oxide is in contact with metallic iron, which will reduce it to the lower oxide, thus becoming oxidized by the oxygen which it has taken up from the higher oxide. You will now see clearly how it is that iron rusts throughout its whole substance with such rapidity, for the oxide of iron serves as a carrier for atmospheric oxygen to the iron to almost any depth. There is another oxide of iron, called the black or magnetic oxide, containing three times 56 parts by weight of iron and four times 16 parts by weight of oxygen. Some chemists consider this oxide to be a sort of mixture of the two others, and they call it ferrous-ferric oxide; whether this be the case or not does not matter to us this evening. But it is a most important point for our consideration, that this oxide undergoes no change whatever in the presence of moisture and atmospheric oxygen. Nor does any temperature to which it can be exposed, in any of the ordinary uses to which iron is applied in the presence of moisture, either decompose it or produce its further oxidation. In every school where chemistry is taught, in the most elementary lecture on hydrogen, the pupils are told that, if they pass steam over red-hot filings contained in an iron tube, they will be able to collect and burn hydrogen gas at the opposite end of the tube to where the steam enters. For a long time it was thought that the particles of black oxide formed by this decomposition of the steam were pulverulent, and could not be made to cohere into a solid mass. The result of a considerable number of experiments has been to prove that they can be made not only coherent amongst themselves but adherent to the body, and that both these produce a proper formation of this black oxide on the surface of iron plates; for, as I will show you later on, the oxidized surface of the iron resists for a long time, and more effectually, the rubbing with emery paper, than does the simple metallic iron itself, and that there is a very manifest difference between the ease with which a sharp rasp is able to cut away the surface of the iron and the difficulty with which this black oxide is removed from the surface by that same instrument. The method, which long experience has taught us is the best for carrying out this process for the protection of iron articles in common use, is to raise the temperature of those articles, in a suitable chamber, say to 500° Fah., and then pass the steam from a suitable generator into this chamber, keeping these articles for five, six, or seven hours, as the case may be, at that temperature in an atmosphere of superheated steam. I will presently call your attention to the diagram of the furnace and muffle which I have employed in all our later experiments, and in which all the specimens before you, which will be alluded to in this paper, were prepared. Differences of temperature are employed where different objects are to be obtained. If it be wished to act upon surfaces of polished iron or steel, it is desirable to let the temperature remain at 500° Fah. until the operation is completed. Articles coated in this way will not resist the action of continued moisture, such as has prevailed for the last two months, when exposed out of doors; but they will resist the action of any amount of moisture with which they may come in contact in a house or building; and

the reason of this will be very obvious, because only a thin film of the iron on its surface is transformed into the black oxide. This I will explain more fully to you when I call your attention to individual specimens. At a temperature of 1,200° Fah., and under an exposure to superheated steam for six or seven hours, the iron surface becomes so changed that it will stand the action of water for any length of time, even if that water be impregnated with the acid fumes of the laboratory. Before calling your attention to our failures and successes as they lie before you on the table, I will just allude to a few of the uses to which this process may be, as I consider, successfully applied—to water mains, also to water-connecting pipes, as well as to the water pipes used inside the house, which, in this case, would supplant their leaden predecessors. In this hall of hygiene, these words will, doubtless, sound as sweet music to the ears of many of those who have honored me with their attendance this evening. The greatest objection to the use of iron pipes for the supply of water in houses hitherto has been this: that by rusting they caused the first quantities of water drawn off in the morning to be dirty and turbid; now this will be entirely prevented if the pipes be first exposed to the treatment which I have just explained to you—of course gas pipes could with advantage be similarly acted upon—and as the surface, when oxidized, is harder than the natural surface of the iron, the friction of large bodies of water through the pipes, and the friction necessarily employed in fixing them in their places, would be much better resisted than by the untreated iron itself. I cannot overestimate the advantages which the employment of this process must confer on architects, who will be by it enabled to employ iron, whether wrought or cast, much more largely, not only in the decoration but in the construction of their buildings. Last summer I was at a very large house in the country where the entrance portico, some twenty feet high, was being painted and decorated, when one of the large plaster ornaments of the ceiling broke away from its holdings, and would have fallen to the ground except that it was caught by a workman. This ornament weighed not less than twenty-five pounds, and if it had fallen from this height upon the workmen below it must have killed them. The ornament had been there many years, and was fixed up in the best method possible, it being supported and secured by iron rods. On examination I found that these rods were rusted through completely to the very center. I need not make any comment upon this, since I have been able to introduce you to iron treated in such a way that it will never rust. Of course, if the process will answer for architectural ornaments, it will answer for statues, so that iron may be used instead of bronze, which will materially lessen the cost of casting statues, both in the material and in the expense of making the moulds. You will know that when a tinned saucepan is allowed to get dry on the fire and burns, as the servant calls it, so that it is rendered useless until it is tinned again. Now, if such a saucepan be treated by the method I recommend, it may be allowed to get red hot without suffering injury, for the protection on its surface is produced at a red heat. We have experimented on some screws, hinges, locks, keys, bolts, with complete success. It has been suggested to me that the iron nipples used in gaslights would not corrode, and would, therefore, be more useful, if submitted to this action of superheated steam. Wherever iron is used, railings, street gas posts, iron safes for keeping documents fireproof and thief-proof, the framework of filters, tanks, cisterns for domestic and other uses, iron employed in the erection of temporary buildings—which I flatter myself, if treated by this process, would become permanent buildings—all these, and many other applications of iron to the arts, would immensely gain by being submitted to this oxidizing action. I think I need hardly take up your time by enumerating other applications for the preservation of iron, for it appears to me that they would be commensurate with most of the uses to which iron is applied, save and except those where friction—such as that to which rails and iron wheels are exposed—would necessarily wear away the coating, as they wear away the material itself. I am happy to see a namesake of mine here present this evening, who will tell you that he is carrying out a process for the manufacture of peat into charcoal by the action of superheated steam, and that he is enabled, by superheated steam alone, to raise the temperature of his chambers to a red heat, quite sufficient to effect his carbonizing process."

Planting Trees for Profit.

A correspondent of the *Ohio Farmer* thinks that trees "can be grown as easily as corn," and also, under some circumstances, with considerable profit. An acre of soft maple trees planted in rows 8 feet apart, with the trees two feet in a row, would prove a remunerative venture, as ten trees, twelve years old from the seed, will make a cord of wood. The writer gives some interesting examples as follows:

"One of my neighbors, in the spring of 1850, started a locust plantation of some acres on rather thin land; he planted the seed in hills four feet apart each way. The seed was prepared by pouring boiling water over it; and after it was swelled plump, several seeds were dropped in each hill. The seed came up well, and the plants were cultivated for two or three years. As soon as they were large enough for bean poles, he began to thin them out, and afterwards, again, for fence stakes. In eighteen years he cut them off clean and sold them for posts, receiving several hundred dollars per acre, and paying off a mortgage on his farm. They are now growing much faster than before, and in about twelve years

from the former cutting will be as large as they then were. On another farm in my neighborhood there was growing, when I moved here in 1848, a double row of locust trees that had been set out to shade a short lane. There were forty trees in two rows, four feet apart, and the trees stood from four to eight feet apart in the row, allowing one rod in width; the ground occupied was one tenth of an acre. When these trees were twenty-five years old, they were cut, and made 400 first-class posts (averaging ten to the tree), and the wood and fence stakes made from the limbs more than paid for the work of cutting and splitting. It is now nine years since the original forty trees were cut, and I find nearly 300 trees have come from the stumps and roots to take their place; 180 of these are now nearly or quite large enough at the butt for posts, and, from the present rate of growth, I am satisfied that, in fifteen years from the former cutting, they can be cut again and make over 1,000 posts, and at the same time leave 100 or more trees growing that will be from four to six inches in diameter.

"Under any possible circumstances, timber must command high prices in the future, and I believe that those parents who wish to make an investment for their children, combining perfect safety with a certainty of profit, cannot do better than to plant timber; it will require no care after it is started, and cannot fail to be profitable."

The Uses of Evergreens.

We extract the following from an address recently delivered by the Hon. H. W. Lord, at Pontiac, Mich.:

Within the last twenty-five years evergreens have greatly multiplied, during which time many new varieties have been introduced; nurserymen have learned to propagate them cheaply, and in such manner that they may be transplanted with certainty, so that they are within the reach of all who have grounds on which to plant them, and with taste and usefulness. Now one cannot travel far through the country without finding here and there fine displays of them, adorning and sheltering the homesteads of the farm as well as the urban and suburban dwellings.

Some ten years ago the writer purchased of a nurseryman at Detroit 1,000 little white cedars, the *arbor vite*; the plants were one year old from the seed, about six inches high, and cost one and a half cents each—\$15 per thousand. Besides planting many of them in groups or singly about the house and grounds, a sufficient number were used to make a hedge or screen on the westerly and northerly sides of a large garden which had been very much exposed to the sweep of blasting winds, sometimes to the destruction of nearly all the early plants that it contained. These cedars, set out some two or three feet apart, all grew luxuriantly, and they now form a living wall about twelve feet high, as impervious to the winds as if built of brick or stone, affording a complete protection to the garden, and more than doubling its value for the purposes of its use. Delicate plants, that one blast of cold wind in a May morning would chill and destroy, now, no matter how bleak the gusty day, seem to nestle in the warm sunshine, unconscious of harm.

This is a cheaply obtained refuge that one may profit by, and an inexpensive ornamentation in which one may indulge. When rough wintry tempests seem to shake the earth, when you hear them howl about your window panes, driving December rains almost through them, when your fires burn briskly, but do not warm your house: then you may reflect that, had you a few years before planted your grounds thickly with a variety of evergreens, in the direction whence come the prevailing storms, the trees would overtop your dwelling and afford you a "hiding place from the wind."

If, in the place of our fences, all the roadsides, and the dividing lines between all fields or divisions of ownership, were lined with rows of evergreens twenty to fifty feet high, it is probable that we should hear no more of winter killed wheat, or very little. The expense would be small in the first instance compared with fencing. Ten evergreens to the rod would be sufficient, and would cost fifteen cents, and the labor of planting about as much more. But how about the cattle? Well, that is a question of considerable magnitude. It is our opinion that they should never be allowed to leave the inclosures provided for them about the barns and sheds.

It is not likely that many in this hall will live to see the day, yet we believe it is not very far distant, when there will be no fences in Michigan, except those provided to keep animals away from the fields, rather than to confine them in them. Farmers themselves, severely as they feel the weight of their expenses for fences, are as a rule unaware of the enormous burden of them, and how much it costs to perpetuate the incumbrance. If to the westward and northward of each farmer's farm and cattle yards a belt of evergreens were planted, they would in ten years form as complete a protection as a stone wall fifteen feet high, and be better every way, affording a hiding place from the winds, that sweet-breathed cows, and oxen, and gentle sheep would regard as a special providence, and for which they would repay their owners many fold. Belts of evergreens planted on the exposed sides of orchards afford such a hiding place from the winds that trees so protected have been observed to be fruitful, when others in bleak situations have utterly failed.

When these truths shall be fully appreciated, and the further truth that every three acres will sustain as much stock in the yard as five acres will in the field, then farmers will begin to inquire if fences cannot be dispensed with; and when they shall realize how destructive to crops it is to let the winds go wholly at large, then they will begin not only

to decorate and adorn their homes and gardens with evergreens, but will extend them along the highways, and make landmarks of them between all neighboring possessions and property.

Is It a New Element?

Dr. George A. König, of the University of Pennsylvania, recently announced the discovery of what he thought to be a new metal. If this proves true, America may have the honor of celebrating her centennial year by the discovery of a new element in a peculiarly American mineral. Dr. König states that in analyzing a mineral resembling schorlomite, brought from Magnet Cove, Arkansas, by Professor A. E. Foote, he obtained, in the place of titanite acid, a white oxide which differed from the former very materially. Inasmuch as Dr. König does not tell us wherein these differences consisted, we can scarcely form an opinion on the probability of this being the oxide of some new metal. The oxide of titanium is itself white, when pure, and possesses many remarkable properties, such as existing both in a soluble and insoluble form, of passing from the former to the latter condition simply by continued boiling, of passing gradually into that state by standing, that it is precipitated pure by ammonia in the presence of sulphurous acid, sulphureted hydrogen, or other reducing agents. The numerous forms in which it appears, and its protean changes, would be likely to deceive a less experienced chemist than Dr. König, who has already discovered one new mineral, a hydrated oxide of titanium, to which he gave the name of hydrotitanite.

In M. Mendeleeff's remarkable prediction of the discovery of gallium from a mathematical comparison of the atomic weights of the known elements, he also predicted the discovery of another element to which he gave the name of eka-silicon, or eka-silicium, having its place between silicon and titanium. Perhaps Dr. König has discovered eka-silicium.

The new element, which Mendeleeff called eka-silicium, will be obtained, says he, from its oxide EsO_2 , or the potassic fluoride EsK_2F_6 , by means of metallic sodium. The metal will decompose steam with difficulty, acts feebly on acids, more easily on alkalis. It will be a difficultly fusible metal of a dark gray color, which when ignited is converted into an oxide, EsO_2 , which fuses with difficulty. The specific gravity of the oxide will be 4.7. It will resemble in external appearance, probably also in crystalline form, in properties and reactions, oxide of titanium, TiO_2 . As the acid characters of the oxides of titanium and tin are feeble, although distinct, the new element will possess the same characters and be a stronger acid than titanite oxide. It will bear the same relation to titanium as zinc to calcium, and as arsenic to vanadium; so its basic properties will be more feeble than those of the oxides of titanium and of tin, but stronger than silica, SiO_2 . We may expect it to form a hydrate soluble in acids, the solution being easily decomposed with the separation of an insoluble metahydrate. It will be more easily separated from acid solution than TiO_2 , less easily from alkaline solution. There is no doubt that it will form with corresponding salts of silicon, titanium, zirconium, and tin, isomorphous double fluorides. The potassic fluoride will be more soluble than the corresponding silicon salt. The chloride of the new metal will have the composition EsCl_4 , will boil at 212°Fah. , or perhaps lower; its vapor density will be about 1.9 at 32°Fah. It will form, like silicon and tin, a series of volatile metallo-organic compounds, which will distinguish it from the chloride of titanium.

If Dr. König has not really discovered this expected metal, its discovery is not distant, for many of our American chemists are earnestly engaged in hunting it down, and with our vast mineral resources, and the Russian chemist's explicit directions of where and how to look for it, we anticipate speedy success.

Mendeleeff's remarkable prediction of gallium was the result of what he calls the periodic law. His table, from which he obtained his results, and the study of which will probably lead to many other interesting discoveries, having never before been printed in English, is given below:

MENDELEEFF'S TABLE OF ELEMENTS.

	Group I.	II.	III.	IV.	V.	VI.	VII.	VIII. Transition to group I.
Typical Series...	H=1							
Series 1	Li 7	Be 9.4	B 11	C 12	N 14	O 16	F 19	
" 2	Na 23	Mg 24	Al 27.5	Si 28	P 31	S 32	Cl 35.5	
" 3	(Cu 63)	Ca 40	Ga 44	Ti 48	V 51	Cr 52	Mn 55	Fe 56, Co 59, Ni 59, Cu 63.
" 4	Rb 85	Sr 87	(Yt 88)	Zr 90	Nb 94	Mo 96	7100	Rn 104, Rh 104, Pt 106, Ag 108.
" 5	(Ag 108)	Cd 112	In 113	Sn 118	Sb 122	Te 125	I 127	
" 6	Cs 133	Ba 137	(Di 138)	Ce 140				
" 7								
" 8			Er 178	La 180	Ta 182	W 184	7190	Os 195, Ir 197, Pt 198, Au 199.
" 9	(Au 199)	Hg 200	Tl 204	Pb 207	Bi 208			
" 10				Th 231		U 240		
Highest oxide...	R_2O	RO	R_2O_3	RO_2	R_2O_5	RO_3	R_2O_7	RO_4
Highest hydrogen compound...			RH_3	RH_4	RH_5	RH_6	RH_7	RH_8

Lead Desilverizing by the Zinc Process.

Some few years since the system of desilverizing lead with zinc, invented by Mr. Flach and tested at the smelting works of Messrs. Guillem at Marseilles, was fully described in the *Mining Journal*, and an interesting account is now given by Mr. James E. Stoddart of the manner in which the process is carried on by Mr. William Lang, Jr., and Co., at the Clyde Leadworks, Glasgow. He explains that the

treatment of argentiferous lead with zinc, for the purpose of extracting the silver and refining the lead, is by no means a novel process. About 20 years ago a metallurgist named Parkes took out patents for desilverizing rich leads by means of zinc, and a manufacturing firm adopted his process. They were, however, subsequently obliged to abandon it, in consequence of the difficulty experienced in the separation of the zinc from the concentrated silver, to admit of the cupellation of the latter metal. A German chemist, named Flach, afterwards took up the subject, and by running the alloy of zinc, silver, and lead, along with iron slag, through a peculiarly constructed blast furnace, was enabled to free the concentrated silver-lead from zinc. He also proposed the use of this furnace for the removing of traces of zinc from the desilverized lead, but this was abandoned in favor of the ordinary improving or calcining pan. The operation with the blast furnace was found to be very troublesome, and, as the greater portion of the zinc was entirely lost, was by no means economical.

M. Manes, of Messrs. Guillem & Co., Marseilles, who were the first to work Flach's process, found out and patented a simple means of treating the alloy and recovering the zinc by distillation. This is the process now in use, and known as the Flach-Guillem process, and which is carried on at the Clyde Leadworks in the following manner: About 18 tons of rich lead, containing generally from 60 to 70 ozs. of silver per ton, are melted in a large cast iron pot, 1 per cent by weight of zinc is added, and the whole well stirred for 20 minutes. The fires are drawn, and the contents allowed to settle and cool until the zinc rises to the surface, and forms a solid ring or crust, containing the silver and other foreign metals. This alloy is removed to a small pot at hand, where part of the lead is sweated out, and the alloy thoroughly dried. The large pot, with the lead now partially desilverized, is again heated up and treated in the same way as before, but with the addition of only $\frac{1}{2}$ per cent of zinc, which when it has risen to the top is removed as before and dried. A third addition of $\frac{1}{2}$ per cent of zinc is found necessary to take out the remainder of the silver, care being taken on the cooling of this zincing that all the crystals are cleanly skimmed off. The lead in the large pot is assayed, and found almost always to contain less than 5 dwts. of silver to the ton of lead; if it should happen to contain more, it is due to carelessness on the part of the workmen. The pot is now tapped, and the lead run down into an improving pan, where it is kept at a high heat for nearly eight hours, for the purpose of oxidizing or burning off the small percentage of zinc which is left in it from the zincing process; after seven or eight hours' firing in this pan, it should contain no trace of zinc. It is then tapped and run into moulds for market lead or for the manufacture of lead products. The old improving pans were made of cast iron, placed on a bed of sand, with a groove in the upper sides, which groove was filled with bone ash, to prevent the action of oxide of lead on the iron. These pans, from the giving way of the bone ash and the great wear and tear on the iron from the high heats necessary, were found to be both troublesome and expensive, being very often under repair, and seldom lasting more than six or eight months. They have been superseded by an improving pan of cast iron, lined with brick inside. This pan, instead of being placed on a bed of sand as was the case with the old improving pan, is hung on brick walls, and is quite open both below and round the outside. This new pan has been working in the patentee's works, Marseilles, for some years, and at the Clyde Leadworks for the last eighteen months, without any breakdown. It burns no more coal, and can be as economically worked in every way as the old pans.

The zinc and silver alloy after being dried is melted in a plumbago crucible, covered on the top, well luted with fire-clay, connected with a cast iron receiver by means of a plumbago pipe, and fired up with coke. The zinc distills over, and is condensed in the iron receiver. After all the zinc has been distilled, the pipe is disconnected, the cover removed, and the lead and silver left in the crucible is ladled out into moulds; thence it is taken to the refinery, where it is cupelled in the usual way. The block of metallic zinc re-

and are all recovered. The lead from the slag hearth, which contains a number of impurities, as copper, antimony, iron, or sulphur, is taken to the improving furnace—a furnace built in exactly the same way as the desilverizing pan. About 20 tons of this lead are heated for a period generally from four to five days, but the time varies according to the amount of impurities present. The oxidized impurities as they are formed float to the surface, and are skimmed off by the workman, who is made to keep the lead perfectly clean, so as to have a fresh surface always exposed to the action of the flame. The dross skimmed off is at first of a black color, but gradually becomes lighter as the operation goes on, until it shows nothing but yellow oxide of lead. When this appearance is noted the pan is tapped into moulds or into the desilverizing pot, where it is treated with zinc, and the silver extracted as in the manner before described.

By this process the lead can be desilverized and turned out in the shape of market lead in 30 hours from the time it is put in process, the loss in working being not more than $1\frac{1}{2}$ per cent. That all the silver is thoroughly taken out may be seen from the fact that there is an excess of silver, to the extent of nearly 2 per cent, over the assays obtained on the large scale. An analysis of the market lead gave antimony 0.0015 and silver 0.0004 per cent, a trace of copper, but no iron or zinc, from which it will be seen that the lead refined by the zinc process is almost chemically pure, and to this is due the finer quality of the products manufactured from it.

An English View of American Manufactures.

It is incumbent upon the manufacturers of the United Kingdom to show the world at Paris next year that they have not fallen behind the position they once occupied. The competition at Philadelphia was not altogether satisfactory to us.

It is true that every nation has an advantage in exhibitions held within its own area; but the products of the industry of the United States surpassed our own oftener than can be explained by this circumstance. It appeared as if there was a greater economy of labor habitually practised in the States, and in conjunction with this there was evidence of the more constant presence of a presiding mind superintending every process of industry. The best machine in the world will fail to give satisfaction if there is not an intelligent human being at hand to watch it, to take care of it, to detect the smallest failure in its working as soon as it is developed, and to suggest and supply the means of correcting any miscarriage of its functions.

A steam engine dropped from heaven in the middle of Africa might be adored, but could not be put to any use. The failure of many of our industrial enterprises in foreign parts can be traced to the difficulty in procuring agents and assistants that can be taught to use the machines committed to their care.

Much of the mechanical work shown at Philadelphia was executed with a fineness that could not have been exceeded if every man who had any share in its production had originally conceived it and had been solely interested in its success. There was evidence of personal care and personal anxiety; every stage must have been watched with intelligence and with zeal. In comparing the results with our own, we are painfully suspicious that they revealed the application of more brains than we always have at our command.—*London Times*.

Platinum Plating.

M. Dodé has patented a plan for giving cast objects a coating of platinum. The object as cast, or after being enameled, is first washed over with a brush dipped in turpentine; a mixture of borate of lead and oxide of copper is next applied, and the casting dried in a drying stove. The next step is to immerse the object so prepared in a composition of borate of lead, German litharge, platinum in the state of chloride, ordinary ether, essence of lavender, and aniline (?) acid. Finally, the platinized object is submitted to the action of heat.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

PATENT DRILLING APPARATUS.—WILLIAM H. CAMMEYER AND SAMUEL LEWIS, APPELLANTS, vs. JOHN NEWTON, WASHINGTON BETTS, CHARLES ECCLESTON, AND WILLIAM L. QUINN.

[Appeal from the Circuit Court of the United States for the Southern District of New York.—Decided October Term, 1876.]

Mr. Justice Clifford delivered the opinion of the Court, which was to the effect that the device used by defendants was not covered by the patent of plaintiff. The Court affirmed the following points:

Inventions may be assigned before they are patented.

Public employment is no defence to the employee for having converted the private property of another to the public use without his consent, and without just compensation.

Private property, the Constitution provides, shall not be taken for public use without just compensation, and it is clear that that provision is as applicable to the Government as to individuals, except in cases of extreme necessity in time of war, and of imminent and impending public danger.

A patent is private property, and the Government cannot, after it is issued, make use of the improvement any more than a private individual without license of the inventor, or making him compensation.

Important Patent Decision in Canada.

In 1873 the Canadian Patent Office granted three patents to George T. Smith, one for a process of milling, and two for flour dressing machines. The following is an extract from the Patent Act of 1872, as amended in 1875:

SECTION 28.—Every patent granted under this act shall be subject and expressed to be subject to the condition that such patent and all the rights and privileges thereby granted shall cease and determine, and the patent shall be null and void at the end of two years from the date thereof, unless the patentee, or his assignee or assignees, shall, within that period, have commenced, and shall, after such commencement, continuously carry on in Canada the construction or manufacture of the invention or discovery patented, in such manner that any person desiring to use it may obtain it, or cause it to be made for him at a reasonable price, at some manufacturing or establishment for making or constructing it in Canada; and that such patent shall be void if, after the expiration of twelve months from the granting thereof, the patentee, or his assignee or assignees, for the whole or part of

his interest in the patent, imports, or causes to be imported, into Canada, the invention for which the patent is granted; and provided always, that in case disputes should arise as to whether a patent has or has not become null and void under the provisions of this section, such disputes shall be settled by the Minister of Agriculture or his Deputy, whose decision shall be final.

"2. Whenever a patentee has been unable to carry on the construction or manufacture of his invention within the two years hereinbefore mentioned, the Commissioner may, at any time not more than three months before the expiration of that period, grant to the patentee a further delay on his adducing proof to the satisfaction of the Commissioner that he was for reasons beyond his control prevented from complying with the above mentioned condition."—*Patent Act of 1872, as amended in 1876.*

We have received from the Minister of Agriculture, of Ottawa, Canada, a book of 24 pages, setting forth the facts, law, and decision in the above case. The case is one in which Benj. Barter (the disputant) alleges the forfeiture of the three patents granted to Geo. T. Smith (the respondent), on the grounds of non-manufacturing within two years of the date of each patent, and on the ground of importing after twelve months, in terms of the above Sec. of the Acts of 1872 and 1876. The case was deemed of such importance in itself and in its bearing on Canadian patents in general, that it was deemed of public interest by the Minister of Agriculture to report it at some length and in detail.

Messrs. Edgar, Fenton, and Ritchie, of Toronto, were counsel for Barter; Messrs. Grahame, Howland, and Byrren, of Toronto, counsel for Smith.

Before the Deputy of the Minister of Agriculture. The petition addressed to the Honorable the Minister of Agriculture (bearing date the 18th of October, 1876) by the disputant, represented that patents No. 1,400, for a process of milling; No. 2,557, for a flour-dressing machine, and No. 2,338, also for a flour-dressing machine, granted to George Thomas Smith in 1873, are null and void, and should be so declared for non-compliance with the provisions of the 28th section of the Patent Act of 1872, requiring manufacturing within two years and forbidding importation after twelve months. The petition asked that the patentee should be required, in case he should state that his inventions have been manufactured, to furnish the particulars. The petition furthermore alleged that importations of the said inventions had taken place on the 25th day and on the 29th day of April, 1876.

The parties appeared at the office of the Minister of Agriculture, at Ottawa, Ont., with their witnesses and documentary evidence. After an exhaustive examination of the case, the Deputy Minister rendered his decision, which is final, in favor of Smith. The Deputy Minister, in giving his decision, reviews at length all the points at issue, carefully digests the Canada patent laws, and cites from patent decisions both in this and foreign countries. We have not space to publish the decision in full, but such extracts only as seem most interesting and instructive to our readers. In the decision, he states: "It is universally admitted in practice, and it is certainly undeniable in principle, that the granting of letters patent to inventors is not the creation of an unjust or undesirable monopoly, nor the concession of a privilege by mere gratuitous favor; but a contract between the State and discoverer. * * * Invention being recognized as a property, and a contract having intervened between society and the proprietor for a settlement of rights between them, it follows that unless very serious reasons, deduced from the liberal interpretation of the terms of the contract, have happened, the patentee's rights ought to be held as things which are not to be trifled with, as things sacred to the State and of the Courts. As it is the duty of society not to destroy, on insufficient grounds, a contract thus entered upon, so it is the interest of the public to encourage and protect inventors in the enjoyment of rights legitimately and sometimes painfully and dearly acquired. The patentee is not to be looked upon as having interests in direct opposition to the public interest, an enemy of all, in fact: 'The gain made by the inventor when his invention is known will be,' says Agnew, 'proportionate to the amount of benefit which the public derive from the use of it.' 'It is almost self-evident,' says an able American author, 'or at any rate readily susceptible of proof, that the magnificent material prosperity of the United States of America is directly traceable to wise patent laws and their kindly construction by the courts.' 'The increasing development,' says Armand, 'which inventive genius undergoes, is principally due to the protection, very insufficient as yet, which is granted by most governments to those who are the real promoters of arts and industry.' * * * Therefore the real meaning of the law is that the patentee must be ready either to furnish the article himself or to license the right of using, on reasonable terms, to any person desiring to use it. But again that desire on the part of such a person is not intended by the law to mean a mere operation or motion of the mind, or of the tongue; but in effect a bona fide serious and substantial proposal, the offer of a fair bargain accompanied with payment. As long as the patentee has been in a position to hear and acquiesce to such demand, and has not refused such a fair bargain proposed to him, he has not forfeited his rights. * * * Therefore, George Thomas Smith's patents, No. 2,257, for a flour-dressing machine; No. 2,338, for a flour-dressing machine, and No. 2,409, for a process of milling, have not become null and void under the provisions of Section 28th of the Patent Act of 1872."

Deputy of the Minister of Agriculture.
DEPARTMENT OF AGRICULTURE,
PATENT OFFICE,
OTTAWA, 15th February, 1877.

NEW BOOKS AND PUBLICATIONS.

NATURAL PHILOSOPHY FOR BEGINNERS. With Numerous Examples. Part I: The Properties of Solid and Fluid Bodies. By I. Todhunter, M.A., F.R.S., St. John's College, Cambridge, England. Price \$1.50. London and New York: Macmillan & Co.

Mr. Todhunter's renown as a teacher is well known in this country, where his numerous works on mathematics and mechanics are highly valued and extensively used. His latest work is the above-mentioned, and it is an admirable textbook, prepared and edited with the greatest care and accuracy. The writer evidently possesses in an unusual degree the skill to impart knowledge in clear and unmistakable language, and he presents the phenomena and the laws and applications governing them in a manner specially adapted to the capacities of young students. We commend this book to the notice of boards of education, in the belief that the time is coming when elementary science and scientific methods of thought will form part of the common school education of this country.

THE CHEMIST'S MANUAL. A Practical Treatise on Chemistry. By Henry A. Mott, Jr., E.M., Ph.D. Price \$6. New York city: D. Van Nostrand, 23 Murray street.

This is one of those books for which professional men generally keep a sharp watch, and which, when purchased, they do not lock up in a case, but place within easy reach of the hand on the working desk. Why they do this is because they have learned or may learn that the author, for some seven years past, has pursued that invaluable habit, the taking of notes. Beginning while a pupil of some of our most eminent chemists, he listened attentively and jotted down useful hints and suggestions, important references, etc., which he has now utilized for his own benefit. Continuing the habit in the practice of his profession, the memoranda soon assumed large proportions; those who knew of their existence, knew also their value; their publication, if only for their preservation in permanent form, was suggested, and hence the large and handsomely executed book before us. The work is by no means a mere compilation, but bears the marks of close and assiduous labor. Every scheme of analysis, for instance, has been proved to be thoroughly right; and as every formula for every reaction is given, this part of the book is of especial value to the student. Another very important portion of the volume, to druggists and physicians, is an elaborate table wherein all drugs in use are named, and their usual impurities denoted, and how the same may be detected. Dr. Mott deals in extenso with qualitative, quantitative, and blowpipe analyses, assaying, mineralogy, stoichiometry, and specific gravity determinations, and adds a miscellaneous department, replete with the species of information which, though constantly needed, is scarcely ever found collated. The author's style of writing throughout is plain and direct, the explanations are lucid, and altogether the work is one we can cordially commend.

DYNAMICS OR THEORETICAL MECHANICS. By J. T. Bottomley, M.A., etc. New York city: G. P. Putnam & Co., 182 Fifth avenue.

This is another volume of Putnam's "Elementary Science Series." It is a good simple treatise, as a rule clearly written; but it reveals obscurity in the writer's mind as to the proper definition of the term "force." This is the grand stumbling block for writers on mechanical subjects, and it is high time that a definite meaning should be attached to so fundamental a conception.

AN ANALYSIS OF RELIGIOUS BELIEF. By Viscount Amberley. New York city: D. M. Bennett.

We would take this opportunity to inform publishers and correspondents that the columns of this journal are not open to the discussion, review, or criticism of matters pertaining to religious faith; and that it is entirely useless to send us letters or books on such subjects. The volume above named is the work of a young English nobleman, now deceased. It created great comment in England at the time of its publication, and caused much pain to the friends and relatives of its author, who, being best conversant

with the circumstances of its production, made every effort to prevent its circulation. The present publisher, as a matter of charity and good taste, should have respected these desires. Hereafter, books of this class sent to us will remain unnoticed.

A TEXT BOOK OF MINERALOGY. By Edward S. Dana. Price \$5. New York city: John Wiley & Sons, 15 Astor place.

This work originated with Professor J. D. Dana, who undertook its preparation several years ago, but was compelled to relinquish the task because of ill health. The present editor has now carried out the plan, and has produced a very excellent book. It is brought fully up to the latest discoveries and investigations; the modern system of chemical formulae is used throughout; and the general arrangement of the volume could hardly be improved. The work is especially valuable as a book of reference for the library, as its various subjects are concisely yet fully treated, while they are rendered conveniently accessible through a copious and valuable index. For schools and colleges, probably no better text book relating to this important subject could be found than this.

ROSE CULTURE.—The Dinger and Conard Company, of West Grove, Chester county, Pa., the great rose vine culturists, have just issued their annual catalogue for 1877. The pamphlet is illustrated, giving names and cuts of new varieties, with instructions as to soil and how to grow and propagate roses in the best manner. We have purchased of Messrs. Dinger & Conard's Company a variety of plants at different times, with invariable satisfaction as to the result. To persons interested in roses, we would recommend the inclosure of 10 cents to the above firm for a copy (by mail) of their new manual.

DREAMS OF A FREE TRADE PARADISE.—This is a gathering of humorous sketches and dialogue, with 12 illustrations on free trade. A very amusing pamphlet. Price 35 cents. Henry C. Baird & Co., Philadelphia, Pa.

Inventions Patented in England by Americans.

From February 20 to March 8, 1877, inclusive.

ALLOY.—F. Raymond, Greenville, S. C.
BALE TIE.—J. H. Elsworth, Galveston, Texas.
BATH, ETC.—C. A. Blessing, Philadelphia, Pa.
BOOT SOLE.—S. J. Gordon, New York city.
BRAKE AND RUDDER.—J. Hutton, New York city.
BREACH-LOADING GUN.—F. L. Bailey (of Indianapolis, Ind.), London, Eng.
CAMPAIGNE BISCUIT.—C. Morfit (of Baltimore, Md.), London, Eng.
CLEANSING WOOL, ETC.—O. Low, Chelsea, Mass.
CRUTCH FERRULE, ETC.—T. C. Allen, New York city.
DISPLAY CARD, ETC.—H. H. Snow, New Haven, Conn.
HARROW, ETC.—G. W. Martin, Port Hudson, La.
HORSE COLLAR.—E. Payne, Chicago, Ill.
KNIFE-CLEANING MACHINE.—L. Guex, Springfield, Ill.
KNITTING MACHINERY, ETC.—C. H. Landenberger, Philadelphia, Pa.
LIGHTING GAS.—C. K. Trull, New York city.
LOCOMOTIVE ENGINE.—H. C. Wells, Brooklyn, N. Y.
PRESERVING MEAT, ETC.—J. P. McLean, New York city.
SCREW MACHINERY.—J. A. Kernochan, Pittsfield, Mass.
SKATE FASTENING.—E. H. Barney, Springfield, Mass.
SPINNING MACHINERY.—E. Harris, Providence, R. I.
TAG, ETC.—T. P. Marston, New York city.
WASH STAND.—H. A. Richardson, New York city.

Recent American and Foreign Patents.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED CARD RACK.

Francis Hayek, New York city.—In this card rack any desired number of cards may be arranged in alphabetical and regular manner, so as to be instantly found, the rack being of compact shape and admitting the arrangement of twice the number of cards on the same space as the card racks in common use. The card rack has a number of pivoted clamp pieces that are connected to a slide rod, to be thrown to one side or the other for putting in or taking off cards from the clamps. The cards whose names begin with one letter form the face, those with the next letter of the alphabet the back, on each clamp piece, the cards of either letter being readily exposed by throwing the clamping pieces by the slide piece to one side or the other.

IMPROVED IMPLEMENT FOR LOADING FIREARMS.

Charles W. Hovis, Parker City, Pa., assignor to himself and W. J. Hovis, of same place.—This invention is a revolving case containing chambers suitable for holding a charge in each one for the gun to be loaded, working between two plates which close the chambers at the ends, except at one place, where there is a chamber to receive the muzzle of the gun to be loaded, and hole through each plate coinciding with it, so that the load can be pushed out of the loader into the gun when the muzzle of the latter is in said chamber, and under each chamber is a valve to retain the load till ready for discharge.

IMPROVED BALE TIE.

James M. Pollard, New Orleans, La.—This invention is an improvement upon the so-called "B" tie, for which letters patent were granted to same party on November 28, 1876. In the present invention, the lag or projection, which in the former invention engages the slotted band, is dispensed with, also the slots in the free end of the band, and a roller or movable cam is employed for engaging the band and effecting the "lock."

IMPROVED FLUID MEAT.

John L. Johnston, Sherbrooke, P. Q., Canada.—This is a compound consisting of lean flesh and albumen, in the form of a dry powder, and the well known gelatinized meat essence.

IMPROVED TYPE MOULD.

Thomas Mason, New York city, assignor to David Wolfe Bruce, of same place.—This is a type mould provided with one or more oppositely disposed angular projections or shoulders within its breaks for severing the jet from the type. Its object is to dispense with that process of type-founding known as "breaking off."

IMPROVED NECK YOKE RING.

Charles Shuman, Red Oak, Iowa.—This ring is so constructed as to allow the neck yoke to be turned nearly parallel with the tongue.

IMPROVED LASTING JACK.

Charles H. Collins, Lynn, Mass., assignor to himself and Francis Doshon, of same place.—The advantages claimed for this invention are that a whole boot or shoe can be lasted complete without the aid of knees or other devices for pulling the upper over. The toe of the boot or shoe may be thrown over, bringing it into a convenient position to last the toe, after which the jack can be readily readjusted to a vertical position. It can be conveniently used at a high or low bench, and the operator may stand or sit at pleasure.

IMPROVED TRAVELER FOR JIB-SHEETS.

Joseph D. Drinker, Montrose, Pa.—This is an improved bar for holding the jib-sheet in a fore and aft vessel, when beating to windward, so as to dispense with a man to attend to said jib. It shifts over the sheet automatically on going about.

IMPROVED CURRYCOMB.

James N. Rundle, San Francisco, Cal., assignor to himself and David L. Fonseca, of same place.—This currycomb is so constructed that it will clean itself of dust and hair while being used, rendering it unnecessary to knock it against the timbers of the stall or stable. The frame and the tooth plates play upon a hinge. The movement is limited by a keeper, so that the jar caused by checking the said movement may knock off any dust and hair that may be adhering to the tooth plates.

IMPROVED FOLDING SEAT.

Arthur B. Cogswell, Burlington, Vt.—This seat is so constructed that it may be folded so compactly that it will occupy no more space than the breadth of the side frames or standards. When the seat is extended for use, the rear edge is raised and drawn forward, bringing the pins into the long arm of the slot in the standard. The seat then drops, by its own weight, into position.

IMPROVED INDICATOR.

Charles C. Curtiss and James Curtis, Chicago, Ill.—This is an improved dial, on which a business man, upon leaving his office, may indicate with great facility whether he is in or out, or that he is out and back at a certain time. It consists of a base dial, with the hours and the words "In," "Out," "Back at" marked thereon, on which, within the outer circumference, a second partly recessed plate or disk is guided, and above the same one or two index hands for indicating the time, the recessed plate and hands being returned by a face plate or disk.

IMPROVED VAPOR BURNER.

Frederick A. Sawyer, Houston, Tex., assignor to himself, Addison H. Baldwin, and Artemas N. Carter, of same place.—This is an improved construction of a vapor burner, by which the same may be readily lighted or adjusted to a larger or smaller flame. An outer sleeve or jacket with disk-shaped flange slides below the outer burner tube for protecting the burner against a draft of cold air from below.

IMPROVED BAGGAGE CHECK GUARD.

David Untermyer, New York city.—With this device no one, not even the baggage-master, can see the check or know what it is after the duplicate check and the key have been delivered to the passenger, until such passenger presents his check and key. In the outer side of a door is formed a slide to receive a ticket, upon which is marked the place to which, and the place from which, the baggage is sent. With this device it would be useless for a thief to change the direction ticket, and thus change the destination of the trunk, as even then he could not get the trunk without the check and key, which the owner of the trunk carries.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED METHOD OF VENTILATING ROOMS.

Gregory C. Quezada, Troy, N. Y.—The object of this invention is to provide fresh air continually for theaters, churches, rooms, etc., and also at the same time to lower the temperature of the same and supply a certain degree of moisture. The invention consists of an outer pipe column or tubular body of suitable non-porous material and of an inner pipe of porous material, between which a space is formed that is filled with water or other liquid. The air is drawn through or forced through the tube by a fan or otherwise, and supplied to the room at reduced temperature. The apparatus is based on the principle of lowering the temperature by the evaporation of water or other liquid percolating through a porous pipe. The air in its passage through the porous pipe is thus cooled and furnished to the rooms.

IMPROVED SASH BALANCE.

Jules Houriet, Terre Haute, Ind.—This invention consists of the combination, with the upper and lower sashes, of a cord that is connected to the upper sash, clamped to the lower sash, and passed over a pulley at the top of the window casing. For raising the lower sash the upper cord is taken hold of and pulled till the sash arrives at the required height, where it is fastened by a suitable sash lock, it being lowered again by its own weight on the release of the lock.

IMPROVED BOX-NAILING MACHINE.

Amos P. Goodhue, Fond Du Lac, Wis.—This is an improved machine for nailing together the parts of round boxes, enabling the boxes to be nailed quickly and accurately. In using the machine, the bottom of the box is placed upon the center of a plate, and the hoop of the box is placed upon the flanges around the edge of the said bottom. A crank is then turned to bring all the slide blocks inward to rest against the hoop of the box, and press it against the edge of the said bottom. A shaft is then turned until punch holders have reached the limit of their forward movement, and the punches are then adjusted so that their forward ends may strike the hoop of the box. The punches are then drawn back, nails are inserted into the dies, the die holders are turned down into a horizontal position, and the punch-driving mechanism is thrown into gear, which carries the punches forward and forces the nails into the box. As the punches are withdrawn their driving mechanism is thrown out of gear, and the die holders rise into a vertical position, so that another set of nails can be readily placed in their dies.

IMPROVED METHOD OF OPERATING SAWMILL CARRIAGES.

Martin Lally, Eau Claire, Wis.—The wheel on the driving shaft, being rotated, causes a chain to draw the carriage in one direction or the other with a positive motion. The tightening pulleys take up the slack in the chain, so that the carriage answers to every motion of the driving wheel.

NEW TEXTILE INVENTION.

IMPROVED SPOOLER.

Samuel F. Cobb, Alberton, Md.—This invention relates particularly to the form or construction of a slotted cam cylinder and the combination of the same with traversing bars carrying the thread guides and working horizontally in slots formed in the sides of the arches, or frames, in which the spool spindles are journaled. The machine can be so changed as to increase or decrease the traverse simply by removing the gear, thereby enabling the operator to make as even and regular layers when spooling number four yarn as when spooling number fifteen, presenting all the while the spool is being filled a smooth even surface to the thread, consequently the spool must be finished as commenced. In other spooling machines, the traverse is generally worked without this provision, and changing them from fine to coarse numbers produces an uneven ridgy surface, which grows worse as the spool increases in size.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SULKY ATTACHMENT FOR PLOWS.

Samuel P. Langford and Wiley N. Stroud, Waxahatchie, Tex.—By this invention a farmer is enabled to apply any kind of plow to the sulky frame, and thereby do all his work with the same without having to walk in plowing. The invention consists of a sulky frame, to which the plow beam is rigidly applied, the connecting pieces and tongue being capable of adjustment to the position of the plow beam on a vertically sliding crosspiece, which is raised or lowered, so as to elevate or depress the plow, by lever connection with the seat of the sulky.

IMPROVED RECIPROCATING CHURN.

Bernhard Janson, Effingham, Ill.—This invention consists in a churn body having a handle and cover attached thereto, and provided with a socket on its lower side, which is adapted to receive a stud or pin on a stationary base piece or platform. The churn barrel turns on a fixed axis, and receives a rocking or tilting movement to the right and left, by making the recess in the projection of the churn larger than the axis pin.

IMPROVED HARVESTER.

Andrew Campbell, Nebraska City, Neb.—This invention consists in two special combinations—one for the fingers and bars, the latter with sharp edged front tooth, and another combination of the reciprocating heads, having depending teeth, cutters, and cutter guards, with endless apron carrying the grain directly back therefrom.

Business and Personal.

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

Grasshopper Killer for sale.—State and County rights of Patent No. 187,833, Machine to kill Locust. Apply to Charles Hoos, Arago, Nebraska.

Silver Solder and small Tubing. John Holland, Cincinnati, O.

For Sale.—Recently granted Patent on Toy Birds. Rapidly vibrating wings, accompanied by a suitable sound. Manufactured very cheaply from sheet metal or printed paper. Address S. Scholfield, Providence, R. I.

Situation wanted by a man who understands to plate hardware with bronze or brass, nickel on zinc, etc., etc. Address Box 33, Ansonia, Conn.

Financial Partner wanted in Inventions. Illustrated on first page; also parties to solicit contracts. Address J. J. Harden, 83 West Van Buren St., Chicago, Ill.

Foot Lathes. W. E. Lewis, Cleveland, O.

The Western Manufacturer, of a recent date, says: "Rock Falls, Ill., is the largest manufacturing town of its age in the West."

Every possible advantage given to Manufacturers on the Water Power at Rock Falls, Ill., by A. P. Smith.

Brown's Patent Chandeliers and Bracket Lights, the only non-explosive lamp in existence, and warranted. Rights or lamps for sale. Send for circular to Wm. Brown, 15 Bromfield St., Newburyport, Mass.

Wanted.—Light Second-hand Rails for a 3½ miles' road. Address A. Moreau, Jeanerette, La.

A Havana merchant will accept the agency of first-class articles. Address Merchant, 15 Calle Tejadillo, Havana, Cuba.

Common Sense Chairs and Rockers. Solid comfort all around the house. Send stamp for illustrated price list to F. A. Sinclair, Mottville, N. Y. For sale by the trade.

For Sale.—A valuable Patent. For further information, address Kelly & Ludwig, Philadelphia, Pa.

Patent Double Eccentric Cornice Brake, manuf'd by Robinson & Co., successors to Thomas & Robinson, Cincinnati, O. Send for circulars.

Safety Linen Hose for Stores, Factories, Hotels and Steamboats, at best rates. Greene, Tweed & Co., 15 Park Place, N. Y.

Painters.—Send for new prices of Metallic Gilding Tools, for "wiping out." J. J. Callow, Cleveland, O.

For the best Galvanized Iron Cornice Machinery for all kinds of work, apply to sole owners, Calvin Carr & Co., Cleveland, O.

For Sale.—Combined Punch and Shears, and Engine Lathes, new and second-hand. Address Lambertville Iron Works, Lambertville, N. J.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheap by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

Gas lighting by Electricity, applied to public and private buildings. For the best system, address A. L. Bogart, 702 Broadway, N. Y.

Catechism of the Locomotive. 600 pages, 250 engravings. \$2.50. Address M. N. Forney, 73 Broadway, N. Y.

Power & Foot Presses, Ferrante Co., Bridgeton, N. J.

Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

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

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 470 Grand St., N. Y.

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

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Cotton Belting, light and heavy, for Polishing and Carrying Belts. Greene, Tweed & Co., 15 Park Place, N. Y.

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

Skinner Portable Engine Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.

Emery Grinders, Emery Wheels, Best and Cheapest. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and split. Chalmers Spence Co., N. Y.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.



A. V. E. will find directions for mending rubber boots on p. 303, vol. 30.—M. F. will find directions for making a Daniell battery on p. 326, vol. 32.—J. H. V. H. will find a description of the process of photolithography on p. 272, vol. 32.—S. can remove marks tattooed on the skin with Indian ink by following the instructions on p. 331, vol. 30.—W. A. H. will find something on the results of the transit of Venus observations on p. 180, vol. 32.—E. will find a recipe for bay rum on p. 363, vol. 29.—J. S. D. will find directions for making paste for marking with stencil plates on p. 379, vol. 35.—J. E. L. will find a recipe for a depilatory on p. 186, vol. 34.—J. H. will find a recipe for aquarium cement on p. 302, vol. 38.—E. G. P. will find an article on

multiple telegraphy on p. 197, vol. 29.—C. H. H. will find on p. 187, vol. 32, directions for making battery carbons.—G. H. will find something on polishing woods on p. 313, vol. 30. For French polish, see p. 11, vol. 32.—J. H. B. will find on p. 21, vol. 36, directions for lining kettles with porcelain.—F. P. H. will find an explanation of the term "nominal horse power" on p. 33, vol. 33.—W. F. A. will find directions for bending timber of all kinds on p. 26, vol. 31.—A. M. P., B. N. R., S. W., F. C., J. B. M., W. H., C. P. G., R. F. W., N. K., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. G. says: A is a movable wheel, moving around and gearing into a wheel of the same size. How many times will A turn on its axis in going once round B? A. Twice, under the conditions stated.

(2) D. M. says: 1. I use an upright 3 horse power engine to run my presses. The boiler is cast iron with about 10 small flues up through it. Is this dangerous? A. Your description is rather indefinite, and though we think that in general the use of cast iron in boiler construction is objectionable, we do not know that your boiler is especially dangerous. 2. I use rain water from a flat tin roof, painted. Stove coal is used in the building, and the soot settling on the roof causes the water to be dark colored. I have been told that the creosote in the soot will corrode or eat into the boiler and flues where it settles on the top of the water. Is this so? Will the paint on the roof injure the water? A. In regard to the water you use, we scarcely think that its action will be injurious to the boiler. This question can, however, in the absence of an analysis, be settled only by observation, and we advise you to inspect the boiler and connections carefully, at short intervals.

(3) R. E. asks: Can you give me a plain rule by which I can ascertain the horse power of 44 inches diameter by 10 foot stroke engine, and the percentage or useful effect of the engine in horse power spent in working a 30 inches diameter plunger pump, pumping water out of a perpendicular shaft through an 18 inches diameter by 38 inches discharge pipe? The receiving pipe is 30 inches diameter by 10 feet long, capacity of engine is 5 strokes per minute with a boiler pressure of 75 lbs. per square inch. We have in use eight 32 inches x 36 feet cylinder boilers. Distance of engine from boilers is 20 feet. A. The only method by which these facts could be determined with any degree of accuracy would be by experiment. From the data sent, we could not give you a reliable rule.

(4) C. H. R. says: I am anxious to get something that will blow a church organ. We could not use hydraulic motor. Has anything else been invented for the purpose? A. There are hot air, gas, and petroleum engines in the market, some one of which might answer your purpose.

(5) J. C. asks: 1. What degree of heat will steam indicate under a pressure of 100 lbs. to the square inch? A. About 338° Fah. 2. How much can the heat be increased by superheating? A. You can increase the temperature as much as desired by using proper apparatus.

(6) H. V. asks: I am building a boat 50 feet long over all, and of 13 feet beam. I am having two engines built of 7 inches diameter and 8 inches stroke. The boat is to draw 3 feet of water, and to be of good model. I intend to put in twin propellers, one engine on each shaft. What diameter of propeller shall I use, and what speed can I expect from the above dimensions? A. Put in propellers of as large diameter as you can conveniently use. By using counterbalanced cranks or disk wheels, you can obviate all danger of catching on the center. With a good steaming boiler, you may expect to realize a speed of at least 7 or 8 miles an hour.

(7) A. C. asks: Does area of a cylinder mean the open surface? A. You probably refer to the volume of a cylinder, which is the space inclosed by it. It is improper to speak of the area of a cylinder. You can, however, speak of the area of the base and of the convex surface.

(8) F. A. L. asks: How much power do I require to raise water 60 feet through a 1½ inch pipe to my cistern in attic? A. It depends upon how fast you want to raise the water. It will be easy to raise it by means of a pump that a child can work, or you may use all the power that can be exerted by a horse.

(9) J. K. N. says: Can you explain the cause of the trouble with our cistern? It was built about 18 months ago, is under the house, and holds about 1,300 barrels. This winter it has proved to be leaky; and upon examination, we found that the cement in places, upon the sides and bottom, had puffed up in blisters of 3 or 4 square feet, and some smaller, leaving a hollow space beneath of from one to two inches. Of course, the cement had cracked and caused the leak. The walls of the cistern stand upon the solid rock; but the bottom does not go to the rock, but is plastered upon sand and gravel mixed, about 4 feet from the rock, with cement about an inch thick. There has been more or less water in it ever since it was built. No one hereabout seems to know the cause of it. A. At certain seasons, the water in the ground is more plentiful than at others, and rises to a higher level; if at such time the water in the cistern is drawn down to a lower level than that of the water in the ground, the latter will have the preponderance of pressure, and the upward movement of cistern bottoms is thereupon a very natural result. The remedy consists in constructing the bottom of the cistern arching—like an inverted dome—cementing the prepared gravel bottom, and then turning a brick arch upon it, laid in cement, to hold it down.

(10) W. H. C. says: 1. I have an engine of 6 inches stroke and 3 inches bore. How large a boiler do I want to make it run a small lathe for turning wood not over 6 inches in diameter? I have a boiler 2 feet long, 15 inches in diameter, and ½ inch thick. How much steam will it stand with 3 rods running through the center of the boiler? A. The boiler will probably answer, and you can carry 30 lbs. of steam. 2. I have a safety valve ½ inch in diameter, with a lever 4 inches long, 1½ inches from fulcrum to center of valve, and a weight of 1 lb.

How much steam can I get before it blows off when my ball is at the full length of the lever? A. The data in regard to your safety valve are not sufficient for a complete calculation; but when the ball is at the end of the lever, the pressure required to raise the valve will be between 40 and 50 lbs. per square inch.

(11) D. F. H. asks: Could not a steam boiler, that would be safe, be made by placing the heads on each end of shell and passing the tubes through the heads, to be fastened by nuts on the ends? A. Such boilers are frequently used on steam vessels. All the tubes are not secured by nuts, but several are made heavier than the others, and are fastened in this way.

(12) S. A. S. says: Can you give me a recipe for making a bright crimson dye, for the purpose of dyeing ordinary white muslin? A. Mordant the cloth with tin salt, and dye in a hot bath of madder extract or alizarine. There are numerous works on the art of dyeing, etc. See our advertising columns for names and addresses of publishers.

(13) T. C. P. says: I use 1 inch gas pipe for a heater and supply. I want to know if a 2 inch pipe in its place would be harder on the pump, as the pump has a 1½ inch plunger, and is run by eccentrics at 200 revolutions per minute. My object is to heat the water hotter. A. It will not.

(14) N. H. T. says: 1. I have a horizontal boiler 3 feet long and 20 inches diameter, with firebox 20 x 20 inches. The heat and smoke go to the front into a smoke box and come back through about 35 one inch tubes to the chimney. It has been tested to 150 lbs. per square inch. Is it large enough for a vertical launch engine 3½ x 5 inches? A. The boiler will probably answer very well. 2. How fast will this engine and boiler run a boat 25 feet long, built for the purpose? A. You may expect a speed of from 5 to 6 miles an hour in smooth water. 3. Can I get as much power with the same engine and boiler condensing in a vacuum, as I can using live steam? A. Yes, and more, other things being equal.

(15) J. Y. P. says: Please give me your opinion of the amount of power required in a machine for pulling pine stumps, and the kind and size of chain necessary, when used double? A. Without knowing what kind of a machine you have in view, we are unable to give you any information. So far as we know, a little giant powder, or some similar compound, forms the most efficient stump extractor that has yet been introduced.

(16) T. V. D. asks: How can I build a cistern? A. One of the first considerations is the nature of the soil in which the cistern is to be built. In some hard soils, an excavation is sometimes made carefully to the size required, the bank sprinkled with water, and then a coat of cement applied to it, without building a wall. In most cases, however, it is best to construct a cistern with brick walls, bottom and top. Let the form be cylindrical, the top arched in the form of a dome, and the bottom in the form of an inverted dome. If economy is an object, the walls may be 4 inches thick for 8 feet diameter or less—larger than this will require 8 inch walls—and all laid in cement. Plaster the interior throughout, together with the top of the crown, with a good coat of cement. Let the crown be 18 inches below the surface of the ground, and place a flat stone on the bottom, directly under the opening in the top.

(17) Y. A. asks: 1. What material or composition, other than lampblack, is successfully employed in the coloring of black mortar joints of brick face work? A. Coal dust and English drop black. 2. What should be the proportion of sand and lime in such mortar, and how should I mix the same? A. Prepare your pointing mortar first, and add color to suit, until the gray becomes black. 3. There is a material known as point black. Is it durable in color? A. We presume you refer to the drop black above referred to. It is the best in use for the purpose, and costs about \$2 to the thousand of front brick. We cannot say if it is much in use.

(18) M. W. D. says: 1. I have a recipe for tempering millpecks, by rubbing cyanide of potassa over the steel, heating to cherry red, and dipping in water. After a little experimenting, I was able to produce an excellent temper. But another time I failed. I used great caution not to overheat them; but out of several dozen I had not one that would not crumble like cast iron, and looked as if it were burnt. A. If the grain of your steel, after hardening, appeared coarse or granulated, it must have been overheated. 2. What will be best to temper them in that will not destroy the steel? A. Try heating them in molten lead, and using the cyanide of potassa as before.

(19) J. W. says: Your answer to G. E. C.'s question as to reversing a stationary engine is not correct. If the eccentric of an engine is turned halfway round, to reverse, the valve will be set wrong to twice the amount of the lap of the valve when the valve has no lead, and twice the lead in addition when it has. The position of the valve when the engine is on the center will be wrong by 1½ inches in an engine cutting off at ¾ stroke, with a 3 inch travel to the valve and no lead, when set by turning the eccentric halfway round. A. Our correspondent G. E. C. spoke of a valve without lap.

(20) T. W. says: We have a belt for polishing spokes, etc., which does not give satisfaction. Can you tell us how to construct a good belt? A. Use sand or quartz glued to a leather belt. Spread the sand on a board, make the glue well hot, coat the belt with glue, lay it glue side downwards on the sand and roll a heavy pulley on the back of the belt to press it into the sand.

(21) H. A. W. asks: 1. How fast should a lathe run while turning a piece of 1 inch bar iron? A. With a good tool, about 100 revolutions per minute. 2. How fast should it run to turn a piece of oak wood 2 inches in diameter? A. As fast as possible.

(22) S. N. says: I wish to heat small article of steel in a lead bath, for the purpose of hardening them by plunging in water after heating, but I find a difficulty from oxidation that takes place on the surface of the lead. What is the remedy? A. Cover the lead with powdered charcoal.

(23) T. S. R. says: 1. I am making a lathe to run by foot or hand power. What ought to be the size of the hand wheel to go by hand, and what the size of the hand wheel to go by treadle? A. To go by hand, 24 inches diameter. To go by foot, 30 inches. 2. What should be the diameter of the pulley? A. Six inches. 3. Shall I use a leather or rope band? A. Use a leather belt.

(24) J. P. L. asks: Is there any die in use for cutting screw threads on bolts, etc., so constructed that it may be opened at the end of the cut, and be run back without reversing the lathe or die holder? A. Die holders such as you require are made by nearly all the prominent bolt-cutting machine makers.

(25) T. H. B. asks: Why do cast iron kettles for melting metal crack on the bottom about two hours after the fire is started, or as soon as the metal is thoroughly melted? A. Because the bottoms are too thick. Try kettles with thinner bottoms.

(26) E. S. asks: What is the best way to solder wire cloth to a round iron hoop? Is there not a preparation that will cause the solder to adhere readily, and prevent rust? A. Use killed muriatic acid (muriate of zinc); then add 2 parts of water and a little sal ammoniac, determining the quantity by experiment.

(27) T. B. asks: What causes the hardening of saws that are gummed out with emery wheels? A. The spaces between the particles of emery fill up with steel (or whatever is being ground on them), creating a smooth in place of a rough surface; and the friction causes heat, heating the outer surface suddenly, and it cools equally suddenly when the emery wheel leaves it, and the outer shell of the steel hardens. To remove it, hack the wheel. This may be done with the corner of a worn-out file. Then go over the saw very lightly, and grind off the extreme outer surface which has been hardened. It is better to keep the emery wheel hacked and cut off only a little at a time, and go around the saw several times in gumming. It will really require no more time than to do it in the usual way of gumming each tooth clear down before commencing the next one. This is an important matter, as hundreds of saws are ruined for want of this knowledge.—J. E. E., of Pa.

(28) W. C. H. asks: How may copper be permanently colored or stained black? The coatings made by varnishes soon wear off, and a process is desired that will render the color durable. A. There is no coating for metals that can conveniently be applied better than that recommended to A. F., on p. 90, vol. 36.

What is the method of silvering glass? A. See p. 35, vol. 35.

(29) S. G. asks: What can I use to color starch brown, for starching brown linens, cambrics, prints, etc.? A. Try a little soluble Bismarck brown.

(30) G. C., of Ballarat, Victoria, Australia, asks: 1. What do the blind manufacturers in America use to prevent the blistering of the paint on inside blinds? A. Paint is apt to blister when mixed with boiled oil. Use raw oil, and let the paint get dry and hard before exposing it to dampness or rain. 2. What are the ingredients used in the manufacture of green paint? A. Paris green is the principal ingredient used in the greens for painting blinds. The color is shaded by adding black. A. Bronze green is sometimes made by mixing black and chrome yellow.

(31) A. A. B. says: Please inform me of the cause of and remedy for granulated eyelids? A. The trouble is commonly caused by a weak and impure state of the blood. Use sulphur and iron tonics for the blood, and wash the eyes regularly, three times a day, with the following: Pure sulphate of zinc 3 grains, tincture of opium 10 drops, water 2 ozs.

What is the process of making emery wheels? A. They are usually made by kneading crude caoutchouc, softened by heat, with about half its weight of sulphur, and the proper quantity of fine emery, and vulcanizing the material by heat.

Can a person make a patent invention for his own individual use? A. No.

(32) J. J. says: Please give me a recipe for making vulcanite, to set artificial teeth in? A. The right to manufacture this material is secured by patents. It is made by kneading caoutchouc with about half its weight of sulphur and a little Indian red. It is vulcanized by heating for 4 hours, under pressure, at a temperature of 310° Fah.

(33) H. G. says: Please give a recipe for making bar soap? There is one offered for sale by peddlers, as follows: Take 5 gallons ley, 5 gallons water, 5 lbs. tallow, 1 lb. potash, 2 lbs. sal soda, ½ lb. rosin, 1 pint salt, 1 pint washing fluid. Let boil half an hour, which is enough for 100 lbs. But I cannot make it work. It does not take up the grease, and it does not harden. A. Dissolve the potash and sal soda in the water (boiling), and add a few ozs. of caustic lime, stir and allow to settle. Pour off the ley thus formed, and boil this for several hours with the tallow and rosin. Then remove from the fire and add the salt (dissolved in hot water). Stir well, and allow to settle. Pour off the supernatant liquid, gather the precipitated flocculent soap on a cloth, and strain off the excess of liquor by pressure. When dry, this should give you about 12 lbs. hard soap.

(34) I. J. asks: 1. How many lbs. of coal will make a bushel of coke? A. On an average 50 lbs. of canal coal will yield a bushel of coke. 2. How many lbs. of coke are there in a bushel? A. A bushel of coke weighs about 35 lbs.

(35) H. E. N. asks: What will remove the stain of white paint, that has become hard and set on brown silk? A. Try good chloroform and ether, and then a little soap and water.

(36) T. S. says: I wish to make an intense light in one end of a hall from a single gas jet, the body of the hall being lighted with ordinary gas burners. I wish the light to last for two or three hours. How can I increase the intensity of gas? A. There is no source of brilliant illumination which approaches, in point of economy and controllability, the oxyhydrogen or lime light. Try large argand gas burners, provided with tall chimneys and good silvered reflectors.

(37) R. C. S. says: 1. A spring is situated on a hill several hundred feet high, and nearly a mile from where we wish to use the water. One half of the required length of pipe is 1½ inches, and the rest 1 inch in diameter. In order to get the best head and largest flow of water, how shall the pipe be used? With the largest size near the spring, or vice versa? A. The larger pipe should be placed nearest to the spring, as in this case its contents will act as a head to force the water through the smaller pipe, in which, on account of the greater velocity, there will be the greater friction. 2. Does water in a pipe, under pressure, flow with less friction in coming down hill than on a level or in being forced up hill? A. No. The friction depends upon the velocity without regard to the power. If you remove the power of gravity, water may be forced up hill as easily as down. 3. Is the friction greater when water is forced through a pipe than it would be if it were drawn through the same pipe by suction? A. No. It is forced through the pipe in either case. Where suction is employed, the pressure of the atmosphere is simply removed from one end, and allowed to exert its full force at the other.

(38) S. T. asks: What ingredients can be mixed with aniline red to turn it black without injuring its quality? A. Use hydrochloric acid and chloride of potassa. Aniline black may be made more economically directly from the aniline oil (crude) by means of the above reagents.

(39) M. M. F. asks: Please give me a recipe for annealing steel very soft? A. Heat it a cherry red, and let it cool in lime.

(40) H. C. D. asks: 1. How is a fine varnish finish put on wood, to be perfectly smooth and glossy? A. First rub down the surface of the wood with pumice powder. Then give three good coats of copal varnish (commonly called furniture varnish), allowing each to dry before applying the next. Rub this down perfectly smooth with pumice powder and water, and finally give the work a good flowing coat of strained varnish. 2. How is a white finish put on wood to represent marble, that will not scratch? It is used on coffins. A. The wood is given several good coats of zinc white, and then rubbed down with pumice powder. It is then flowed with a lacquer of gum aniline, and baked at a temperature of about 300° Fah. 3. What can I use to fill the pores of walnut before varnishing? A. Common oil size is sometimes used; but the best material for this purpose in use is a rough varnish composed of rosin, oil, and turpentine. It is known in the trade as scraping varnish. Several coats of it are applied to the wood and then scraped off with an iron or steel scraper and fine sandpaper, leaving the pores of the wood evenly filled.

(41) W. D. M. says: When do fishes sleep? In my aquarium my gold fish and minnows seem always on the alert. A. Such fishes rarely sleep, unless in very cold water.

(42) J. L. of Manchester, England, asks: How are the castings of zinc figures or statues made in France and Germany? The mode of procedure is, I believe, casting the zinc in brass moulds, with the pattern engraved inside the mould; but I cannot arrive at the way in which they cast them hollow, for by the appearance of the metal no sand core is used. A. The moulds are built in pieces, and the sand is faced all over, for both the inside and outside of the statue, leaving no sand or parting marks on the castings.

(43) S. asks: 1. What is the greatest perpendicular height to which water can be lifted by a steam pump? A. From 30 to 32 feet. 2. Which can lift the highest, a piston or a rotary engine? A. If the two forms of pump are equally tight, there will be no difference in favor of either.

(44) A. E. B. says: 1. I wish to construct a foot power jig saw. The saw blade is to be stretched in a frame after the fashion of the gate saw. A. A man can comfortably make about 130 strokes of the treadle with the foot per minute. This will turn your driver 120 times per minute. 2. How large a driving wheel must I have to attain 800 strokes a minute, and of what size should the pulley be? A. The driver pulley may be from 1½ to 2 inches in diameter, and you can make your own calculation for driver. 3. How large shall I make my flywheel, and will it make any difference whether I have it on the shaft with a pitman pulley or on the same shaft as the drive wheel? A. It is better to attach a pitman to the shaft which carries the driver, because it is more direct and saves the friction of intermediates.—J. E. E., of Pa.

(45) W. H. D. asks: 1. How can I construct a hand pump for the purpose of pumping oxygen gas from a bag into a cylinder, to compress it for a calcium light? A. If you are entirely unacquainted with the details, we think it will be more satisfactory for you to purchase the pump from a maker of philosophical instruments. 2. In making oxygen gas in a cylinder over the fire, how is the pressure gauge made, and what kind of liquid does it contain? A. A pressure gauge can be made of a bent tube containing water. 3. What is a Bunsen burner? A. It is a gas burner in which the gas is mixed with air before being burned. 4. What is the expansive capacity of hot air to the square inch? A. If the volume is constant, the pressure increases about 1½ for each 1° Fah.

(46) E. P. B. asks: 1. Will the salt in oil made from butter be injurious to machinery or leather? A. It is better to extract the salt. 2. Is there any cheap way of removing the salt? A. The salt may be extracted from the butter by agitating the same with a large quantity of water just hot enough to fuse it. On allowing the water to stand for a few minutes, the fatty oil will rise to the surface.

(47) J. McT. asks: What is the substance called breeze, mentioned in a recipe for making concrete? A. Small ashes and cinders, sometimes used instead of coal for burning bricks.

Is there danger of a balloon frame rotting when filled in with concrete, the inside of the studs being exposed? A. No, especially if the ends of the studs are not covered with the concrete.

Which is the best to apply to wood, crude petroleum

or coal tar? A. Coal tar is best for coating wood underground or where subject to dampness.

(48) R. C. G. says: Our western coal has a great deal of sulphur in it, which makes it very troublesome to work; and as I am a blacksmith, it gives me much trouble. Is there anything that will remedy the evil? A. This cannot be obviated, as the sulphur in the fuel exists in combination with iron as pyrites.

(49) F. S. asks: Is there anything which will take smoke stains from white marble? A. If you do not succeed with soap and water, try rubbing with a little prepared chalk moistened with benzole.

(50) W. B. asks: How can I color brick-work black? A. Use a paint or varnish made from Brunswick black, oil, and turpentine.

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

B. B. T.—The material contains nickel, cobalt, arsenic, and sulphides of these metals. After solution, the arsenic may be separated by sesquioxide of iron. Neutralize and precipitate with lime, dry the precipitate, and dissolve it in very dilute oil of vitriol. The iron may then be separated by neutralizing with lime and a little carbonate of lime (chalk). Crystallize the nickel solution, and decompose by roasting.—A. E. F.—No. 3 appears to contain gold, but it would require a quantitative analysis of the ore to determine the amount. We can give no opinion as to the probable value of the ore from the small fragment which you send.—A. E. L.—No. 1 is galena—sulphide of lead. Nos. 2 and 3 consist principally of iron pyrites and marcasite. See p. 7, vol. 36.—C. J. D.—It contains iron, nickel, cobalt, and arsenic.—A box from Mobile city (no letter with it) contains guano of good quality.—O. P.—It contains galena and iron pyrites. See p. 7, vol. 36.—H. C. M.—It is an aggregation of small crystals of smoky quartz. Its occurrence is not necessarily indicative of the close proximity of any valuable metal. See our advertising columns for addresses of dealers in scientific books, who will send you catalogues on application.—A. R. R.—No. 1 is hornblende. No. 2 is galena—sulphide of lead. No. 3 appears to be cerussite—a double sulphide of copper and iron. No. 4 is clay containing a large percentage of carbon. It is not a natural formation. No. 5 is mica schist.—S. M. W.—It is an iron ochre—clay colored with oxide of iron. It is used to some extent, mixed with oil, as a paint for outside work and for floors.—M. S. H.—It appears to contain British gum (dextrin), gum arabic, shellac, borax, soap, glycerin, and some perfume. Shellac may be rendered soluble in water by adding borax.—A specimen contained in small yellow box, with no name on it, appears to be a piece of slag or scoria from some furnace.—C. J. L.—It is a piece of furnace slag.—S. G. McM.—It is sesquioxide of iron.

COMMUNICATIONS RECEIVED.

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

On the Bourdon Pressure Gauge. By A. B. W.
On the Attraction of Atoms. By D. P. B.
On Home-Made Philosophical Instruments. By J. P.
On the Telephone. By H. H.
Also inquiries and answers from the following:
L. H.—A. B.—T. A. K.—E. B., Jr.—W. W.—A. J. B.—G. B.—C. A. F.—N. J. W.—J. T. R.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells small distilling apparatus? Where can agricultural steam engines be bought? Who sells electro-magnetic motors? Who sells the best microscopes? Who is the best work on watchmaking?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is especially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

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Granted in the Week Ending

March 6, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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[NEW SERIES.]

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[Continued on page 246.]



Fig. 1.—TORPEDO EXPERIMENTS AT CHERBOURG, FRANCE.

Scientific American.

ESTABLISHED 1845.

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VOL. XXXVI, No. 16. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, APRIL 21, 1877.

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DARWIN ON THE EFFECTS OF CROSS AND SELF FERTILIZATION IN PLANTS.

It is impossible to finish the perusal of any of Mr. Charles Darwin's works without a genuine feeling of admiration, not only for the manner in which the investigator pursues every branch of the great principles he has enunciated to its minutest ramification, but for the almost inconceivable patience with which he accumulates grain after grain of proof, until his position is not only firmly established but seems possessed of even a superabundant support. For eleven years he has been conducting the difficult and delicate inquiry of which his recent volume is the record; and yet the result to be adduced, from the great mass of facts so slowly and laboriously gathered, is no strikingly novel discovery, although much is embodied that is new. It is rather a substantiation of opinions already enunciated, leading to their wider generalization. His conclusion is closely connected "with various important physiological problems, such as the benefit derived from slight changes in the conditions of life, and this stands in the closest connection with life itself. It throws light on the origin of the two sexes, and on their separation or union in the same individual, and lastly on the whole subject of hybridism, which is one of the greatest obstacles to the general acceptance and progress of the great principle of evolution."

In briefly reviewing Mr. Darwin's new work, or rather its conclusions, for we cannot attempt the consideration of his countless experiments, it is best to begin by the repetition of his own statement, made to avoid misapprehension, namely, that the term "crossed plant seedling, or seed," means one of crossed parentage, that is, one derived from a flower fertilized with pollen from a distinct plant of the same species. And a self-fertilized plant seedling, or seed, means one of self-fertilized parentage, that is, one derived from a flower fertilized with pollen from the same flower, or sometimes from another flower on the same plant.

From his observations on plants, and guided to a certain extent by the experience of breeders of animals, Mr. Darwin many years ago became convinced that it is a general law of Nature that flowers are adapted to be crossed at least occasionally by pollen from a distinct plant. It often occurred to him that it would be advisable to try whether seedlings from cross-fertilized flowers were in any way superior to those from self-fertilized flowers. It so happened that, without any thought of the above inquiry, he raised close together two large beds of self-fertilized and crossed seedlings from the same plant of *Linaria vulgaris*. To his surprise, the crossed plants, when fully grown, were plainly taller and more vigorous than the self-fertilized ones. As it seemed quite incredible that the difference between the two beds of seedlings could have been due to a single act of self-fertilization, Mr. Darwin attributed the fact to some accidental cause; but in order to test the matter, he prepared two more beds from the carnation *dianthus caryophyllus*, which, like the *linaria*, is almost sterile when insects are excluded; and hence the inference may be drawn that the parent plants must have been intercrossed during every, or almost every, previous generation. Nevertheless, the self-fertilized seedlings were plainly inferior in height and vigor to the others. This was the starting point of Mr. Darwin's experiments, conducted with all the refinement and minuteness necessary for the most accurate of observations.

Of the conclusions reached, the first and most important is that cross-fertilization is generally beneficial, and self-fertilization injurious. This is shown by the difference in height, weight, constitutional vigor, and fertility of the offspring from crossed and self-fertilized flowers, and in the number of seeds produced by the parent plants. The advantages of cross-fertilization do not follow from some mysterious virtue in the mere union of two distinct individuals, but from such individuals having been subjected during previous generations to different conditions, or to their having varied in a manner commonly called spontaneous; so that in either case their sexual elements have in some degree differentiated. Again, the injury from self-fertilization follows from the want of such differentiation in the sexual elements. Thus when plants of the *ipomoea* and of the *mimulus*, which had been self-fertilized for the seven previous generations, and had been kept all the time under the same conditions, were intercrossed one with another, the offspring did not profit in the least by the cross. On the other hand, as showing that the benefit of a cross depends on the previous treatment of the progenitors, plants which had been self-fertilized for the eight previous generations were crossed with plants which had been intercrossed for the same number of generations, all having been kept under the same conditions as far as possible. Seedlings from this cross were grown in competition with others derived from the self-fertilized mother-plant crossed by a fresh stock; and the latter seedlings were to the former in height as 100 to 52, and in fertility as 100 to 4.

Under a practical point of view, agriculturists and horticulturists may learn much from the above conclusions. Thus it appears that the injury from the close breeding of animals and from the self-fertilization of plants does not necessarily depend on any tendency to disease or weakness common to the constitution of the related parents, and only indirectly on their relationship, in so far as they are apt to resemble each other in all respects, including their sexual nature; and secondly, that the advantages of cross-fertilization depend on the sexual elements of the parents having become in some degree differentiated by the exposure of their progenitors to different conditions, or from their hav-

ing intercrossed with individuals thus exposed, or from spontaneous variation. Animals to be paired should therefore be kept under as different conditions as possible, and excellent results have been obtained from the interbreeding of individuals reared on distant and differently situated farms. With all species of plants which freely intercross, by the aid of insects or the wind, the best plan is to secure seeds of the required variety which have been raised for some generations under as different conditions as possible, and sow them in alternate rows with seeds matured in the old garden. The intercrossing of the stocks will yield far more favorable results than any mere exchange of seeds. Florists may learn that they have the power of fixing each fleeting variety of color, if they will fertilize the flowers of the desired kind with their own pollen for half a dozen generations, and from the seedlings under the same conditions. But a cross with any other individual of the same variety must be carefully prevented, as each has its own constitution. After a dozen generations of self-fertilization, the new variety will probably remain constant, even if grown under different conditions; and there is no longer any necessity of guarding against intercrossing.

With respect to mankind, Mr. George Darwin has concluded, from a statistical investigation which has already been reviewed in these columns, that the evidence of any evil due to the intermarriage of first cousins is conflicting, and on the whole points to the same being very small. Our author infers that, with mankind, the marriages of nearly related persons, some of whose parents and ancestors had lived under very different conditions, would be much less injurious than that of persons who had always lived in the same place and followed the same habits of life. He sees no reason to doubt that the widely different habits of life of men and women in civilized nations, especially amongst the upper classes, would tend to counterbalance any evil from marriages between healthy and somewhat closely related persons.

THE TRANSMISSION OF CORRECT TIME.

The public clocks in the city of Vienna, Austria, are at present driven by a pneumatic system, actuated at the Imperial Observatory by an automatic arrangement connected with an astronomical timepiece. The idea originated with an engineer named E. A. Mayrhope, who had long experimented with the transmission of time by means of electricity, and at last gave it up in favor of pneumatic transmission, which is free from the drawbacks and uncertainties connected with the use of electric batteries, insulated wires for transmission, delicate contact breakers, and other complicated arrangements. Such annoyances have occurred in the experiments made in this country, where electric arrangements for the transmission of time have thus far never been in use for any considerable period. Some years ago, a time ball in the New York Custom House, intended to be regulated by an electric current from the Dudley Observatory at Albany, soon failed, because of the constant attention required, which could only be expected from persons specially engaged and exclusively interested in electric transmissions. Therefore it is not to be expected that such an enterprise can be successful until telegraph companies take hold of the matter; and only in such case is there possibility of a regular working of electric timepieces.

The method of Mr. Mayrhope consists in originating a wave of compressed air, which is sent through airtight tubes laid along the street gas mains to all the public clocks. This wave is transmitted once every minute, when the minute hands of all the clocks move forward the required distance. It is intended to extend this system until it includes the clocks in all the schools, public institutions, hotels, railroad depots, and the houses of such persons as desire it.

There is no doubt that this method has the enormous advantage of simplicity, especially when applied to a great number of clocks. Such a pneumatic tube may have ever so many branches; and at the end of every branch the impulse must invariably reach the moving lever which, pushed by an elastic membrane, will propel the minute hand. It must, however, be borne in mind that, by this system, the clocks will not move so instantaneously as by the electric current. Electricity is transmitted over a telegraph wire with a velocity of from 4,000 to 12,000 miles per second, according to the perfection of the insulation; therefore the motion of the various clocks will be practically isochronous. But the wave of compressed air, transmitted by the elasticity of the atmosphere, moves only with the velocity of sound, which is, on an average, only 1,100 feet, or little over one fifth of a mile, per second, minus the resistance in the narrow tubes, which may reduce it somewhat; so that its velocity of transmission may vary from 25,000 to 70,000 times less than that of electricity. This, however, is of little practical importance, as it would only cause the clocks to be one second behind for every 1,100 feet distance from the central station; and if in some cases seconds had to be counted, the correction would be easily applied. Clocks at a mile distance would be about five seconds behind; and the correct amount having been determined by direct observation, a constant number would have to be added to the time indicated by each clock, in order to find the correct time to within a fraction of a second.

But if we go into such close calculations, the difference in time for difference in longitude ought not to be neglected. At the latitude of Vienna, the degrees of longitude are nearly forty-six miles long; that means that meridians drawn on whole numbers of degrees are nearly forty-six miles apart.

The sun crosses each meridian every four minutes; the time for the meridians to the east from the central station is therefore, for every degree, always four minutes earlier, and for meridians to the west four minutes later, than it is at the central station. Four minutes for 40 miles, or two hundred and forty seconds for 241,040 feet, is at the rate of 1,000 feet for one second: a velocity a little less than that of sound. So that the propulsion of the air wave, when going directly west, would slightly overtake the solar movement; and if sent at noon from the central station, it would arrive at a western station before the sun passed the meridian of such western station. If we make the calculation for the latitude of New York city, we come to the curious result that the wave of compressed air, or the sound wave, travels west at the same rate as the sun does; as, in our latitude, the degrees of longitude have a length of nearly 50 miles, which is passed over by the sun in four minutes, being at the rate of 262,000 feet in two hundred and forty seconds, or very nearly 1,100 feet per second. Therefore, if a pneumatic system of transmitting time were adopted here, the impulse would, in tubes running directly from east to west, be transmitted at the same rate as the solar motion, and a wave sent from Brooklyn at noon would arrive in five seconds in New York, where it would then be exactly noon; and it would arrive in Jersey City in another five seconds, where the sun would then cross the meridian, and so on, travelling west and keeping pace exactly with the solar time.

THE UTILIZATION OF RATS.

Most people have an instinctive aversion to rats, classing them with snakes, bedbugs, mosquitoes, and other evils of this world, allowed to exist by an inscrutable Providence for reasons past human discovery. Beyond having a vague knowledge that the heathen Chinese devours the murine tribe, and deems the unsavory-looking rodent a delicacy, the average thinker on the subject can perceive no utilization for the vagrant denizen of cellars and wharves, save (indirectly) in his furnishing an object to be caught by the multiplicity of ingenious traps which inventors have constructed, and serving as a source of perpetual nervousness to the wiry Scotch terrier who spends his days in searching for him under parlor sofas, behind furniture, and in every other shady corner where the illogical canine mind conceives a rat might possibly shelter himself. The fact of the case is that the rat is in reality a useful animal; and as we showed recently in a discussion on bedbugs, it is a violent assumption for anyone to suppose that any living thing does not serve, or may not be made to serve, a useful purpose. Moreover, it is equally erroneous to assert that a rat is a noxious beast. To be sure, he breeds with astonishing rapidity, and he has the failing of cannibalism toward his progeny. But so has his arch enemy, the well fed tom cat. He is pugnacious, but rarely attacks man save in defence of his life. On the other hand, he is scrupulously neat, even more so than the average male feline. As a scavenger, his labors are of great value in the filthy cities of the Orient; and his tail is a marvel of constructive design and a source of perpetual admiration to the anatomist. Unfortunately he is a pronounced kleptomaniac; and this, with his supposed proclivity to take refuge in the vicinity of female ankles, makes him a pariah and an outcast among four-footed things. Yet mark the inconsistency: On the fair hand of the damsel, who shrilly shrieks at the sight of that wonderfully constructed tail whisking into a friendly hole, may be a glove—or at least the thumb of it—made from that despised creature's skin, and called by courtesy a "kid." On the head of paterfamilias, who ruthlessly pursues the fugitive interloper with the kitchen poker, may be a felt hat made from the rat's fur, which exceeds in delicacy that of the beaver, and which is sought after by a large corporation, expressly organized for the purpose, in Paris. An eccentric Welshman once, in order to show how far the rat might be utilized for clothing, spent three years in collecting enough ratskins to make himself a complete dress, hat, neckerchief, coat, waistcoat, trousers, and even shoes; six hundred and seventy rats were immolated for this purpose, and the six hundred and seventy beautifully organized tails were strung together to form a tippet.

It is in Paris—that home of the utilization of everything—that the rat is turned to the greatest number of uses. He furnishes employment for an army of hunters, who pursue him in his sewer fastnesses for the sake of his skin. In the great abattoirs of the city rats exist by the million. One proprietor, on becoming nearly driven from his premises by the rodents, threw a dead horse in a walled inclosure, and then stopped up all means of escape, so that the rats, attracted by the bait, could not get out. In one night 2,650 rats were caught in the trap and killed by men armed with clubs; in a single month, 16,050 of the animals were thus destroyed. We note this case mainly in connection with a curious utilization of rats, wherein dead animals of all kinds are placed where they can get them as an easy way of disposing of the refuse flesh and securing the valuable bones. A regular pound, surrounded by a massive stone wall, is provided for this purpose by the city authorities of Paris, and it is the regular morning's work of those in charge to remove the beautifully polished skeletons.

Of course, when thus pampered, the rats multiply amazingly, and therefore once in a while a grand *battue* is necessary to reduce their numbers. The way in which this is conducted is curious. Horizontal holes are bored all around, in and at the foot of the inclosing wall, the depth and diameter being respectively the length and thickness of a rat's body. Upon the morning of the *battue*, men armed with tin

pans, kettles, drums, and other objects for producing horrible noises, rush in at daybreak. The astonished rats precipitately rush for the nearest openings, which are those in the walls. But these, while large enough to contain their bodies, will not accommodate their tails, and the walls are soon ornamented with a vista of those anatomically superb members, whisking about like animated icicles. Then arrives the rat collector—a scientist in his way—who, with admirable dexterity, seizes the pendent tails, jerks forth the owner attached thereto, and deposits him in a bag worn over the left shoulder. The privilege of catching the rats is farmed out by the authorities, and a profitable business it is. The rats are sleek and fat, and fetch high prices for their fur, skins, and flesh—the latter doubtless appearing in the restaurants where one may have "dinner for one franc with wine, bread at discretion." Rat flesh is not bad eating, at least so say those who have tried it, our knowledge in the matter being limited. It is delicate, white, firm, tastes like chicken, and in China the soup made from it is considered to be equal to our well known oxtail. In the Celestial Kingdom rats are worth two dollars per dozen. In the West Indies the rats exist in enormous numbers on the sugar plantations, and work great damage by gnawing the growing sugar cane. Each plantation has its official ratcatcher, who is paid by piecework, that is, so much a dozen for tails brought in.

The credit of suggesting the most extensive utilization of rats is due to Mr. P. L. Simmonds, who has lately printed an admirable work on these and other undeveloped sources of profit—from which we have drawn many of the curious facts above given. Mr. Simmonds suggests that a profitable venture might be made from Kurrachee to Canton and Hong Kong of salted rats. About 7,000,000 could be cured and packed aboard a 400 ton ship. For the sake of curiosity we quote Mr. Simmonds's estimate of profits: 7,000,000 rats at 6 cents per dozen, \$35,000; salting, curing, etc., 60 per cent, \$21,000; total cost, \$56,000; and 7,000,000 rats sold at \$2 per dozen, \$1,166,666.66, shows a profit of \$1,090,666.66. There! No one can charge us—thanks to Mr. Simmonds—with not having done our best to enrich our readers. Few journals can claim the proud laurel which we boldly now grasp, of having pointed out the way for any one to become a millionaire.

A FIFTY THOUSAND DOLLAR BOTCH THAT THE PEOPLE PAID FOR.

There will be found, recounted with much detail, in the recently issued report of the Chief of Ordnance of the United States army, about as glaring and inexcusable an instance of waste of the people's money, through a series of mechanical blunders, as can probably be found in the already long category of expenditures for fruitless tests of military inventions. Fifty thousand dollars have been squandered in an attempt to manufacture one 9 inch cannon according to the plans of Mr. Alonzo Hitchcock. The story of the various botches and mistakes, which we summarize briefly below, would verge upon the laughable, were it not well calculated to render any thoughtful mechanic ashamed of the men who did the work, as well as of those who permitted it to continue in the manner recounted for a period of over two years.

The Hitchcock system of cannon making is based on the welding together of a number of wrought iron rings, which are seated on an anvil located upon the piston of a hydraulic press. The latter is lowered as the rings are added, and a furnace is provided for keeping the rings hot while being hammered. In this way a gun is gradually built. This description is very general, but it will serve to convey a sufficient idea of the invention to appreciate what follows. Early in February, 1873, Mr. Hitchcock was granted an appropriation of \$50,000 for the manufacture of his gun at the Springfield armory, and given the supervision of the work; and every opportunity was afforded him for making the most careful studies. But so vague were his plans at the outset that he neglected even to have working drawings made of a part of his plans until the mechanics had actually begun labor thereon. The preparations consisted in blasting a pit 40 feet deep into the solid rock, lining it with concrete, and afterwards with a huge iron tank. Two months later, after a part of the ponderous machinery above this had been erected, Mr. Hitchcock concluded to cut the holes, which received his steam hammer supports, down four feet. This was then a very slow and difficult operation, as blasting, owing to the concrete, could not be resorted to. Finally, in August, 1874, the hammer was built, and steam was let on; but the machine refused to work. The hammer bound against the steam cylinder, and unlimited filing of shafts became necessary. "Had Mr. Hitchcock made a careful inspection of these machines when he visited the ironworks for that purpose," the reporter says, "this would not have happened." Then it was discovered that, through a blunder, the anvil pit was not deep enough, and more alterations had to be made.

By April, 1875, more than two years after the work had begun, the furnaces were furnished, and tested satisfactorily, and preparations were made to heat one of the gun disks. Prior to beginning work, tests were made of the water bottom on which the disks rest in the furnace; but through some stupidity, the exhaust valve of the same was closed, so that steam was generated, which drove back the water in the supply pipe. Thereupon "somebody," in a state of great excitement, opened the valve suddenly, relieved the steam pressure, in poured the cold water, and of course the water bottom cracked. The diary of the ordnance lieutenants en-

gaged upon the work now becomes amusing reading. We quote a few extracts: "April 7. Mr. Hitchcock proposes to make a false bottom of sand." "April 8. Tried to resolve piece in heating furnace through the door with a wrench-shaped tool. Piece stuck on hearth, and gaspipe handle grew soft by heat, and bent. Hammer accidentally dropped on the furnace lid crane, which was standing directly under it. Mr. Hitchcock at the throttle." "3:25 P.M. The top piece" (suspended in hammer furnace) "is lowered; it strikes one of the corners of the cast iron center, melts the corner, and topples the piece over. 3:28 P.M. Fortunately by this time it is too cold to stick. 3:35 P.M. It is decided to draw fire." Mr. Hitchcock decides that a cast iron water bottom is essential; but two days later he changes his mind, and concludes to tinker the old cracked bottom with an iron hoop. This promptly burst on being used, and the inventor set about making a wrought iron water bottom, having a locomotive tire for a rim. This was made and inserted, and operations now progressed to the welding of several disks—not, however, without an interesting variety of accidents which we shall not recapitulate. The sixth piece to be added was accidentally dropped, and the unfortunate water bottom was again damaged, and caused to bulge and leak. The pieces welded were cut up and the welds found bad. More alterations of the machinery followed, and at last, in June, fires were again started; but, to quote the official report again, "Mr. Hitchcock dropped the hammer upon the first ring, and found himself unable to raise it again." The anvil had not been properly adjusted, the hammer fell too hard, and away went the cylinder head. Two weeks later, another attempt was made to weld together two large disks to form the breech of the gun. But "the hook at the end of the chain sustaining the transfer tongs became heated, and straightened out, allowing the upper disk to fall. Before the disk could be placed in proper position, it had become chilled, had to be reheated, and finally a weld was made; but this, on examination, was again found to be exceedingly bad."

We have given the above in some detail in order to exhibit to the reader the placid effrontery with which Mr. Hitchcock, in his letter dated June 24, 1875, declining to proceed further with his gun, explains the reasons for this grand series of botches and blunders. We quote *verbatim*: "Notwithstanding the machinery, all works satisfactorily; I find that, by practical operation, there is great danger of uncertainty about the old reverberatory furnaces, which we now have in the works. This was, however, well understood by the Ordnance Board; and all practical furnace men knew that there are better furnaces in use, as, for instance, the gas or Siemens' regenerative furnace; but simply for prudential motives, it was deemed sufficient to test my mechanical mode of welding up guns as I proposed, leaving the furnaces to future consideration if the machinery would do the work, as was promised. We are trying to make impossible things possible, and going squarely in the face of all known facts in science and practical knowledge that have been developed within the last ten or twelve years."

Mr. Hitchcock makes these statements after two years and nine months' experiment, and after the \$50,000 of the people's money is all but exhausted. With reference to them, Colonel Benton says: "All parts of his gun machinery, including the furnaces, were designed by Mr. Hitchcock, and were constructed under his immediate supervision and without limitation in the selection of the nature of the furnace." Further comment is needless.

Explosive Compounds.

Two more instances of unexpected decomposition, accompanied with some degree of violence, have lately been brought to our notice. The first happened with iodide of strychnia: a bottle, in which some of the salt had been long kept, was held near the fire, to warm the glass and loosen the stopper. An explosion suddenly occurred, scattering the glass and badly wounding the hand. The other accident was related by Mr. B. F. McIntyre, at a meeting of the Alumni Association of the New York College of Pharmacy. On distilling essential oil of bitter almonds over nitrate of silver, to free it from prussic acid, toward the end of the operation the material in the retort violently exploded, breaking all the glass apparatus in the proximity, but doing no further damage. Neither explosion can be very easily explained; in fact, few explosions can, except in a general way. In regard to the iodide of strychnia, it is supposed that the substitution compound had formed, on decomposition, some iodide of nitrogen, in a somewhat similar manner to the production of that substance when iodine is treated with an excess of ammonia. As to the reaction which occurred between oil of bitter almonds and argentic nitrate, it may be said not to be altogether extraordinary, as the silver is known to readily form explosive compounds with a number of organic substances. The only wonder is that no mention has been made of it before this time, for the rectification of the essential oil over nitrate of silver is not an unfrequent operation, while it seldom happens that one has occasion to heat old iodide of strychnia.

To Protect Molten Lead from Explosion.

Molten lead, when poured around a damp or wet joint, will often convert the water into steam so suddenly as to cause an explosion, scattering the hot metal in every direction. This trouble may, it is said, be avoided by putting into the ladle a bit of rosin the size of a man's thumb, and melting it before pouring.

PRACTICAL MECHANISM.

BY JOSHUA BORE.

NEW SERIES—No. XXIV.

PATTERN MAKING.—BENCH WORK.

Round columns are either plain, fluted, or of a mixed design to agree with the square columns in the same building. Fig. 180 represents a plain round column; but it must be remembered that, even though the shaft be plain, the design of the base and cap may be modified according to taste. In the case of so simple a one as we have illustrated, it would probably be cast solid as represented; though if of very large size, as those in the crypts of churches, perhaps 18 inches in diameter, a great deal of metal would be saved by simply casting a plain round shaft with the mouldings, N and O, upon it, and of a length measured from the lower part of the base to the top of the cap. This casting takes the weight of the building. The base, B, with its moulding, B M, and the cap, C, with its moulding, C M, are thin castings fixed to

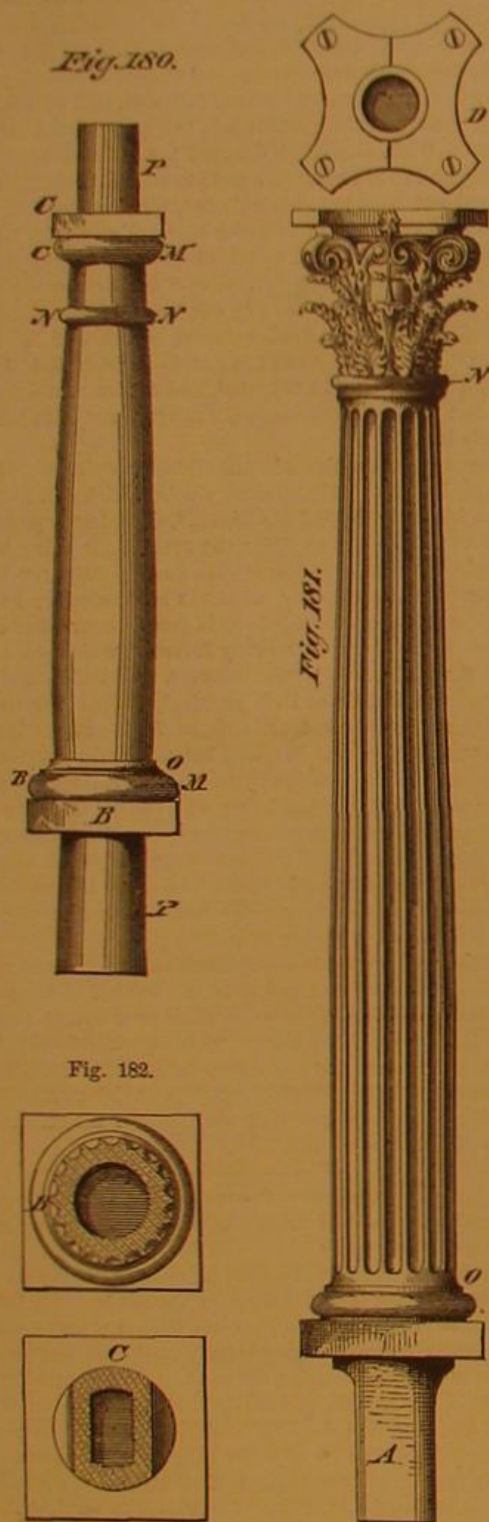


Fig. 182.

the column by screws. P P are the core prints. Little need be said as to the method of preparing a pattern of this description. If small, it will be turned from the solid wood; and if large, it will be lagged or staved up, as we have described on page 101 of our current volume. In any case, the pattern must be made in halves. Some foundries require a half-core box; while in others, the core is struck up in the manner described on page 229, volume XXXV. We may now pass to the consideration of the fluted column shown in Fig. 181. D is a plan of the peculiar cap required for this kind of column; it is neither square nor round, but of a shape which harmonizes beautifully with the carved work below, all of which, including the cap, is added afterwards, the column being cast a plain round above the member marked N, and also below that marked O. The extension, A, is the part which passes between the joists of the flooring; it is often flattened to admit of this, as shown at C, Fig. 182. B is a section of the column through the fluted part. It is not thought necessary to show the prints, as they would be similar to those shown in Fig. 180, the lower one being flattened if the extension, A, were required.

We have now arrived at the most important part of this branch of our subject, and that is, how to make the fluted

pattern column so that it may be extracted with facility from the mould; for, by referring to Fig. 181, it will be seen that the rammed sand, by entering the flutes, would lock the pattern down unless this difficulty were provided for. To overcome this difficulty, we refer the reader to Figs. 183, 184, 185. Fig. 183 is a sectional view of a column, turned extra large at the part intended to be fluted so as to form a plain core print all around the column. A convenient number, divisible by 3 or 4, of flutes must be taken; we have taken 12 flutes in the half column. A suitable core box must be constructed with, say, four flutes; these cores, when packed around the mould, will core out the flutes in the column. This method is only given because there may be special cases where it would be most suitable; but it is not that generally adopted.

In Fig. 184, each half of the column is formed of three pieces, which are held together by taper dovetails; in this case the middle piece is first drawn from the mould and then the side pieces. This method will accommodate any even number of flutes, and is quite practicable; the objection to it, however, is that the dovetails are liable to stick, and also that, when the middle piece is drawn out, the side pieces sometimes fall into the mould, to its irretrievable injury.

Fig. 185 represents the arrangement in most general use; it is not nearly so expensive as that shown in Fig. 183, nor is it open to the objections mentioned in connection with Fig. 184. The three pieces marked S are the main staves of the column pattern, but the number is not arbitrary. We may take four or any other number, depending on the size of the column; it is advisable, however, to have as few pieces as possible. What we have to do is to notice the direction taken by the pieces as they are drawn out, and if it appears that the flutes do not escape properly, then a larger number of divisions must be made. The pieces marked f are the supplementary staves in which the flutes are cut; they are attached to the inner staves by screws, which are removed by the moulder, who is then able to extract the pattern. The side pieces, f f, are then drawn out, and lastly the lower pieces, the process being, it will be noticed, the reverse of that shown in Fig. 183. In each case, the line, A B, is the parting line of the pattern, which must always occur in the middle of a ridge and not in a flute. The flutes should be cut out to a half circle, and eased off slightly towards the ridges with sand paper. They must not be in the least undercut, because of the draft in the mould. The pattern should be made as smooth as possible by alternately sand-papering and varnishing, using well worn sand paper to insure smoothness.

In Fig. 186 are shown what are called bastard flutes. Their use gives a cheap but not beautiful style, and they are sometimes employed on lamp posts and columns in the cheaper class of tenement houses. The flutes, it will be noted, are made shallow and of a shape to permit the whole half pattern to be removed from the sand. The flutes are cut out of the solid, the front ones being the deepest and the side ones so shallow that many of them are scarcely distinguishable.

In columns whose designs are of a mixed character, the methods illustrated for fluting are equally suitable for cableing, as shown in Fig. 185, where the cableing is shown in dotted lines; while rosettes, rope mouldings, and the like, are either attached by wires, as shown in the illustration of square columns, or they must be cast separately and afterwards affixed by screws, as are many other ornaments whose shapes preclude their being moulded solid with the columns.

Diamond Cutting by Girls.

Messrs. H. Cohenno & Co., of New York city and Boston, Mass., write to say that the Dutch Israelites have never refused to instruct American boys, but have consented to do so if paid a proper remuneration, such as they themselves had to incur to learn the business; and further, Mr. Morse's

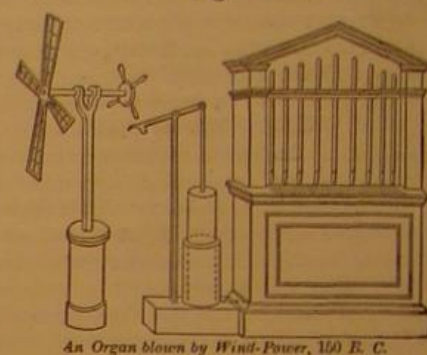
men were not discharged, but left voluntarily. They also say that they are not able to discover where Mr. Morse's girls are at work.

ORGANS, OLD AND NEW.

In the organ the notes are produced by pipes of different lengths, shapes, and materials, supplied with air by bellows and operated by keys which admit or cut off the supply.

The dimension of the instrument is designated by the number of feet of length that its largest pipe measures, forming the lowest note of the key board. Thus we speak of an organ of 32, 16, or 8 feet. An instrument which possesses open flutes of 32, 16, 8, and 4 feet, and a principal an octave above the latter, has a compass of 8 octaves. Large organs sometimes have five key boards, one above another. The first, nearest to the organist, is that of the choir organ. The second, that of the great organ. The third, the swell key board. The fourth, the recitative key board. The fifth, the echo key board. Below these is the pedal key board, played by the feet. The music of the organ is sometimes written on three lines, the two upper ones for the hands and the under one for the pedal key board.

Fig. 1.



In the "Spiritalia" of Hero of Alexandria, who flourished 150 B.C., we find a description of an organ blown by the agency of a windmill which works the piston of the air pump. Its invention is, perhaps, to be credited to Ctesibius of Alexandria, though it is likely that it was the result of the gradual improvement by various parties through the centuries. The reconstruction of it, given in Fig. 1, is taken, with other engravings presented, from Knight's "New Mechanical Dictionary."* The descriptions of it by Athenæus, Vitruvius, and Claudian render it certain that the pipes were musical, and blown by the force of water, instead of expansible air bellows.

Fig. 2.



Fig. 2 shows several old methods adopted for supplying wind to the organ; the arrangement of the keys and the manner of manipulating them are also illustrated.

A is a representation by Father Kircher of a very primitive form of Hebrew organ, the "Macrape d'Aruchin." In this, as in other of the earlier organs, a leathern bag served the purpose of the wind chest.

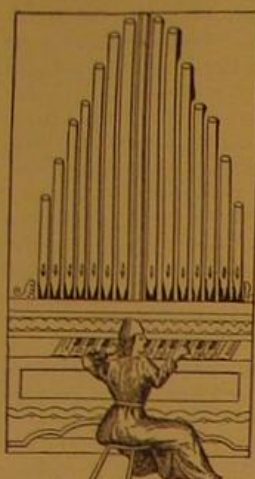
B is copied from the sculptures on an obelisk at Constantinople, erected by Theodosius, who died A.D. 395.

C is a pneumatic organ of the tenth century; it is taken from an ancient psalter in the library of Trinity College, Cambridge.

* Published in numbers by Messrs. Hurd & Houghton, New York city.

D, from Gori's "Thesaurus Diptychorum," is said to have been taken from a manuscript of the time of Charlemagne. It represents King David seated on his throne, his scepter in one hand and a lyre in the other, on which he appears to be playing, accompanied by several instruments, including the organ.

Fig. 3.



Old-Time Organs.

Fig. 4.



Old-Time Organs.

The pipes are of two descriptions: the mouth or flute pipe (technically called flue pipe) and the reed pipe, which are each further divided into several varieties. Mouth pipes, so-called from having a mouth and lips similar to those of the flageolet, are either of wood or metal. The latter are those observable at the front of the organ case, and are cylindrical in cross section. The wooden pipes are rectangular in section, the sides being in the proportion of 5 to 4; the interior is usually sized with glue. The upper end is open, or is closed by a stopper made airtight by a leather covering. The other end is closed by a block to which three of the sides are glued, a narrow aperture being formed between the block and the front side, by beveling this side so as to have its sharp edge on the interior; this is called the upper lip or windcutter. Another block is arranged so as to leave a narrow space between it and the block. The hollow cylinder, through which air from the bellows is supplied, is let into this block. A mahogany cap, hollowed out on the inner side so as to leave the aperture free, is fastened to the front of the pipe below the mouth. The aperture between the cap and the block, called the plate of wind, admits the compressed air from the bellows in a thin stream, which, being forced against the mouthpiece or windcutter, produces a musical note determined in pitch by the length of the column of air set in motion. In order to voice the pipe—that is, improve the tone—the edge of the block opposite the upper lip is slightly pared away and serrated so as to divide the plate of wind and direct it against the inner edge of the lip. The pitch of a note depends on the length of the pipe, while the tone or timbre depends on its diameter, its shape, or on the kind of wood employed; that yielded by pipes of hard woods, as mahogany, being more clear, while the softer woods yield a mellower sound.

The chimney-top pipe has a small open tube in the top plate for the purpose of sharpening a note: a similar effect is sometimes produced by a hole in the stopper. Metallic mouthpipes are made conical at their lower termination, and where this cone and the cylindrical portion unite is an aperture occupied by a thick plate of soft metal, called the languette, nearly closing the tube, but leaving a small opening for the wind plate, formed with the upper lip.

The thickness of the stream of air admitted to the pipe may be diminished by turning down a projecting exterior lip on the plate. The reed pipe is closed near the bottom by

Fig. 3 is from an engraving in the "Theoria Musica" of Franchinus Gaffurius, printed at Milan, 1492.

F, Fig. 4, shows the ancient method of blowing. On each bellows is fixed a wooden shoe; the men who work them hold on to a horizontal bar, and, inserting their feet into a pair of the shoes, alternately raise one and depress the other.

G is what was formerly known as the "positive," in contradistinction to the "portative" organ. The latter, as its name implies, was portable, being carried in processions by one person and played by another; it was also called the "regal" or "rigol."

The former was fixed in position, and, when carried in a procession, it and its stand were placed on a car. An organ of this kind was afterwards placed before the great organ in churches, the two constituting a single instrument, the "positive" being the origin of what has since been designated the choir organ.

The devices required in order to make a pipe sound or speak are: the bellows for supplying condensed air; a channel for conducting it to the pipe; a valve or other contrivance for admitting and cutting it off; and a lever for opening and closing the valve.

a solid plug, having apertures for the passage of the reed and its adjusting wire. The reed is a cylindrical or slightly tapering tube of brass, having a narrow longitudinal slit in front, covered by a thin plate of metal called the tongue, which is made fast to the reed at its upper part, but is free at the lower end. The back part of the reed is cut off slanting at its lower termination, over which a piece of metal is soldered. The pitch of the reed pipe depends on the length of the tongue, which is adjusted by means of the tuning wire above mentioned; the quality of tone depends on the pipe.

A stop consists of a series of pipes agreeing in quality of tone, or timbre, but differing in pitch. When any particular stop is drawn the keys will play on the corresponding set of pipes. The stops are designated by figures or by words intended to be descriptive of the quality of sound, as *flute*, *oboe*, *vox humana*, etc.

Two or more key boards are required to enable the performer to produce all the notes in an organ of more than one stop. In a large organ the different series of stops are so arranged as to form three or four separate instruments, each having its own set of keys, wind trunk, wind chest, sound board, etc. These have been distinguished by different names, as the great organ, the choir organ, and the swell; also the pedal organ or foot keys which act on the larger pipes.

Couplers are also brought into action at will, which connect the keys on different banks so as to make them act together when one is played. The effects are also varied by tremolo and swell, which give respectively quivering and rising and falling force of sound. The feet of the pipes are inserted in the upper or stock boards, above the bearers and supported on racks—thin boards mounted on pillars. The pipes of the larger stops, however, take up so much space that they cannot be placed immediately over their proper groove, but they may be placed in any convenient position, even outside of the case, and air conveyed to them by means of grooves cut in the upper boards and covered with parchment, forming closed channels.

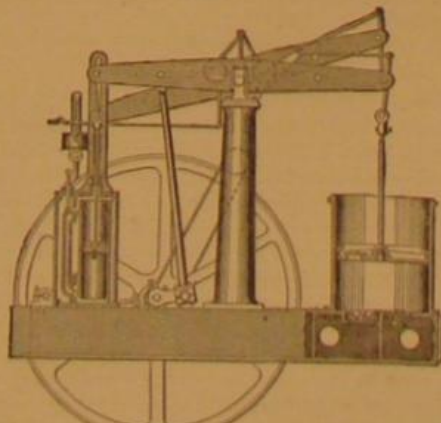
The key movement, in its simplest form, comprises: the key, a pivoted lever, which being pressed down at one end causes the other end to raise the sticker, a small wooden rod depending from the end of a second lever above, which is thus depressed at its opposite end, drawing down the pull wire and opening the valve.

The foregoing description will give an idea of the general principles governing the construction of organs, though there are many mechanical details and improvements introduced into modern construction to which we have not space to refer.

The bellows communicate with the wind chests, which act as reservoirs and distribute the air to the different pipes, as the finger or foot keys are pressed down. The pressure of air is regulated by a weight on the upper part of the reservoir, usually about 15 lbs. to the square foot. The different parts of the organ are now commonly supplied with air under different pressures, separate bellows being used for each pressure.

The wind chest is an airtight box communicating above with the sound board, an oblong frame or box of wood divided by parallel strips into channels or compartments completely separated from each other. Holes corresponding with the number of ranks of pipes are bored through the upper part of the sound board into each channel. Its lower side is covered with parchment or leather, except on that part where the channels communicate with the wind chest and are closed by clack valves opened by means of pull-down wires operated by lever connection with the keys and brought back by a spring. On the upper side of the sound board, at right angles to these channels, a set of grooves, corresponding in number to the number of stops, is formed by screwing down thin pieces of hard wood, termed bearers. These communicate through holes with each of the channels below, and each has a register or slide, a little thinner than

Fig. 5.



Blowing-Engine for the Organ Royal Albert, Hall of Art and Sciences, South Kensington, London.

the bearers, but exactly fitting the groove in length and width. The slides are pierced with holes corresponding in number and size with those of the sound board, so that, by drawing out or pushing in any particular slide, it is caused to open or close the holes in the sound board, and supply or cut off the air from the range of pipes above it.

In organs of the largest class as formerly constructed the operation of the keys was a work requiring, in addition to

musical skill, a large amount of hard bodily labor. It is said that the performer on the great Haarlem organ was obliged to strip preparatory to commencing his work, and retired covered with perspiration at the end of the hour's performance. This is one of the largest instruments in Europe, having 60 stops and 8,000 pipes. One at Seville has 5,300 pipes. The expenditure of wind varying greatly, according to the series of notes produced, the tension of the air supply was very different at different times, causing a variation in the purity of the tone and difficulty in opening the valves when under high pressure. These difficulties were remedied by the pneumatic lever of Barker, in which small subsidiary bellows operated by the movement of the key are employed to depress the wires by which the valves are opened.

Where an extraordinary large supply of air is required, it may be furnished by blowers or bellows operated by hydraulic or steam power. Fig. 5 illustrates the blowing engine employed for the great organ at the Albert Hall, South Kensington, London, England. It is a vertical beam engine having two steam cylinders of 7 inches diameter and 24

Fig. 6.



Lascell's Organ-Blowing Apparatus (Dr. Partridge's Church, Brooklyn, N. Y.).

inches stroke, and two blowing cylinders of 24 inches diameter and 24 inches stroke. Its principal duty is to compress and attenuate air for blowing and for mechanical purposes, such as opening and closing the stops. The valves of the blowing cylinder are of india rubber. The upward stroke exhausts the air from vacuum receivers, to which it is connected by zinc piping, and the down stroke exhausts the pressure receivers to which it is similarly connected. In addition to the ordinary governor, it has two throttle valves connected respectively with the pressure and vacuum receivers: so that when the former is filled with air at 1½ lbs. pressure above, and the latter with air at 1½ lbs. pressure below, that of the atmosphere, both throttles are closed and the engine stops, thus regulating the supply according to the ever-varying requirements of the organ.

A horizontal engine of 13 horse power, driving a crank to which six large bellows are connected, furnishes compressed air to the reservoirs which supply the pipes.

The giant organ is 60 feet wide and 70 feet high; the four center pipes, which are over 40 feet long, weighing nearly a ton each. The instrument was erected by Mr. H. Willis, and, according to the *English Mechanic*, is the finest in the world, having five clavier (four manuals, extending from C C to C in altissimo, and one pedal from C C C to G). The pedal organ consists of 21 stops; the first manual clavier, or choir organ, including the echo organ, comprises 20 stops, all the pipes in which are of metal. The second clavier, or great organ, contains 25 stops, only two of which have wooden pipes in the bass notes. The third clavier, or swell organ, comprises 25 stops, and these are all, with the exception of the basses of two stops, of metal. The fourth clavier, or solo organ, has 20 stops, making in all 111 stops; then there are 14 couplers and 32 combinations. The total number of pipes is close upon 9,000, and these range from 30 inches diameter down to the size of a straw, and from 40 feet in length down to 6 inches.

Fig. 6 illustrates an organ provided with the hydraulic blowing apparatus designed by G. W. Lascell, Brooklyn, N. Y.; a is the cylinder, the piston rod of which b is attached to the crosshead of a reciprocating frame, c, by which the movable diaphragm, d, of the double-acting bellows is operated, alternately forcing the air through the pipes, e, e, into the wind chest, f, from which it is distributed by the trunk, g, to the organ bellows, h. The wheel, i, is connected with a wire that controls the lever, k, of the governing valve of the water supply pipe. As the bellows, h, becomes inflated, the block on its upper lid strikes against the lever, m, closing partially or entirely the valve, and automatically regulating the supply of air to the demand. By means of a hand wheel, n, which can be conveniently reached by the or-

ganist, a valve, *k*, is opened or closed for admitting or cutting off the water supply. In this engine the crank is dispensed with, and the valve gear so arranged as to prevent stoppage on the dead centers.

Communications.

Danger of Galvanized Cooking Utensils, Water Pipes, Etc.

To the Editor of the Scientific American:

I notice in your issue of March 31 an item from the *Deutsche Industrie Zeitung* on the deleterious effects of zinc oxide in toys, etc., and from the remarks preceding judge that you agree with what follows. I have always in the practice of my profession (analytical chemistry) strongly deprecated the use of galvanized articles, water pipes, culinary utensils, tanks, etc.; but am well aware that this is a point on which the doctors disagree. I would like exceedingly to have the matter argued, in your excellent paper, by disinterested parties, for I have somewhat myself to say on the subject.

I know that the water boards of certain cities hold certificates from practical chemists to the effect that galvanized pipe is harmless and the best for general use, and that citizens are advised to employ it. I consider the use of zinc-coated pipes or vessels for culinary purposes both filthy and dangerous to the public health, whether they are used cautiously and intelligently, or rashly, like the farmer who purposed to boil down cider and sour apples in a galvanized tank.

In large houses, where there are great lengths of galvanized piping, much zinc goes into the systems of the inmates, producing more or less ill health and discomfort; I have heard complaints of milky drinking water on the breakfast table, etc., proving that the servants draw water for use directly from the pipes without allowing any to run to waste.

That zinc-lined pipes contaminate water flowing through them for very long periods is plain from the following: The water for my hothouses flows through 190 feet of inch galvanized pipe from the street main; the water is from Wrenham Lake and proverbially pure; the pipe has been in position and daily use for seven years; even now the first water drawn from this pipe in the morning is quite opalescent from hydrated oxide of zinc. I would be loth to drink such water; and believing that what is unfit for animals' use from metallic contamination cannot benefit plants, I have given directions that at least ten gallons shall run to waste before the water is used. Such precautions are rare in dwelling houses, I am sorry to say.

If we can have this matter discussed in your journal, and perhaps settled one way or the other, much good may accrue. I feel convinced that zinc misused is doing great mischief to public health.

DAVID M. BALCH.

Salem, Mass., March, 1877.

[We shall be pleased to receive such information as any of our readers may have to offer on this subject. But we are inclined to think that there is not room for lengthened argument as to whether galvanized pipes are or are not a safe and desirable medium for the conveyance of drinking water. They are unquestionably dangerous; and if further evidence than that above offered by our esteemed correspondent is desired, it can readily be had by consulting the back numbers of the *SCIENTIFIC AMERICAN*. In fact, in our present number, under the head of Answers to Correspondents, in the correction of a reply given to W. D., we republish a few facts bearing upon the matter.—Eds.]

A Woman's Success with Bees.

To the Editor of the Scientific American:

I am a reader of the *SCIENTIFIC AMERICAN*, from which I obtain much valuable information. I am wintering fifty swarms of bees on their summer stands, some of them being nearly buried in snow. They are doing finely. I have of my own a system of management entirely original. My hives are so constructed and arranged that I have the swarming propensities of bees as completely under my control as does the stock raiser an increase of his cattle, sheep, or swine. I have no increase by bees swarming unless I desire it; I turn the whole force of bees to storing honey in the boxes connected with the hive. Ample room is given in the boxes for storing honey, so that the bees will fill thirty boxes as quickly as they would three in an ordinary hive. The boxes are so easy of access that the bees enter and commence work without the least hesitation. When I want an increase of swarms, I do not divide or make artificial swarms. But after a close study of the habits and instincts of bees, I am able to have them swarm out naturally, at any designated date in the swarming season, which I may arrange in early spring. My bees average me a clear profit of over fifty dollars a year for each hive I keep, by sale of surplus honey in glass boxes. I am satisfied that bee-keeping is profitable, even in our cold New England climate, where the honey season is short.

I have the Italian bees, and find them greatly superior to the common bee in many points. They will collect double the amount of honey in the same locality. Their vigor in withstanding our cold climate is a strong point in their favor. They also resolutely protect themselves from the ravages of the bee moth, while the common bee often falls a prey to its ravages. Then their beautiful color and large size render them objects of admiration. Then they seldom sting, or show any signs of anger. I have furnished several of my friends with full swarms of Italian bees in my hive, and they have in each case been highly pleased with them.

My Italians are beauties; nearly the entire body of the bee is a light straw color. If bee keepers would study more closely the habits of bees, the profits would be greatly increased.

West Gorham, Me.

L. E. COTTON.

On Color and Disease.

To the Editor of the Scientific American:

There is something in the color of animals, especially of the feet of animals; but I think your correspondent (page 200, current volume) is mistaken in regard to the pigs eating a poisonous plant, which caused their white hoofs to drop off.

During the war I was in the artillery service, and it was a noted fact that a horse's white foot would get sore when others would not. "Scratches," some called it; and at one time every white foot in a battery of 156 horses was sore, and with few exceptions the rest were all well. They did not graze, but only got the regular rations of oats, corn, and hay, sent from the North and West, and could not have eaten any poisonous plants. We attributed the sore feet to standing in wet and mud, making it impossible to keep the hoofs clean during a Virginia winter with the poor facilities at hand. But how it was that the white feet only were affected we never could explain.

Baltimore, Md.

FRED. W. WILD.

How Safes are Blown Open.

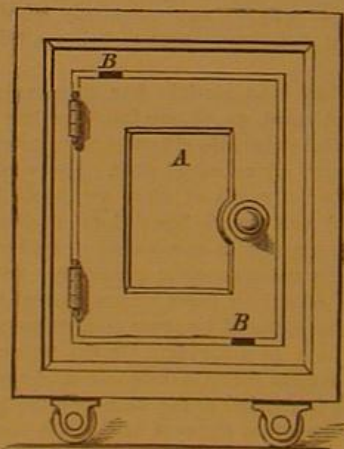
A criminal lately gave to a reporter of the New York *Herald* the following mode of introducing powder within a safe for the purpose of blowing open the doors.

"What tools did you use in drilling the holes?" asked the reporter.

"Good cracksmen don't use tools," answered the burglar. "I'll show you how to blow open any safe in New York without any tools. Just take me to a safe."

There happened to be a safe in Judge Kilbreth's private room, and the writer acquainted the magistrate with the prisoner's proposal. "By all means," said he, "let us learn;" and in a moment the room was filled with spectators.

The prisoner knelt beside the safe, which was locked. "Look," said he, "at this door. Its fits so tightly that no instrument can be introduced in the cracks and powder cannot be inserted. So far so good. The burglar," continued he, "simply sticks putty all along the cracks except in two places, one at the top of the door and one at the bottom, where he leaves about an inch of space uncovered by the putty. At the lower place he puts a quantity of powder and he sucks out the air from the upper place, either by a suction pump, which is the better way, or by his mouth. The vacuum created in the safe draws in the powder through the small crack below. The entire work does not occupy more than five minutes."



The above diagram illustrates the method described. D is the safe door; E E are points left uncovered by the putty. The powder is placed at the lower point, the suction pump at the upper one.

Borax as an Antiseptic.

At a recent meeting of the Pharmaceutical Society, London, Mr. Robottom made some very interesting remarks on the discovery of borax in Southern California, and related a very remarkable and somewhat romantic incident. Traveling on one occasion, weary and unwell, across the bed of what had been at some former period a vast salt lake, and from which some hundreds of tons of native borax are now dug out and obtained, he saw in his pathway the dead body of a horse, and upon it, with but little hesitation, sat himself down to rest. The sun was shining fiercely, and the water he was carrying was hot and unfit to drink. He, however, bathed his temples from the vessel containing it and felt refreshed. Then, with his mind bent on discovery, he commenced a post mortem on the body of the horse. To his astonishment, though the temperature around him was almost too high for endurance, he found that no decomposition had taken place, but that, on the contrary, the flesh, as such, was in a perfectly sound and good condition. On inquiry, he was told that the carcass had been lying on the bed of borax, which was immediately underneath it, during the whole of the previous six months. Thereupon Mr. Robottom arrived at the conclusion, and very naturally so, that the borax had been instrumental in preserving the flesh, and in entirely preventing those putrefactive changes which under ordinary circumstances would inevitably have set in. Now if this were really

the case, says Mr. W. Willmott, in the *Pharmaceutical Journal*, the discovery would be of much value. "For an account of some excellent experiments, showing the effect of borax on substances readily capable of fermentation and putrefaction, I would refer to a paper by J. B. Schnetzler, inserted in the 'Year Book of Pharmacy' for 1875, page 332. Though, in these experiments, beef, veal, and portions of sheep's brain, were wholly immersed in a concentrated solution of borax, the result was not completely successful. There was no putrefaction, but the meat had an odor *sui generis*. In the case, however, of the dead horse, not only had the borax kept intact the part with which it was immediately in contact, but, inferentially, the whole carcass had been brought successfully under its preservative influence. It is difficult to acquiesce in a conclusion such as this. Borax, in fact, possesses no such power. As an antiseptic it is inferior to boracic acid, whilst boracic acid must yield in turn to carbolic and benzoic acids. And yet meat will putrefy in an atmosphere of the latter though entirely cut off from contact with the outer air. How then, in the present instance, is the preservation of the body of the horse under a burning sun to be accounted for? Presuming the statement of Mr. Robottom's informant to be correct, it would seem to point to the probable truth of the germ theory. It is not impossible that in the wild and untrodden regions of Southern California, beyond and around the Sierra Nevada, the atmosphere, from its extreme and almost optical purity, together with its excessive dryness, causing particles of saline matter from the surface deposits to diffuse themselves through it, might be found incapable of propagating germ life. In an atmosphere such as this, decomposition would be slow, and even the experiments of Dr. Bastian might be reduced to *nil*. But, be this as it may, borax can scarcely exercise its antiseptic power except under the condition of actual contact. If it were otherwise, the grand problem of bringing animal food from the distant shores of Australia would be immediately solved. We might well wish for such a result, and it may be ours in time. In the meanwhile, it is instructive to learn the many and various uses to which borax may be advantageously applied, and at the same time deeply interesting to know that, henceforward, it will come to us in comparative purity, and without stint or limit, direct from the newly discovered saline deposits of the Far West."

Opposition to Machinery.

We are informed, says *Capital and Labor*, that in an eminent coach-building establishment, a short time ago, the principals desired to introduce an American machine for making the wheels. These, of course, have to be prepared and fitted together with the utmost accuracy; and the machine in question secured this so that any number of wheels could be turned out strictly to gauge. Some of the men engaged in this department were ready enough to work the machine, by which their own labor was lightened, and higher wages were secured to them. But as the use of the machine was contrary to the trade union rules, the men were ordered to desist. The machinery was therefore put aside. Since that time wheels made by similar mechanism have been imported from America, this being the only way by which the public requirements for light and strong wheels could be met. It is a curious fact that some of the English carriages exhibited at Philadelphia last year were mounted upon American wheels, which had been sent over from the United States to England, painted, and then returned with the body of the carriages for exhibition. We understand that large numbers of wheels are thus imported, which might have been made in England but for the insensate opposition to the use of machinery.

Cotton and its Spindles.

An eminent cotton firm, in an annual report of the cotton trade during 1875-76, gives the following as the number of spindles in Europe and America, and the average annual consumption of cotton:

	No. of spindles.	Cotton per spindle lbs.	Annual estimated consumption lbs.
United States.....	9,600,000	63	600,000,000
Great Britain.....	39,000,000	33½	1,297,000,000
France.....	5,000,000	42	—
Germany.....	4,650,000	55	—
Russia and Poland.....	2,500,000	77	—
Switzerland.....	1,850,000	25	—
Spain.....	1,750,000	46	—
Austria.....	1,580,000	67	—
Belgium.....	800,000	50	—
Italy.....	800,000	56	—
Sweden and Norway.....	800,000	65	—
Holland.....	230,000	60	—
Total spindles.....	68,060,000		2,906,000,000

or upwards of 6,000,000 bales of the average weight of an American bale.

Ring Sickness.

This is not dissimilar from sea sickness; it requires long experience in a ring to overcome the nausea consequent upon going round and round in one direction. One of the most difficult things for a circus rider to overcome is this sickness. Clowns and ringmasters suffer from it greatly, at first, from merely seeing the horses go round and round; but even after years of experience, a ringmaster (whose principal business in the ring is to keep the horses up to a certain gait, and not merely to give cues to the clown), if a horse balks or gets behind time, and he is obliged to keep close upon him, is very likely to suffer from a pronounced fit of sickness at the stomach after he leaves the ring.

The Patent Office.

The new Commissioner of Patents, having been called upon for a report of the condition of his department by the new Secretary of the Interior, makes an elaborate statement in which important information and suggestions in regard to his bureau are given. General Spear informs the Secretary of many things which some of our readers know; but a few extracts from the somewhat lengthy letter will, we think, be read with interest.

"The force," states the Commissioner, referring to his department, "consists of two distinct classes, the examining and the clerical, with the usual auxiliaries of laborers and messengers."

"The examining corps consists of 23 principal examiners, each having a first, second, and third assistant; of an examiner of interferences, and an examiner of trade marks. Each principal examiner has charge of a class relating to some one or more kindred subjects matter. Each one of these principal examiners, with the aid of his assistants, examines all applications in his class as to patentability, and decides all questions relating thereto, both of law and fact. His favorable decision is practically final, and the patent issued upon his order. In case of his adverse decision, appeal may be taken to the Board of Examiners-in-Chief. This board consists of three equal members appointed by the President and confirmed by the Senate. Their legal duty is to hear appeals from the adverse decisions of the principal examiners and from the examiner of interferences, to review the decisions of those examiners, and they may affirm or reverse them. From their adverse decision appeal may be taken to the Commissioner in person, or to the Assistant Commissioner acting as Commissioner."

"The duties of the examining corps are partly scientific and partly judicial. They require general intelligence, mechanical aptitude, scientific training, familiarity with the state of the art for each particular class, a knowledge of the law and the decisions of the courts relating to patent matters, a judicial turn of mind, willingness to hear arguments and receive information, and firmness to decide adversely to eager applicants. The examiner, in the performance of his duties, is required to make laborious researches in order to ascertain the novelty or the lack of novelty of applications submitted to him. In making the search, he acts the part of prosecuting attorney at the same time. When the search is completed, it is his duty to decide questions, nice and perplexing, as to differences between the processes or machines sought to be patented and those already shown in references in his class. I need hardly add that this duty requires of the examiner an amount of patience, fairness, intelligence, and fidelity not often to be found. And, further, that on the one hand he shall be so sustained that he can act honestly and intelligently, without fear and without favor; and on the other hand, that he shall not be so sustained that he can in security act carelessly or unwisely."

According to the Commissioner's statement, some of the few "fossil" examiners have been removed, and others reduced in rank, which evinces his determination to improve the working force of the Office, which we fully commend. He states as follows:

"A few of the older examiners and assistant examiners were, in my judgment, incompetent for the positions they held, and some have been reduced in grade or discharged since I came into office. In respect to others, I propose to submit recommendations. Many of the older and most of the examining corps appointed since 1869 are able and faithful officers. With respect to them I have but few recommendations to make. In the performance of their difficult executive and judicial duties they need only the incentive that faithful official services will be appreciated. The standard of the examining corps may, and undeniably should be, raised. It is possible on the pay allowed by law (although that pay has not been enough to retain some of the best and most experienced men) as it now stands to elevate the standard of the corps in point of ability, but it is a work which needs to be done gradually. Some of the less able officers have acquired long experience, considerable knowledge of the business, and in some respects render better service than inexperienced though able men. But they have long since reached their maximum, and their maximum is small. On the other hand, great care is required in the selection of new men."

The clerical force of the Office, which consists largely of ladies who have usually been appointed on personal solicitation, the Commissioner also proposes to sift out, and he will retain only such as are competent to perform the duties required of them. Referring to this force, says the Commissioner:

"Its efficiencies are not up to the standard required by the public interests, nor that which the salaries paid ought to command. The renovation of this force and the elevation of the character of it require time and patience. By carefully sifting out the incompetent and inattentive, I am confident that the Office may be benefited both by the addition of better elements and by better services from those who are retained."

"In respect to reductions, I am of the opinion that the examining corps should be kept up to the maximum allowed by law. The clerical force, I think, may be reduced, when improved in the manner heretofore indicated, and when the method of carrying on the clerical business is changed as I shall hereinafter suggest."

The most important feature, to the greatest number of persons having dealings with the Patent Office, is the examination of applications and promptitude in decisions; and we hope to see the Commissioner more exacting than most of his predecessors have been, requiring the examiner in charge of each class to keep his work up so closely that not more than a fortnight shall intervene in any case, after the application is completed, before a decision is rendered. The long delay in some instances before a decision is made by the examiner is annoying to the solicitor, discouraging to the inventor, and demoralizing to the examining corps itself; and we hope for a reformation in this respect.

"The method of conducting the receipt of applications, examination of cases, and issue of patents," adds the Commissioner, "appears to have been carefully thought out at a very early period in the history of the Office. It works well, is as simple as is consistent with the proper safeguards and checks, and needs no change."

After some suggestions tending to facilitate the furnishing of copies of patents, assignments, and abstracts, and a recommendation of the competitive system of examination of applicants for positions, the Commissioner closes his communication as follows:

"There is no need of going far outside the business of the Office to find matter for examination in order to test the fitness of applicants for appointment. I have found by an experience of nearly three years that an examination in matters pertaining to official business, or pertaining to matters intimately connected therewith, is all that is required, not only to test the knowledge of an applicant, but the quality of his mind and mental habits."

Professor Gray's Telephone in New York.

The first public exhibition of Professor Gray's musical telephone recently took place at Steinway Hall in this city. This instrument is altogether a different invention from Professor Bell's speaking telephone, which we recently described, as it is adapted only for the transmission of musical sounds. At the concert in which the telephone took part, the operator was located in Philadelphia, over 90 miles from New York, and was in telegraphic communication with Professor Gray on the platform of the hall in this city. Professor Gray made a short introductory speech, in which he said: "We don't exhibit the telephone merely as a musical instrument, but as something wonderful in the science of electricity. It cannot produce as fine music as has been heard here to-night from the other performers, but it can be heard further. It should be explained that this is bad weather for the telephone. It has been raining all day, and the wires are wet, and we shall not get as loud sounds as we might under more favorable circumstances." Mr. Gray proceeded to explain that a good deal of the volume of sound produced in Philadelphia would leak out in its passage through the State of New Jersey, and that those who had bought a ticket of Mr. Strakosch, expecting to be entertained with the music of a full brass band, would be equally disappointed with those who had come expecting to be humbugged. The music was quite audible throughout the room, and sounded like a distant organ, with the difference, however, that the low notes were heard much more distinctly than the upper ones.

The sound of the instrument was rather feeble, but occasionally fine and clear tones were produced. The noise made by the instrument was about as loud as that produced by blowing through a comb covered with tissue paper. It was, however, very distinct and clear, and the tunes it performed were distinguishable. The dampness of the atmosphere decidedly interfered with the clearness of the intonation.

A full description of the Gray telephone, with illustrations, was published in the SCIENTIFIC AMERICAN SUPPLEMENT No. 6; and others showing the scene and the instrument in Steinway Hall, during the recent exhibition, will be published in these columns, in our next issue. The construction of the apparatus is briefly as follows: A tongue of metal is arranged to vibrate automatically between two electromagnets, when the electric current passes. Of course the number of vibrations per second of the tongue is dependent upon its length, and consequently two tongues of different lengths will have a different number of vibrations, which, when translated into sound, will produce different notes. If we have sixteen tongues, then it is evident we may produce all the notes of two octaves. With each tongue, connection is established from a different key on a keyboard, so that, by pressing any key, the current passes and the corresponding tongue vibrates, and in so doing breaks and closes the circuit of the main telegraph wire. Therefore the latter is caused to transmit vibrations perfectly synchronous with those of the tongue; and these pass to an electromagnet at the receiving station, which, instead of an armature, has a steel ribbon stretched on a metallic frame. This ribbon is tuned to vibrate as a particular pitch; and hence if the vibrations which pass over the main wire are in accord with it, it will then and then only be thrown into vibration, and will produce sound. As there are as many receiving instruments as sending ones, it follows that the vibrations of any one tongue may be imagined as searching through all the receiving ribbons until one is found which vibrates correspondingly. In this way any note produced at the sending station is reproduced at the place of reception; and whether one or a dozen or more notes are sounded at once, the vibrations will all disentangle themselves, and each set will affect its correspondingly pitched ribbon. This is a very general description of an exceedingly beautiful invention, the practical value of which lies especially in its adaptation to the purposes of multiple telegraphy.

The Orang-Outang.

"The Zoological Society, London, have again been very fortunate in obtaining two orang-outangs. These interesting beasts are now accommodated with apartments in the keeper's room adjoining the monkey house. They are very funny and about as big as a human baby just beginning to walk. They sit in their box surrounded with flannels, and nestle one against each other like the babes in the wood. Their features are exceedingly human; in fact, I have seen many human faces that are much less human in appearance than these infantine catarrhines, or apes of the old continent. They are covered with hair, long and scanty, and of a deep chestnut red. The ears are very small and well shaped. The orbits of the eyes prominent; the eyes very bright and observant; no eyelashes, but the eyelids are surrounded by a few stiff hairs. The forearms are much longer than the legs; all the hairs of the forearm point towards the elbow, where

they unite with those of the humerus, and end in a point. The fingers are very long; in fact, the hand is more like a foot. The thumb is placed parallel with the fingers, and is not of the same service to the animal as the human thumb. All the fingers have nails of a blackish color and oval form, but I believe some have no nail on the thumb.

"It is very funny to see the orang try to walk upright. When he is put on the floor he manages to progress by placing his bent fists upon the ground and drawing his body between his arms. When moving in this manner, he strongly resembles a cripple walking on crutches. In a state of nature, he probably seldom moves along the ground; his whole configuration showing his fitness for climbing trees and clinging to their branches. The length and pliability of his fingers and toes enable him to grasp with facility and steadiness; and the force of his muscles empowers him to support his body for a great length of time by one hand or foot. He can thus pass from one fixed object to another, at the distance of his reach from each other, and can obviously pass from one branch of a tree to another, through a much greater interval. In sitting on a flat surface, this animal turns his legs under him. In sitting on the branch of a tree, or on a rope, he rests on his heels, his body leaning forward against his thigh. This animal uses his hands like others of the monkey tribe.

"The orangs, as they sit in their box, look exceedingly grave and sedate. They have somewhat the physiognomy of an eastern prince who has no end of riches and nothing particular to do, yet fond of being amused by other people. I expect their intelligence is very great. It is a very old story that monkeys can talk if they like, but won't because they would be made to work. It would indeed be a wonderful thing if we could get one of these orangs to articulate even a single word; and I should much like the opinion of one of the clever professors who teach the deaf and dumb people to articulate words.

"It is a curious fact that the adult animals are never taken, or I believe even seen, while the young ones are comparatively common. The parents are, I believe, immense fellows, growing between five and six feet. In the 'Asiatic Researches,' Dr. Abel gives an account of a large orang having been killed by the officers of the brig Mary Ann Sophia, who had landed to procure water at a place called Ramboon, near Touramar, on the northwest coast of Sumatra. This apparition, 'when moving, had the appearance of a tall man-like figure, covered with shining brown hair, walking erect, with a waddling gait.' They managed to hunt him to a place where there were few trees, and they were obliged to cut down the trees before they could drive him to fight on the ground. It is stated by those who aided in his death that the human-like expression of his countenance, and the piteous manner of placing his hands over his wounds, distressed their feelings, and almost made them question the nature of the act they were committing. When dead, both natives and Europeans contemplated his figure with amazement. His stature at the very smallest computation was six feet. He was said to be a full head taller than any man on board, measuring seven feet in what might be called his ordinary standing posture, and eight feet when suspended for the purpose of being skinned.

"It seems probable that the animal had traveled from some distance to the place where he was found, as his legs were covered with mud up to the knees, and he was considered as great a prodigy by the natives as by the Europeans. They had never before met with an animal like him, although they lived within two days' journey of one of the vast and almost impenetrable forests of Sumatra. They seemed to think that his appearance accounted for many strange noises resembling screams and shouts and various sounds, which they could neither attribute to the roar of the tiger nor the voice of any other beast with which they were familiar."—*Frank Buckland, in Land and Water.*

Lime in Agriculture.

Pure lime, where it is not mingled with clay, sand, and other organic and inorganic substances, consists of the oxide of the metallic element calcium, and, entering into the composition of all plants, must occupy a large place in Nature's laboratory. It has an affinity for water and carbonic acid; when applied to the land it absorbs water, forming hydrate of lime; this hydrate then absorbs carbonic acid, so that lime, although applied to the land in the caustic state, really exists, shortly after its application, in the form of carbonate, along with a little sulphate and phosphate, as previously mentioned. Lime has for a long time been used as a fertilizer; when land previously unworked is brought into cultivation, or when worn-out pasture land is broken up, lime is generally applied. It affects chiefly the vegetable matter contained in the soil, promoting its decomposition, and thus rendering it available as plant food. We, however, find its action important on some of the mineral constituents—decomposing insoluble silicates, the result being soluble.

The Contagion of Typhoid Fever.

The question of the contagion of typhoid fever has been examined by M. Guérin by the experimental method. He injected into a number of rabbits fecal matter from typhoid subjects, and he finds it has a poisonous principle, at leaving the system, capable of causing death. Various other excrementitious products of persons in typhoid fever, such as urine, blood, mesenteric liquids, etc., have likewise this poisonous property, which is retained for several months. It is absent from the fecal matter of healthy subjects.

[Continued from first page.]

jammed his helm hard a-starboard, showing that the boat is going about, and thus abandoning the attack until some time when her huge antagonist shall be less wide-awake.

Fig. 2 shows one of the new French torpedo launches, recently built by Thornycroft in England. She is of steel; and although only 64 feet in length, has attained a speed of 18.85 knots per hour. Her engine is capable of developing

in the electric light, which renders them visible when approaching at night, even at quite a long distance away. Our engravings are selected from the pages of *L'Illustration*.

PRESERVATION OF MILK.

If milk is kept in ice water at 33.8° to 35.6° Fah., it will continue sweet and unaltered, M. Soxhlet states, 14 days. In one experiment it began, after 17 days, to taste a little

Improved Method of Laying Concrete under Water.

BY JOHN C. GOODRIDGE, JR., OF NEW YORK CITY.

In the ordinary method employed in laying concrete under water it has been considered necessary to use broken stone and coarse gravel with cement. This material thus mixed has been thrown directly on the water, which was inclosed to prevent washing away the cement, or has been dumped from boxes prepared for the purpose.

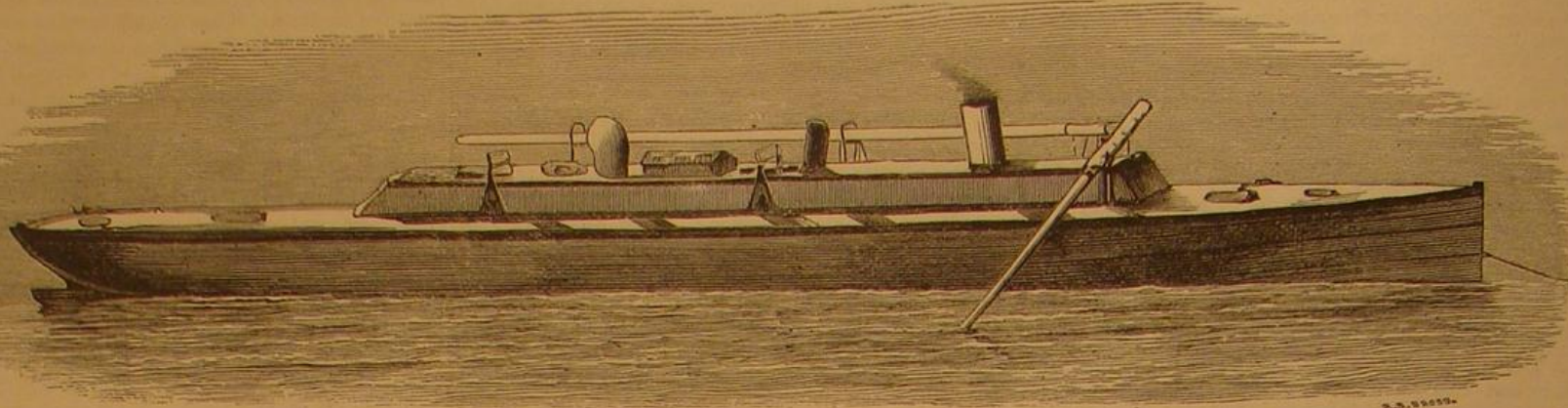


Fig. 2.—THE THORNYCROFT TORPEDO LAUNCH.

200 horse power. The torpedo employed is charged with 66 lbs. of gun cotton, and its effects are shown in Fig. 3, which represents the stern of an old frigate used in Cherbourg for the experiments. The Paris correspondent of the *London Times* writes concerning these experiments as follows: "This was the first occasion of testing in French waters whether a torpedo could be launched against a ship in full sail. Accordingly Admiral Jaurez, who commands the squadron, ordered a disabled ship, the *Bayonnaise*, during a rather rough sea, to be towed out by a steamer belonging to the navy. A second lieutenant, M. Lemoine, was sent for, and informed that he had been selected to make the experiment of launching the Thornycroft against the *Bayonnaise* while both were in full sail. He accepted the mission without hesitation, picked out two engineers and a pilot, and went down with them into the interior of the Thornycroft, of which only a small part was above water, this visible portion being painted of a grayish color, so as to be easily confused with the sea. The torpedo was placed so as to project from the bow of the vessel, at the extremity of which were two lateen sailyards about 10 feet in length. The towing steamer then took up its position in front of the squadron, and the Thornycroft also assumed the position assigned for it, an interval of three or four marine miles separating the torpedo and the *Bayonnaise*.

"On a signal being given, both were set in motion, the steamer advancing in a straight line, and the Thornycroft obliquely, so as to take the *Bayonnaise* in flank. The steam tug went at fourteen knots an hour, going at full speed in order to escape the Thornycroft. The latter went at nineteen knots an hour, a rate not attained by any vessel in the squadron. The chase lasted about an hour, the squadron keeping in the rear so as to witness the operations. At the end of that time the distance between the Thornycroft and the *Bayonnaise* had sensibly diminished, and at a given moment the former, in order to come up with the latter at the requisite distance, had to slacken speed to eight knots an hour. The whole squadron watched this last phase of the struggle with breathless interest, and people asked themselves whether the shock of the torpedo would not infallibly destroy the little vessel that bore it. It was feared that the lives of the second lieutenant, Lemoine, and his three companions were absolutely sacrificed. However, the two vessels got visibly nearer.

"All at once the Thornycroft put on a last spurt, and struck the *Bayonnaise* with its whole force on the starboard bow. The sea was terribly agitated, a deafening report was heard, and the *Bayonnaise*, with a rent as big as a house, sank with wonderful rapidity. As for the Thornycroft, rebounding by the shock about 50 feet, even before the explosion occurred, it went round and round for a few moments, and then quietly resumed the direction of the squadron. No trace remained of the *Bayonnaise*; it was literally swallowed up by the sea."

The best mode of defence against torpedo launches lies

rancid; this taste increased till, after 28 days, the milk became coagulable with boiling, and even coagulated in ice water.

Considerable quantities of volatile fatty acids were formed through oxidation of milk fat in the air. This acid formation is completely different from the lactic acid formation which occurs through decomposition of the milk sugar by an organized ferment at high temperature, but is prevented by the low temperature of the Schwartz process, while the oxidation through cold is not hindered, but takes place, though slowly.

Air Suspended in Water.

Some curious experiments with regard to the suspension of water in air have been brought before the French Academy by M. de Romilly. For example, take a bell jar and cover the mouth with net. Place the mouth horizontally in

I have found, by repeated experiment, that it is impossible to obtain a good result from such a mixture. The varying velocity with which bodies fall through water is owing to their different specific gravities. If stone of a specific gravity of 2.5 is used with a cement of 1.4, the stone is in its descent washed entirely free from the cement, and is deposited on the bottom, while the cement, held in partial suspension, and moved by every new addition of the mixture, is finally deposited above the stone and gravel, after being rendered inert by the washing of the water.

My improvement consists, first, in rendering the water (which is inclosed in water-tight compartments or coffer dams, to prevent any motion or current that may allow the escape of the concrete) strongly alkaline by the addition of a sufficient quantity of air-slaked lime. This renders the water less apt to hold the cement in suspension, and causes a more immediate precipitation of the cement. It also causes the concrete to attach itself the more firmly to adjoining masonry; second, sand, clean, sharp, and of fine grain, is selected, and as near as possible of the same specific gravity as the cement, which is about 1.4, and weighing about 88 lbs. to the cubic foot, and carefully mixed with cement.

A good proportion for general use is three parts of sand to one of cement. The proportion may be varied, depending on the strength required of the concrete. In this proportion it requires 4.25 cubic feet of dry cement and 12.75 cubic feet of dry sand to make 10 cubic feet of concrete, measured after being laid in place. The sand and cement are then mixed with water. Sufficient is added to make it thinner than is used in the plastic bétons, yet not watery or thin enough to run, as used in ordinary concrete. A quantity of this mixture should then be placed on an incline, where it should be allowed to lie for a short time until the cement has formed a slight bond with the sand—five or ten minutes—varying with the quickness of the setting of the cement, and then the whole mass should be allowed to slide slowly down the incline or inclines, the bottom of which should be placed in the water, and the concrete evenly distributed by any suitable means.

A large mass should be collected before depositing, in which case the greater portion of the concrete does not come in contact with the water. Succeeding batches are prepared and deposited in the same way, and the process is continued until the space to be occupied by concrete is entirely filled.

Béton so deposited under water needs no ramming. The grains of sand close together with their irregular interstitial spaces filled with concrete. We have then a homogeneous compact mass, weighing about 144 lbs. to the cubic foot, and a specific gravity of about 2.3, and capable of having a crushing strain of over 6,000 lbs. per square inch, and a tensile strength of over 300 lbs. per square inch.

An iron wash for woodwork can be made by taking fine iron filings 1 part, brickdust 1 part, and ashes 1 part. Put them in glue water, warm, and stir well together. Use two coats.

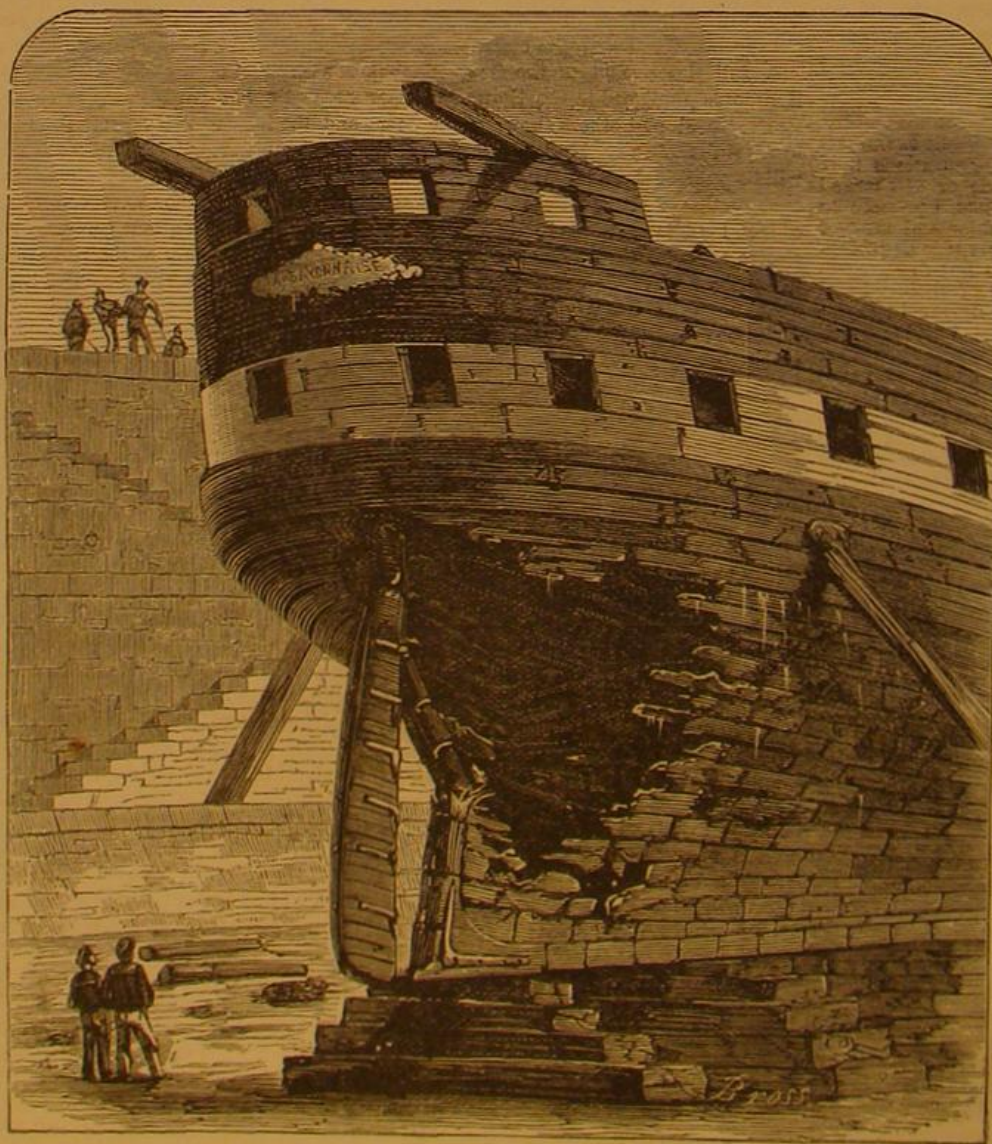


Fig. 3.—EFFECT PRODUCED BY A TORPEDO.

water, and suck up some water into the jar by means of a tube inserted in the upper part, and furnished with a stopcock. If you now close the stopcock and raise the jar, the water will remain in the latter, a meniscus being formed at each mesh of the net, along with a large general meniscus. In a similar arrangement, M. de Romilly succeeds in even boiling this suspended water, by placing a flame under the net (which in this case is metallic). The jar is here made to communicate with another jar placed in a vessel, the suction tube acting through this second jar.

CENTRAL AFRICAN HABITATIONS.

Commander Cameron, R. N., whose famous journey across Africa has proved so rich in valuable additions to our geographical knowledge of a little-known portion of that continent, gives, in the record of his travels, the sketches from which the annexed illustrations are made. Both represent discoveries which will afford an excellent idea of the ethnological importance of a study of the people of Central Africa and their habits.

Fig. 1 represents the curious village of Manyuema, where the explorer found the houses arranged in regular streets, and the latter kept scrupulously neat and clean. The inhabitants, although cannibals, are much more civilized than their neighbors, and appear to be a conquering race which has enslaved the tribes of the vicinity. They are skillful iron workers, and erect furnaces which show considerable inventive ability.

It is well known that, in prehistoric times, whole villages were often constructed on piles, above lakes. Relics of these dwellings have been abundantly found, belonging to extinct peoples representing all stages of civilization, from the age of stone down to the dawn of the iron age. It is not understood why the ancients adopted this form of habitation. Protection from hostile tribes, safety from wild beasts, and convenience in fishing, have all been suggested; but there are reasons which go to show that none of these explanations are entirely satisfactory. Commander Cameron has found the same species of dwellings in use on Lake Moya, in Central Africa, and in Fig. 2 one of the huts is represented. The inhabitants are excellent swimmers, and, although provided with boats, frequently take to the water in preference to using them.

The lake dwellings of which our engraving gives a specimen are to be found in all parts of the world. The oldest known are in Switzerland, and in that country they have been thoroughly explored. They are of two kinds, those built of fascines and those built on piles. Those of fascines were commonly used on the smaller lakes of Switzerland, and wherever the bottom was too soft to hold a mass of piles firmly; those of piles were built in deeper water, where the waves would sweep away a foundation of fascines. Lake dwellings as old as the stone age are found in some parts of Russia, and in Borneo and the Malay archipelago, as well as in Africa. Herodotus mentions them on Lake Prasias, in Thrace; and as these were connected with the shore only by a single narrow bridge, the inhabitants were enabled to defy the troops of Darius. Each family occupied one hut, and caught fish by letting a basket down through a trap door.

In Switzerland, large settlements of lake dwellings have been discovered in Lakes Zurich, Constance, Geneva, Neuchâtel, and others; and from one in the little lake of Moosseedorf, near Berne, a vast quantity of very interesting relics of the stone age have been found, together with weapons and implements made of teeth and horns of animals, and fragments of pottery. A lake village at Robenhause, in the Canton of Zurich, contains numerous dwellings, and it has been estimated that 100,000 piles of oak, beech, and fir were used in its construction; and three different sets of piles indicate as many different periods of construction. Wheat, barley, burnt apples and pears, beech nuts, cherry stones, fragments of cordage, and cloth of flax and bast, and stone relics, were found here in great profusion.

Similar structures have been found also in the lakes of Scotland and Ireland.

Shams.

If there is any special curse under which the world at large, and our own country in particular, is laboring, it is that of sham. Both directly and indirectly, shams effect an injury; and this injury is both material and moral. It is, however, hardly supposable that the latter aspect of the case will nowadays have much attention paid to it; society seems calloused, and, possibly, the only way in which shamming can be made unpopular is to show that it is unprofitable. To show that shamming and shams are also in very bad taste, as well as being dishonest, would be quite easy; but it seems as though the high road to man's reason lies through the pocket. Shams are uneconomical in most instances. The desire to appear better than facts warrant leads, in nearly every case, to a sacrifice of some cardinal merit. Thus the textile fabric of a given material, weight, and strength may be combed up, or filled in, or highly calendered, until it simulates a nobler material, has a greater weight and bulk, and assumes a more costly appearance; but the first operation weakens the fibre; the second renders it brittle; the third

takes the life out of it. The "doctored" fabric neither wears as long, nor looks as well after a short use, as though untampered with. In furniture, the attempt to imitate elaborate carving has led to, and in fact encouraged, weak and unworkmanlike construction. The present style of building offers a premium on slight in hidden work; and we find houses in which our grandparents lived unpretending lives, outlasting those which we ourselves put up.

Professional and "practical" (?) men, devoid of, and in many cases incapable of receiving, the proper training, have intrusted to them our lives and our property; and by their ignorance endanger them both. Instruction is given, or pre-

attend sham churches and pray to be delivered from lying and hypocrisy; as if half the columns and mouldings were not flat and downright lies, and most of the brown stone fronts simply paint and sand or thin veneer. To be sure, the "columns" scale off and look ridiculous, and have to be renewed, and the brown stone fronts get measly if shammed with paint, or if of thin sheets, buckle out and tumble down and kill a passer-by now and then; but then paint can be renewed, and there are plenty more passers-by in the world. A split pin or a key is left out, or insufficiently driven home, and a flaw in a bedplate is filled up and painted over, in a piece of heavy machinery run at a high speed; and some day there is a thud and a crash, and castings are broken, and forgings twisted, and six or eight thousand dollars' worth of damage done; and every one stands round in sham shoes and wonders how it happened. A large percentage of patents granted is for "substitutes," as though there were not sufficient fertility in lying, and enough originality in covering the lies up, without protecting the—the—(well, we might as well say it) the liars.

A prominent Methodist divine once rode from Washington to San Francisco on a free pass granted to his brother, and made out in his brother's name. He afterwards "hoped the Lord would forgive him for telling a lie three thousand miles long." But there is not a city in our land in which there are not lies covering acres of ground and towering up stupendously in their magnificent pretension; sheet iron lies, pretending to be granite; cast iron lies passing themselves off for marble; and plastered brick lies, shamming sandstone; and in them merchants are selling cotton velvets, and baryta paints, and fusel oil whiskey, and leaded "tinware," and soap loaded with water, and all kinds of abominable shams; and we (bless our dear unsuspecting, unmindful souls!) enjoy it all immensely, and keep on stealing from our right hand pockets to put into the left, and then boast of our superior acuteness and progress. And the devil, or whoever else it is that gets a share of what we waste and a dividend on all that we cheat ourselves out of, looks on and laughs, and pockets the income brought him by sham. And, doubtless, as long as we can stand it, he can. But how long can we stand it?—*Polytechnic Review*.

April Management of Bees.

Mrs. E. S. Tupper tells the readers of the *Bee Keeper's Magazine* how to treat bees during this month (April), to produce the best future results. She says:

In all places near timber, bees find natural pollen now, in average seasons; and if the colony has a prolific queen and they have honey or are fed, the brood should be abundant and young bees appear fast. This state of things should be encouraged, and then you are sure of good working colonies. Where bees are thus doing well, empty combs may be added from time to time, as fast as hatching bees are plenty enough to cover the brood. We have in early seasons and in strong colonies had comb built to some extent in April. Two years ago we gave comb foundations to several colonies in April, feeding them quite liberally with diluted honey, and we had ten full combs completed in the hives in eight days. We found always a great gain in using the comb foundations.

Usually no comb is built until much warmer weather than we have in April, and we attribute our success then to the heat generated by a very large number of bees in hives very tight. We would always take care to have the quilts, blankets, or mats snugly tucked in and the entrances quite small, so that all the heat possible may be maintained.

If there are wild cherry trees near your bees, they should not be allowed to store honey in boxes or frames while the bloom of these trees continued. We have seen honey that was unsalable from wild cherry flower.

If it is intended to multiply colonies this year, by the last of April it is well to begin raising surplus queens to be ready for the season when dividing is in order. Our way to do this is to take combs from the best and most prolific queen we have, with brood in all stages in the cells, and plenty of young adhering bees with them. Two of these combs will do, but three or four are better. Put these in an empty hive (a small one if you have it), and take it to a dark cellar or bee house for a few days, taking care of course to supply it with syrup or diluted honey. You can set it where you please when taking it from the cellar, for the bees will mark their location. They will start a number of cells, and these may be used for forming new colonies, or the cells may be preserved in nucleus hives until fertilized and the queens be used. Young queens are of great value in dividing; and you should begin in season to rear them.



Fig. 1.—THE VILLAGE OF MANYUEMA.

tended to be given, and yet where (by some rare chance) solid and practical studies are undertaken, they are slurred over so that when the time comes when we need them, the facts or rules which should be "at hand" are forgotten, if indeed they were ever learned. Vessels are built of poor iron, and commanded by poor officers; they go down, or run ashore and break in the middle, and the account of "profit and loss" has an entry, running more or less into the hundreds of thousands, on the debit side.

Patent attorneys, of more or less enterprise and "cheek," procure patent papers with big red seals thereon, and fob their clients' (or victims') money; and when the time comes

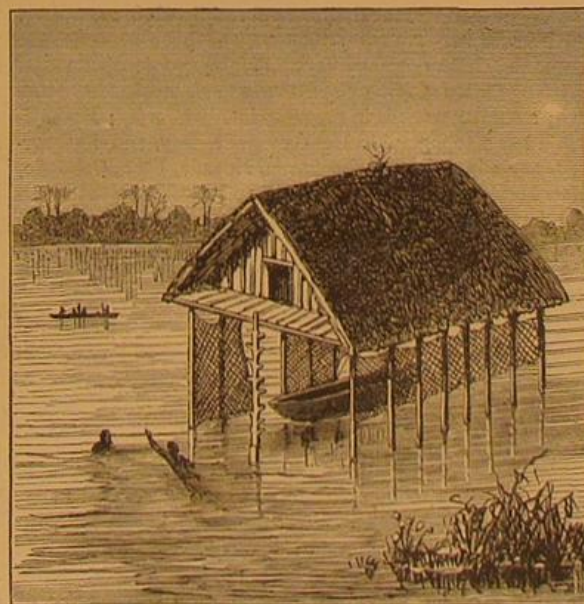


Fig. 2.—AFRICAN LAKE DWELLING.

to test them, any one can drive a triumphal chariot of infringement through the claims and never ruffle a plume.

Bridges with any amount of ornamental work and stylish paint (in showy places) are thrown across streams or chasms, and over them heavy trains are thundered, until some cold still night a chord snaps and travelers' wives are widowed by the score, and everybody shudders—and goes on shamming and being imposed on just the same as ever.

A theater has a gaudy domed ceiling which shows deep and heavy panelling, frescoed in the highest style of the art—a flash and a blaze and a quick licking of flames, and the whole disgusting sham curls up and drops upon a panic-stricken audience, and the entire tinder-box of a man-trap crackles and falls, and in it are the sickening corpses of a happy unsuspecting throng; all the world is horror-struck, and inspection is rife, and committees rampant for a term of days; and now we all go into sham theaters the same as ever;

Plants and Insects.

Sir J. Lubbock, M.P., recently delivered a lecture at the Society of Arts, London, on "Certain Relations between Plants and Insects." The lecturer said that he would endeavor to bring before them in a condensed form what was known in regard to the importance of the functions which insects performed for plants, and the attractions which plants provided for the insects. Neither plants nor insects would be what they were but for the influence of the other; indeed, some plants were altogether dependant on the visits of insects. He thought that there was no doubt that, as Sprengel originally suggested, the true use of honey to flowers was to attract bees and other insects. Ants, however, were also very useful to plants in destroying caterpillars and other injurious insects which fed upon them. M. Foret watched from that point of view a large nest of *formica giratensis*, and he found that the ants brought in dead insects—small caterpillars, grasshoppers, etc.—at the rate of 28 per minute, or 16,000 per hour: which, when it was considered that the ants worked all day, and sometimes during summer weather all night, it would be easy to see what important functions they fulfilled in keeping down the number of small insects. Some of the most mischievous of the class of small insects—certain specimens, for instance, of aphids and coccids—had turned the tables on the plants, and converted the ants from enemies to friends, by themselves developing nectaries and secreting honey, which the ants loved. They had all seen the little brown ants running up the stems of plants to milk their curious little cattle, and by the adoption of that ingenious idea not only did the aphides and coccids secure immunity from the attacks of the ants, but even turned them into friends. They were subject to the attacks of a species of ichneumon, and M. Delphine had noticed the ants watching over them with a truly maternal vigilance and driving off the ichneumons whenever they attempted to approach. Certain plants would produce no seeds at all unless they were visited by insects.

In some of our colonies the very useful common red clover will produce no seeds on account of the absence of humble bees. The same remark applied to the non-production of seeds from the scarlet runner in Nicaragua. Even in cases where it was not absolutely necessary, it was better that the plant should be fertilized by the pollen from another flower. Ants if they left one plant generally crept to another of the same kind; but cross-fertilization was wanted for flowers, and hence they required insects which readily flew from one flower to another. Even in the case of many small plants, such as crucifera, composita, saxifragæ, which might well be fertilized by ants, the visits of flying insects were much more advantageous. Moreover, if the plants were visited by ants, not only would they deprive them of their honey, but they would destroy the bees. If an ant was touched with a bristle it would turn round and bite it with its horned jaws; if, then, the delicate proboscis of a bee was bitten by an ant in the same way, its power of procuring honey would be quickly destroyed altogether.

The lecturer gave instances of plants and flowers which were naturally protected from ants by their natural formation, in some cases the stems being covered with bristles, in others being "sticky," thus preventing the ants from creeping up them. That was the case with plants which bore horizontal or upright flowers. In other cases the ants could readily reach the outer leaves of flowers which were pendulous, but could not get at the honey, or if they attempted would generally fall to the ground. Among the former class of plants were the *lamium* and the *earlina vulgaris*; among the latter the snowdrop, the cyclamen, etc.

The lecturer next called attention to several varieties of "sleeping flowers," some of which slept during the day, others during the night, opening and closing at different periods of the day or night, and said that he thought that the explanation was due to the fact that bees and wasps were flying about very early in the morning, while the ants did not come out till the dew was off the grass, and therefore could not get at flowers which were by that time closed.

Passing to the second portion of his lecture, Sir John said that the larvae of insects taught many instructive lessons. It would, in fact, be a great mistake to regard them merely as preparatory stages in the development of the perfect insect. They were much more than that, for external circumstances acted on the larva as well as on the perfect insect, and both therefore were liable to adaptation. The modification which insect larvae undergo might be divided into two kinds, namely, "developmental," or those which tended to approximation to the mature form; and "adaptational" or "adaptation," namely, those which tended to suit it to its own mode of life. Some of the larvae were very dissimilar in their perfect form, others were not much altered in their ultimate shapes. Among the former class were the larvae of moths, sunflies, and beetles. Among the latter class were the centipede, the weevil, the stitars, the anthran, etc. The classification of insects founded on larvae would be quite different from that founded on the perfect insects. It would puzzle a very good naturalist to determine the species of ant larva; while the larva of butterflies and moths was as easy to distinguish as the difference in the perfect insect was palpable. The lecturer proceeded to explain the different species of caterpillars: that their outer coatings, varying from dark brown to light green, and spotted and striped specimens with shades of various hues, had in each instance been provided with such colors for the purpose generally of being almost indistinguishable on the flowers and plants which they affected. In one or two cases, indeed, the reverse was the case, inas-

much as a striking contrast was created; but in those instances the insects were unfitted for the food of birds, who could thus easily distinguish and avoid them. Much, however, yet remained to be discovered; but, in conclusion, he might say that in the insect kingdom there was not a hue, or spot, or color which did not serve some purpose or perform some function, or which was not of some use in the economy of Nature."

Surveying the State of New York.

The report of the Board of Commissioners of the State Survey, for the year 1876, has just been issued. In it the necessity for a thorough survey of the whole State is pointed out as a measure of economical value to the people. The report says:

"The officers of the survey found, in intercourse with the people in those sections which were visited, that there were evils growing out of the prevailing ignorance with regard to the topography of our State, which exceeded anything before suspected. We learned that large numbers of our citizens, a great proportion of whom were women; and persons dependent upon small estates had been induced to invest their property in railroad stocks or bonds which had proved to be of little or no value, and that these investments were made upon solicitations and statements which would not have been listened to if the maps and surveys of New York had given any idea of the character of its surface. If these maps had shown our people the relative heights and positions of our hills and valleys, and the natural channels of commerce, they could not have been induced to invest their money in projects so placed that failure was inevitable. Had there been but a fair knowledge of the hills and valleys of our State, these disasters never could have happened. Our citizens would have been protected against reckless or fraudulent enterprises, as the people of England or of Switzerland are protected, by maps and surveys which show at a glance the character of the country, and to which it is their practice to refer whenever they are solicited to invest in this class of public improvements. We have already discovered several instances where roads have been carried over hills at a ruinous cost, not only of construction but of operation, where valleys might have been followed at comparatively small expense, and which would have furnished a larger and more profitable traffic.

"As illustrating the grossness of these errors, we find that on our best map Buffalo is placed about three miles from its true position, Elmira about three miles, Ogdensburg half a mile, Syracuse a mile and a half, Plattsburgh three miles, and similar misplacements wherever tests have been applied. Lake Champlain is laid down from a survey made before the Revolution. Recent measurements show that, with respect to distances of twenty miles on the lake, the maps are in error as much as three miles. The maps of New York we find to be worse than those of any other civilized country of equal wealth. Even Japan has a rough triangulation of her territory a hundred years ago, and has now a more accurate work of similar character in progress under American officers. Every European government has executed a careful survey of its territory based upon triangulation, not because they are richer than we, for Switzerland and Sweden are poorer, but because they are wiser than we, and have observed the waste that follows bad surveys and false and deficient maps. A triangulation of Massachusetts was made nearly forty years ago; a similar work is in progress in New Jersey; Pennsylvania has a topographical survey under way, and like surveys are advancing in California, Nevada, Utah, Colorado, New Mexico, and Wyoming. When New York attains distinction as the worst mapped wealthy State in the world, it is time to consider whether this marked deficiency has not already produced serious evils, which are generally felt, even though their cause is not understood.

"For these evils we propose the same remedy that other governments have tried with perfect success—a trigonometrical survey. By this means points about ten to fifteen miles apart should be exactly determined in position throughout the State, the work being verified by reference to the surveys of the general government. This system of points, perhaps twelve miles apart, will form the principal triangulation of the State survey, and every effort will be made to have both the courses and distances between stations known with utmost precision, and to have them marked with monuments which will remain for many generations. This is usually done by burying below the frost line an earthen jar of peculiar form and marking, with its center at the point to be preserved, while directly above it is placed a stone squared and marked with the number of the station, and projecting enough above the surface of the ground to be readily found. These principal stations would be placed upon prominent hills overlooking the neighboring country. Where principal stations are too far apart for convenient use in local surveys, secondary and tertiary stations must be fixed by trigonometrical measurements from the principal stations. These secondary and tertiary points would also be preserved by underground marks and surface monuments of cut stone. Their distances apart would be determined by the character of the local surveys to be based upon them, being nearest together where land is most valuable. Those familiar with the subject well know that such points and lines can never be lost. They form an enduring base upon which each county or town can found special surveys of any degree of precision. All property lines or public boundaries measured and referred to the State survey points will be permanently fixed. The use of the magnetic needle will no longer be

necessary, since the course of every line will be astronomically determined, and the accuracy of surveys can be tested by connecting with two or more of the State monuments.

"An annual appropriation of \$20,000 for ten years will, we think, complete a State trigonometrical survey in such a manner as to furnish accurate bases for local surveys throughout the State in every town where they are needed, and secure the corners of the counties. This estimate is based on careful examinations during the summer, and has been compared with the cost of surveys elsewhere."

Paralysis in the Peas.

The London *Punch*, alluding facetiously to the popular scare on poisonous canned peas, adds a few lines of chemical fact worth remembering. Beware, says the writer, how you try the effect of strychnine, prussic acid, or any other poison, on a rabbit or a guinea pig. Have the fear of the Anti-Vivisection Act before your eyes. If you want to try experiments with poisons on a living animal, try them on yourself. Should you kill yourself, unintentionally, the law will acquit you of suicide, as it does not forbid any donkey to experiment on a donkey. Suppose, for instance, you want to know what is the effect of repeated small doses of copper upon the human system, take a fraction of a grain of the sulphate or acetate of that metal once a day continually till you discover. Ultimately you will find it produce paralysis. You will lose the use of your hands or legs, or one side, or more, of your body. Salts of copper will paralyze you sooner than even salts of mercury. But you must take them in minute quantities. In large doses they mostly rid you of themselves—copper acting like antimony. In order to take your copper pleasantly, your best plan will be to swallow it at dinner time, daily, along with green peas. This you can do all the year round, as peas are always to be had preserved in tins. You can mix your copper with your peas if necessary. If the peas are of a dull, grayish, faded, ugly color, there is probably no copper in them, and you may have to put some. But when their tint is a beautiful bright green, then you may suspect that there is plenty of copper in them to cause paralysis if persevered with sufficiently long. The copper is mingled with the peas to make them look pretty; and few people seem to be deterred by the fear of poison from preferring pretty-looking peas to plain ones. It is possible, however, that it may become rather less easy than it has been heretofore to procure tinned peas, which besides being tinned are also coppered. Several foreign provision dealers have lately been summoned before Mr. Knox, and, on medical evidence, fined for selling tinned peas containing copper in dangerous quantities. As they sold them in ignorance, they have been let off with nominal fines, but in future vendors of coppered peas may expect to incur a penalty of \$250 for each offence—and have to pay. Of course the multitude ignorantly eating peas greened with copper must be, all of them, greener than any peas. Bright green tinned peas may always be suspected of containing copper. If there is any question on that point, it may be summarily settled by pouring on the peas a little strong liquid ammonia, which, if copper is present, will make them turn bluer than even their seller will look when he is fined \$250. So also with pickles, only the vinegar of the pickles will require a large excess of ammonia. In case there is no ammonia or other means at hand of determining whether the greenness of peas or pickles is owing to copper or no, a philosopher would give copper the credit of the color, and himself the benefit of the doubt.

A New Photo-Sculpture Process.

In the United States Army Department at the Centennial, there was exhibited a handsome model of the Rock Island Arsenal. It is to be regretted that this work of art did not bear some description as to the manner in which it was produced—an explanation of which we find for the first time in the recently issued report of the Chief of Ordnance of the United States army. From the various buildings, it appears, positive photographs were obtained, representing all their different sides. Each view was then exposed over a thick film of sensitized gelatin covering a glass plate, and afterwards the soluble, opaque portions of the gelatin were washed out. The film was then swelled by a peculiar process, so as to magnify its differences of level, until a suitable relief was obtained; and a plaster cast being taken of the film, it gave a permanent mould from which many repetitions could be made. A successive series of these plaster views, taken from the different sides of a house, were mitered together at their edges; and when roofed in, they formed a perfect reproduction of the house itself, every stone and crevice being represented. In one building, the slats of a lattice work around the piazza were plainly exhibited, in lines not over 0.006 inch in width. The model was made by Baron F. Von Egloffstein, of this city.

Evaporation of Nitroglycerin in Dynamite.

According to recent investigations of Captain Hero, of Vienna, it appears that a specimen of dynamite made in 1871 lost in five years 2.2 per cent of its nitroglycerin, and another sample manufactured in 1872 lost in four years 1.52 per cent, through evaporation. The conclusions are that regular times should be fixed as limits for the employment of dynamite supplies, and that, when the material is kept beyond these periods, it should be replaced by fresh. It is also suggested that, to allow for this loss, a larger proportion of nitroglycerin than the percentage now employed (ranging from 71 to 73) should be introduced in dynamite.

The Niagara Railway Suspension Bridge.

MERRIS, W. Milnor Roberts, Chief Engineer N. P. R. R., T. E. Sickels, Chief Engineer U. P. R. R., and W. H. Paine, Assistant Engineer New York and Brooklyn Bridge, who were lately employed to examine the Niagara Railway Suspension Bridge, and to report upon its state and stability, have concluded their labors. They report that they first examined carefully those portions of the bridge supposed to be defective, and found, at the anchorages where the strands are separated and pass to and around the shoes, some of the outer wires somewhat corroded with rust: particularly at the first anchorage opened, where eight or ten wires were corroded quite through.

All of the badly rusted portions of the several wires have been removed until perfectly sound wires were found underneath. The portions removed have now been replaced by splicing a new piece to each individual wire under the strain due to the weight of the bridge.

The state of the strands now at this anchorage, and the general condition of the strands at the other anchorages, lead them to the opinion that there is at none of them a diminution of strength from corrosion of half of one per cent, which is as little as might be expected in any iron bridge structure standing the length of time this has stood; and it is to be noted that the oxidation of the wires has not taken place in the main cables between the towers, but at the extreme shore ends near the shoes where the strain is less than it is elsewhere.

Careful tests have proved conclusively that the wire has lost none of its original strength from the strains to which it has been subjected, and there is no reason to believe that the bridge is now less capable of carrying the usual trains or the test load which was at first imposed upon it.

During the examinations they carefully noted that the action of the bridge under passing loads is normal; and as the heaviest locomotives and trains of eight or more loaded freight cars during this period were constantly using the bridge, they had excellent opportunities of observing their effect.

A further report, accompanied with drawings, is to be submitted at an early day, in which will be stated in detail the examinations that have been made and the results of numerous tests of the strength of wire from the cables.

Effect of Sunlight on Flour.

It is maintained, says *The Millstone*, that the inferior quality of certain kinds of wheat and rye flour is frequently due to the action of sunlight on the flour; even when in bags or barrels the gluten experiences a change similar to that occasioned by heating in the mill. The tendency thus imparted to it, to become lumpy, and to form dough without toughness, is similar to that of most grain, or of flour when it is too fresh, or made from grain ground too early, or when adulterated with cheaper barley meal. Such flour can be improved by keeping some weeks.

Recent American and Foreign Patents.**NEW MISCELLANEOUS INVENTIONS.****IMPROVED HAME FASTENER.**

Tunis H. Poland, Farmersville, Collin County, Tex.—This hame fastener comprises a pair of plates and a set of graduated links. Upon one end of the strap is formed an eye or hook to receive the hame loop. Upon the other end is a hook, to be hooked into one or another of the links. This fastening can be readily fastened and unfastened without taking off the gloves, and with cold and benumbed fingers, and when fastened will hold the hames securely. This invention is for sale. For terms, etc., address the inventor as above.

IMPROVED BRUSH.

Lewis Uitz, Nora Springs, Iowa.—This consists of a brush head, with a recessed bottom and side lugs, in connection with a broom whisk fastening wire, that is wound around the head and the whisk ends, and retained by lugs and suitable end fastening.

IMPROVED SLATE.

George S. Veloz, New York City.—The object of this invention is to provide an improved device for facilitating and expediting the multiplication of larger and smaller numbers by the assistance of mechanical means. It consists of a slate with a sliding slate rule, guided in a slot or recess of the slate, and worked in connection with the graduated or subdivided edges or the adjoining slate sections.

IMPROVED BAG FASTENER.

Constantin Lazarevitch, Brooklyn, N. Y.—This invention consists in a rectangular frame of metal sewed to the mouth of the bag at one side. It is shorter than the width of the bag, and is provided with buckle-shaped catches at its lower side near each end, which are each provided with a number of bars. A bar of metal having formed upon it two hooks capable of engaging with the bars of the buckle-shaped catches is sewed on the side opposite the rectangular frame. The parts are so arranged that the loose sides of the mouth of the bag may be folded in upon its contents, and the rectangular frame closed over the loose sides of the mouth. The bar having the hooks is closed over all in such a manner as to draw the side against the rectangular frame, and is then hooked to the buckle-shaped catches.

IMPROVED BALE HOOK.

Henry Hanschmidt, New York City.—The object is to provide for the handling of bales an improved hook that is rigidly connected to the handle without working loose therein, or injuring the hand of the workman using it. A cross pin is passed through a longitudinal hole of the handle, and an eye of the shank end of the hook. The shank end may be threaded and screwed into a screw socket of the handle, the key being also threaded at the end and screwed into the wood of the handle at the side opposite to the longitudinal entrance hole of the key.

IMPROVED COMBINED COLLAR AND HAME.

Ezra Stroud, Riceford, Minn.—This relates to an improved collar and hame combined, which may be fitted in flexible and easy manner to any size of neck of a horse, and which admits the adjustment of the draft on the hame, and the convenient opening and closing of the collar and hame for putting the same on or off the neck.

IMPROVED HEATER.

José Guardola, Chocoma, Guatemala.—This consists of a heating furnace of new and improved construction, for heating air for drying purposes, and for heating buildings, etc., having an inner and outer cylindrical shell enclosing an annular air space, and a central air pipe and radial pipes, that connects the same with the annular air space, and a firegrate and fireplace. The device also consists of a cold air pipe leading from the blower pipe to the hot air pipe beyond the heater, for the purpose of introducing cold air in the place of hot air into the drying apartment when desired. This invention was described and illustrated on p. 82, vol. 36.

IMPROVED HARNESS TRIMMING.

Isaac N. Just, Belding, Mich.—This consists in the combination of the swinging wedge block, having its bottom concaved, and provided with a flange along its rear edge, and an extension having the inner side of its bottom bar concaved or flat with the terret. In using the device the free end of the tie-strap is passed through the cavity of the extension and is drawn back for a suitable distance. It is then drawn forward and draws the wedge block into the cavity of the extensor, and clamps the said tie-strap securely between the lower edge of the said block and the bottom bar of the extension.

IMPROVED GLAZIER'S DIAMOND HOLDER.

Jacques E. Karselen, New York City.—The object is to simplify the construction of glaziers' diamond holders in common use in such a manner that they can be made cheaper, and also so as to take up less room in the pocket. The invention consists of the breaker being secured to the handle directly and in line with the axis of the handle and of the swiveled diamond holder. The present ferrule construction is thus dispensed with.

IMPROVED TRACE BUCKLE.

Lyman D. Hubbard, Hume, N. Y., assignor to himself and Henry C. Brown, of same place.—This trace buckle is provided with a swinging tongue section provided with wedge-shaped slides, that slides in horizontal slots of the buckle frame. It is readily opened to detach the trace by pulling the same forward and swinging the lateral tongue section into open position.

IMPROVED COMBINED DRYER AND SMOKE HOUSE.

Ransom Sabin, Shelby, Mich.—This is a building made of sheet metal and angle iron, having a fireplace, and a fine running around its interior and out at the roof. It also consists in a circle provided with hooks, upon which to hang meat and other articles, and in the arrangement of swinging shelves for supporting fruit and vegetables.

IMPROVED OILER.

William H. Harrison, Livermore, Cal.—This oiler is so constructed as to catch and hold any oil that may run down the stem, while at the same time it keeps the outside of the can free from oil, and the caught oil free from dust.

NEW MECHANICAL AND ENGINEERING INVENTIONS.**IMPROVED ORE SEPARATOR.**

William M. Courtis, Wyandotte, Mich.—The tailings are received from the tail-race by a chute, and are projected between blocks and upon the grating with sufficient force to carry the larger particles over the end of the grating into a vertical chute. By the action of currents of water the heavier of the particles that pass through the grating fall toward the pipe leading to the settling tank, while the lighter of such particles are carried upward and discharged with the tailings.

IMPROVED RAILROAD SWITCH.

William H. Cooke, Wilton, Conn.—This switch is operated by the passing locomotive. A notched bar is connected with the movable switch rails, and a locking lever engages with notches of said bar. By means of a T lever, the locking lever is disengaged, and the notched bar and rails are moved. Levers, which are moved by the locomotive, are placed each side of and remote from the notched bar, and connected with the T lever by means of rods.

IMPROVED BOAT-DETACHING APPARATUS.

William McK. Bell, Collingwood, Ontario, Canada.—This invention consists of a detaching device applied to the boat, and made of a supporting frame with a pivoted tumbling bar and swinging tongue, locking by its toothed or serrated end to a correspondingly toothed projection or catch of the supporting plate, until the pressure on the tongue is released, and thereby the same detached.

IMPROVED TURNSTILE.

Alfred F. Swan, Hoboken, N. J.—This consists of parallel guide rails, with central pivoted side standards, having rigid horizontal arms, of which one set extends parallel to the other at an oblique angle to the longitudinal axis of the stile. The side standards and arms are revolved and locked by hinged and spring-acted platforms, which are jointly worked by the weight of the person passing through the turnstile. One platform operates the standards by ring-shaped sleeves, with pins entering spiral recesses of the same. The second platform locks the standards by recesses binding on stop pins, jointly with the first platform or singly, to prevent the return of the person.

IMPROVED MILLSTONE CURB.

William L. Taggart, Niles, Mich., assignor to himself and William R. Taggart, of same place.—This invention consists in a double walled curb for stones of flouring-mills, the inner wall being provided with openings and deflectors, which receive the air from the interior of the curb, and deliver it to the space between the double walls. Apertures are provided in the top of the curb for the admission of air between the walls of the curb. A tube that connects the space between the walls with an exhaust fan, the object being to provide efficient means for ventilating burr stones, so that the capacity of the stones may be increased and the quality of flour improved.

IMPROVED WATER WHEEL.

Andrew Jamison, Taylorstown, Pa.—This invention consists in a water wheel provided with semi-cylindrical or wedge-shaped buckets, placed in a channel in the middle parts of said wheel. Holes lead from the ring channel in said wheel at the ends of the buckets, out through the ends of the wheel. By this construction the water, as it enters the wheel, impinges upon the buckets, and by its force gives motion to the wheel. At the same time the rapid motion of the wheel keeps the buckets and holes in the lower part of the wheel full of water, so that the wheel will be driven by both the force and the weight of the water.

IMPROVED POST AND PILE DRIVER.

William A. Newton, Pappinville, Mo.—This machine is mounted on wheels so as to be moved from place to place as desired. Its standards may be adjusted into a vertical position when the surface of the ground into which the posts are to be driven is inclined. The standards also serve as ways for the hammer, which may be made in parts securely bolted together, so that its weight may be increased or diminished as required.

IMPROVED CAR COUPLING.

John B. P. Mohan, Dryden, Minn., assignor of one third his right to Thomas D. M. Mohan, of same place.—The mode of operation is as follows: The link passes into the drawhead under and against the rear of a lever, lifting the latter against the spring until its recess receives a spring bolt, which then holds the lever in a horizontal position against the tension of a spring. As soon as the shaft or key is turned sufficiently to force back the bolt, the spring forces down the rear and up the front end of the lever, thus uncoupling the cars.

IMPROVED CAR AXLE BOX.

Joseph A. Picard, North Platte, Neb.—This consists in the arrangement, on the upper side of a journal box, of a reservoir for containing oil, provided with split tubes, having screw caps for controlling the flow of oil. The said tubes communicate with a series of holes in the back of the "brass" or bearing surface of the box through grooves cut in the brass for that purpose. The device also consists in backing the said brass by a plate of iron and a heavy sheet of rubber.

IMPROVED CROSS TIE FOR RAILWAYS.

Henry S. Wilson, Fernandina, Fla.—This consists of an iron beam having wide flanges formed on its upper and lower sides, and provided with fixed and removable clips for clamping the rail flange. The advantages claimed are, that the cross tie is practically indestructible, and that a track laid upon ties of this description is more durable and less liable to accidents than those laid upon ordinary wooden ties.

IMPROVED STEAM ROCK DRILL.

Joseph C. Githens, New York City.—This rock drill is so constructed as to avoid the necessity of a large steam chest upon the outside of the steam cylinder to enable the drill to be used close to the top of the cutting. The middle part of the piston is made smaller and is surrounded with a sleeve, the space between the said middle part and the said sleeve serving as a steam chest. The steam is introduced through guide pins screwed into the opposite sides of the cylinder, the inner ends of which enter curved slots in the sides of the sleeve so that the said sleeve may be turned to admit and exhaust the steam by the longitudinal movement of the piston.

NEW AGRICULTURAL INVENTIONS.**IMPROVED BRUSH AND CANE CUTTER.**

Oliver Pickering, Needham, Mass., assignor to himself and Charles E. Keith, of same place.—This consists in a ferrule provided with the three hooks, a pivoted button, and a bolt, in combination with the handle, to receive and hold the shank of the cutter. By this construction the cutter will be held securely in place while in use, and may be readily detached by removing the bolt.

IMPROVED GRAIN SEPARATOR.

Theophilus Harrison and William C. Buchanan, Belleville, Ill.—From thrashers the straw comes to the separator from six inches to three feet in depth, and the shaking packs the straw, so that it requires to be pulled apart by some instrumentality. This is accomplished by rakes mounted on crank shafts, so that they are alternately oscillated and carried forward over the straw, then down into it and back with it, thus pulling apart the straw at the point of juncture of the sections of the shaker.

IMPROVED CRANBERRY SEPARATOR.

Joseph C. Hinchman, Medford, N. J.—In using this machine, as the berries drop through the space between boards they strike the forward part of the upper side of an upper roller, and the perfect berries bound over the upper edge of the inclined board and pass down from one to another of the boards until they are received in a box placed beneath the forward lower part of the case. The perfect berries that were prevented from bounding, and those that struck against the inner side of the board, pass down between another set of boards to the next roller, where the same operation is repeated, and so on to the last, when the bad berries drop into a suitable receptacle.

NEW HOUSEHOLD INVENTIONS.**IMPROVED LAMP BURNER.**

Charles A. Ferron, Paris, France, assignor to George R. Tuttle, New York City.—This consists of an interior fixed, and an exterior detachable, guide tube for the wick, to which the air is supplied from the outside through the base of the dome, and the inside through a radial air channel of the conical base, arranged around the stem of the wick-adjusting spur wheels. The wick is evenly adjusted by intermeshing double spur wheels in connection with flat side springs of the base part. The upper part of the wick is closed, while the lower part is open, the closed part being arrested in its downward motion by a radial top plate or partition of the base section. The chimney, globe, and dome holder are supported on a collar of the base section, and by a guide ring on the outer wick tube.

IMPROVED LINE FASTENER.

Andrew S. Goodrich, New York City, assignor to himself and Henry Goodrich, of same place.—This invention consists of a clothes-line supporter consisting of a supporting plate, which is attached to the window casing outside of the lower sash, and provided with a fixed horizontal arm, carrying an upright standard and outer hook. On the inclined collar of the standard swings a lever arm that supports the pulley line, the arm being, at the end swinging on the post, inclined in similar manner as the collar, and secured by set-screw in inward or outward position thereon.

IMPROVED SPICE BOX.

Orville M. Brock, Monroeton, Pa.—This consists in the combination of a pepper box and salt cellar, the latter being screwed on or otherwise attached to the former, so that it may be readily detached when salt is used.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.**IMPROVED SHEET METAL ROOFING.**

Henry W. Smith, Waynesburg, O., assignor to himself and Thomas C. Snyder, of same place.—This consists in the use of flanged sheets and anchors. The roofing is held securely without driving nails through the sheets of metal composing the same. The peculiar form of the seam permits of expansion or contraction without injury to the roof.

IMPROVED MACHINE FOR PLANING WOOD.

Frederic Godeau, Paris, France, assignor to Pierre Ferdinand Arbey, of same place.—The knife rests on the front bearing or cheek of a lower plate. The top plate bears by its front part or face on the knife, and is curved to be raised a short distance above the main part of the knife for the same purpose of leaving the knife free of pressure at the rear part. The lower plate is secured by fastening screws passing down through the plate into the cutter-head, or from below, through the cutter-head, into the plate. The top plate is secured to the cutter-head by fastening screws near the center of the plate, or to the lower plate, as described. For the purpose of sharpening the cutting knives a grinding attachment is arranged at the top of the frame. The side plates of the frame carry a lateral revolving wheel, on which is placed a laterally sliding but axially revolving emery wheel, that is adjusted to the knife to be sharpened by means of a hand lever, connected with suitable mechanism. By moving the lever handle to either side, the ready following of the revolving emery wheel is caused.

NEW TEXTILE INVENTION.**IMPROVED SHUTTLE BOX LOOM.**

James Hyde, Stottville, N. Y.—This is an improved fancy loom, so constructed that it may be run at greater speed and at less expense than ordinary fancy looms; and that may be worked without pickers or spindles. The construction cannot be explained without the aid of detailed drawings. It is, however, exceedingly ingenious, and forms an improvement in weaving which is well worthy of careful examination.

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

Notes & Queries.

T. F. D., Jr., will find on p. 315, vol. 29, directions for tempering edge tools. Back numbers of this journal are sold for 10 cents each. See publishers' notice on the second page of this issue.—E. R. does not send sufficient data as to his boat, engine, and boiler.—S. W. H. will find directions for coloring brickwork on pp. 235, 236, vol. 36.—T. P. P. will find something on changing the color of the hair on p. 220, vol. 35.—E. will find a recipe for cologne on p. 75, vol. 31.—C. P. G. will find a full description of the Great Eastern steamship on p. 346, vol. 31.—A. S. will find directions for making crucibles on p. 330, vol. 32.—O. A. P. will find directions for recovering tin from tinned plate scrap on p. 319, vol. 31.—F. v. J. will find a recipe for a gold-plating solution on p. 116, vol. 35.—W. H. H. will find a recipe for a silver-plating solution on p. 299, vol. 31.—W. C. will find a recipe for a stain to imitate black walnut on p. 90, vol. 32.—L. G. L. will find on p. 379, vol. 31, a good recipe for a paint for smoke stacks, boilers, etc.—J. H. B. will find on p. 150, vol. 35, directions for making imitation marble.—C. M. can drill glass by following the directions on p. 218, vol. 31. A cement for fastening glass to wood is described on p. 143, vol. 33.—E. F. M. will find a recipe for Vienna bread on p. 189, vol. 33.—N. E. L. will find an article on sending the time by telegraph on p. 358, vol. 30.—M. G. will find directions for ridding fruit trees of insects on p. 200, vol. 36.—G. H. P. will find an answer to his query as to the surface of a brake on p. 273, vol. 31.—W. R. W. can make his glass windows opaque by following the directions on p. 264, vol. 30.—E. H. will find something on parhelia and halos on pp. 172, 171, vol. 28.—C. W. B. will find a recipe for a liquid dressing for shoes on p. 107, vol. 36. For a recipe for writing fluid, see p. 92, vol. 33.—S. A. S. will find directions for dyeing crimson on p. 235, vol. 36.—J. A. will find directions for mending rubber boots on p. 203, vol. 30.—H. J. M. will find directions for making potato starch on p. 315, vol. 30.—J. R. will find directions for making rubber hand stamps on p. 156, vol. 31.—E. P. will find descriptions of emery wheels and their uses on p. 22, vol. 29.—E. W. will find directions for ridding a house of cockroaches on p. 43, vol. 31. As to bedbugs, see p. 378, vol. 24.—R. H. M. will find directions for glazing earthenware on p. 353, vol. 35.—W. H. T. can fasten rubber rollers to their spindles with glue. For wringing machines, marine glue would be best. See p. 43, vol. 32.—L. S. B. will find something on endurance of life in an airtight place on p. 202, vol. 32. To make oxygen, see p. 290, vol. 33.—L. C. will find a recipe for cement for stopping leaks in boilers on p. 202, vol. 34.—E. H. P. will find a recipe for invisible ink on p. 267, vol. 34.—J. A. T. can calculate the power of his engine by the rules given on p. 33, vol. 33.—W. C. J. will find directions for removing freckles on p. 187, vol. 32.—J. H. will find on p. 298, vol. 30, a recipe for cement that will fasten metals to glass.—J. A. McC. can blue his gun barrels by the process described on p. 123, vol. 31.—J. C. K. should trap his moles. See p. 223, vol. 26.—J. R. J. will find directions for making an eolian harp on p. 330, vol. 26.—A. M. N. will find directions for drilling holes in glass on p. 218, vol. 31. Hydrochloric acid will dissolve glass. See p. 203, vol. 33.—C. W. H. will find on p. 171, vol. 36, a recipe for a cement that will fasten paper to stone or iron.—A. S. will find a recipe for waterproof glue on p. 43, vol. 32.—G. I. M. will find a full description of the East River bridge on p. 99, vol. 35.

(1) A. McG. asks: Why do frost crystals form on windows? A. If ice water be introduced into a glass vessel in a warm room, it speedily determines the precipitation of the moisture from the surrounding air, which forms as beads of dew upon the exterior surface of the vessel. If instead of cold water a mixture of pounded ice and salt be introduced, the condensed moisture will be frozen as it forms into hoar-frost, which is composed of minute crystals of ice. This precipitation and congelation is precisely analogous to that which takes place upon window panes in cold weather. All frozen water is crystalline.

(2) J. R. L. asks: How can I give shirt bosoms the polish and stiffness obtained by shirt manufacturers? A. Rub 1 oz. best potato starch up with a little cold water, so as to reduce all the lumps; add a tablespoonful of best loaf sugar, an equal quantity of dextrin, a little soluble indigo, and a lump of pure paraffin about the size of a nutmeg. Then add a pint of boiling water, and boil, with occasional stirring, for half an hour (not less). The starch should be strained through a linen cloth before using.

(3) D. F. H. asks: What is used on the end of magnets to keep the wire in place? Will iron or brass do? A. Brass or bone rubber.

(4) J. A. H. asks: 1. In an electromagnet made of 25 feet of No. 18 copper wire, of what length and size should the core (composed of small soft iron wires) be, to give the greatest inductive effect to a secondary coil? A. Of 7½ or 8 inches length and ¾ inch diameter. 2. Which will give the most magnetic power, a single coil 1 foot in length, or 4 layers 3 inches long, and should the iron cores be the same size in each case? A. The single coil, with proper battery? 3. What is the rule regulating the proportionate lengths of helices to their diameters and to the diameter of the iron cam? A. About 8 or 10 to 1 is a good proportion. 4. What rule regulates the size of the wire of which the helix is composed? A. The wire should be of such size that, when filling the proposed space, its resistance about equals that of the battery.

(5) W. S. asks: 1. Please give a description of how a good vibrator is made, and how is it applied on electrical apparatus? A. Connect one end of the coil of an electromagnet to the armature of the same; the other end, to one pole of a battery; and the opposite pole of the battery to an adjustable spring against which the armature presses when not attracted. The points of contact of armature and spring should be made of platinum. 2. Can you mention a good work on experimental electricity and magnetism? A. Read Davis' "Manual of Magnetism," Pynchon's "Chemical Physics," or Tyndall's "Lectures on Electricity."

(6) G. M. F. asks: Will 60 feet silk-covered copper wire, ½ of an inch in diameter, for the primary coil, which is 6 inches long, and 1,300 feet of silk-covered copper wire, ¼ of an inch in diameter, for the secondary coil, give a severe shock? A. Yes.

(7) H. F. G. says: 1. I am making a small horizontal steam engine; the cylinder is of brass, cast, with a 1 inch bore and two inches stroke. How large and heavy must I make the balance wheel? A. Make it 9 inches in diameter, to weigh 4 lbs. 2. How large must I make a boiler of sheet copper, and how much pressure will it stand? How large must I make a boiler of sheet iron, and also what pressure will it stand? A. Boiler should be 8 inches diameter and 15 inches high. Copper should be ¼ thick, iron ½ thick, for a working pressure of from 50 to 60 lbs. per square inch.

(8) H. P. asks: 1. Would steam at low pressure mingled with compressed air at a higher pressure moisten the air and increase the pressure? A. Yes. 2. What thickness should I make my air tank to stand a pressure of 150 lbs., the diameter being 19 inches? A. About ¼, if it is wrought iron.

(9) S. A. H. says: 1. I bought a telegraph sounder having about No. 32 wire on it; and I have made another instrument using No. 18 wire—about 175 feet in coil. When working it alone, it works well; but when I attempt to work the two instruments together in a short line, I find only one of them will work, the one which has the fine wire on it. What is the difficulty? A. The resistance of the fine wire is too much for the circuit, both instruments should be wound with the same size wire. 2. Please publish a recipe for a varnish or composition to be used on wire as an insulator in place of the silk covering generally used. A. Shellac and alcohol is sometimes used for the purpose. 3. Can you publish a process for making hard rubber? A. See p. 123, vol. 32.

(10) G. M. G. asks: Has an electromagnet more attraction on an armature approaching directly upon it than it has on one approaching in an oblique direction toward the poles of the magnet? A. Yes.

(11) A. E. T. asks: Of what are the zinc plates made that are used in medical batteries, so that they do not need to be amalgamated, but can be used until they are worn out? I refer to the kind used in a bichromate solution. A. A very small amount of mercury is sometimes put in the molten zinc before casting. Please give me details of the process of tempering steel springs? A. See pp. 37, 363, vol. 32.

(12) J. D. J. asks: 1. Is there anything that will neutralize the attraction of a lodestone? A. Its attraction can be neutralized by placing an equal magnetic force of the same polarity in juxtaposition with it. 2. Has a lodestone ever been used as a light motor power? A. No.

(13) D. W. L. asks: 1. Will a small magneto-electric machine, such as is used for medical purposes, be sufficient to charge a small magnet? A. No. 2. Has electricity in this form ever been used for telegraphing? A. Yes.

Is the exhaust steam of an ordinary engine heated to above 212° Fahr.? A. Yes.

(14) A. S. asks: Does it take more time to send one letter by telegraph over a continuous line of 10,000 miles than over a line of 1,000 miles? A. Yes, one hundred times more.

(15) C. S. M. says: Some time ago I purchased a second hand galvanic battery; and when I added the solution and tried to run it, I could only feel the very slightest current, and that only lasted a few minutes. How can I remedy it? A. We cannot tell you, unless you state what the battery is composed of.

(16) J. F. D. asks: Can I run by foot power a magneto-electric machine capable of heating a ¼ inch steel rod to a red heat? A. No.

(17) W. R. B. says: In making vinegar, I use a common German generator containing corn cobs soaked in vinegar. When I let a stream of cider flow in, the temperature rose to 110° Fahr.; but when it flowed out at the bottom, it was flat, like warm water. I have made strong vinegar in this way before, and with the same apparatus. Can you tell me what is the difficulty? A. Add a little vinegar to the cider and let it ferment a short time before running through the acetifier; or return the liquid to the same, and let it trickle slowly through it a second time, and even a third time, if necessary.

(18) F. W. J. says: Can you give me a recipe for a gold wash for watch chains, etc.? A. Clean the articles perfectly, and wash them in a strong neutral bath of chloride of gold in warm water. Then dip for a moment into moderately strong solution of copperas, dry, and polish. Or use an ethereal solution of chloride of gold, dry, and reduce by contact with hydrogen gas (coal gas will answer) in a tight apartment. Or dip in the gold solution first mentioned, and then in a hot solution of caustic alkali.

(19) G. S. says: 1. I wish to make a collection of marine animals, such as sponges, anemones, and algae. Which is the best time to commence it, spring or summer? A. We believe the latter part of the summer is generally chosen for such collections. 2. Would such animals live in water mixed with common salt in the same proportion as salt or sea water? A. Experience has shown that genuine sea water is best. 3. Do you think it would improve the health of these animals to have the light of the sun filtered through yellow paper or glass? Professor Draper, of New York, says: "The yellow ray of the sunlight is that portion which is the peculiar stimulus of the chemistry of the leaves and plants." I doubt not but that it would have some influence on the polyp, but I would like to have your opinion. A. Dim, diffused sunlight is best.

(20) J. B. H. asks: How can I best make a cement that will stand fire and not wash or crumble out? I have a boiler in two parts, and a space between the two has to be stopped with a V-shaped piece of iron. The cement that I have used dries and crumbles out. A. Use a cement made as follows: Cast iron borings 10 lbs., red lead 1 lb., alum ¼ lb., lime 5 lbs., sal ammoniac 2 ozs. Dissolve the alum and sal ammoniac in a small quantity of hot water, and mix in the other ingredients.

(21) J. H. H. asks: Can you give me a recipe for cement with which I can fasten thicknesses of paper together, which, on application, will cause no enlargement (expansion or contraction) or alteration in shape or size? A. We do not know of such a preparation.

(22) J. C. C. asks: 1. How can I make stearic acid without an hydraulic press, or the use of costly chemicals? A. It is not practicable. 2. How can beeswax candles be prevented from guttering? A. Add about 10 per cent of stearic acid to the wax. 3. How is paraffin wax made? A. The mode of obtaining paraffin differs according to its being an educt or product: an educt as from petroleum, naphtha, ozokent, etc., and a product of the dry distillation of brown coal, peat, and bituminous shale. It is usually obtained from petroleum, by distilling the residues after the separation of the lighter oils, with steam at a temperature of from 300° to 400°. It is separated from the liquid distillate by artificial cold and the centrifugal machine, purified by treatment with oil of vitriol and steam, and neutralized with lime water. It is then rapidly redistilled, and treated in the hydraulic press, as in the preparation of stearic acid.

(23) M. J. B. asks: What is an east and west line? Is it a parallel of latitude or a line running at right angles to a meridian? A. It is a parallel of latitude.

(24) E. A. H. says: 1. What is the pressure of water freezing in an airtight cylinder? A. About 30,000 lbs. per square inch. 2. What is the strength of cast iron and sheet iron, of ¼ inch and ½ inch thick respectively, to resist water pressure? A. Cast iron 18,000, and sheet iron 35,000 per square inch. 3. Which plan would be best for strength of resistance to the hammer in riveting, a bar 5 feet in length one end not supported, or a 10 foot bar with both ends supported? A. There might be no difference, if the bars were sufficiently rigid. Steel or wrought iron would answer for the bar.

(25) J. B. O. asks: Is it possible to build an electro-magnetic engine of one-half horse power? A. Yes. 2. If so, what size of magnet will be required? A. It requires a combination of magnets to get continuous work. 3. Will a cast iron magnet answer as well as a wrought iron magnet? A. Wrought iron is best.

(26) G. G. says: A little while ago I made a simple telephone, to be used without the electrical current. I tried a thin sheet of brass in place of a membrane as a cover to the mouthpiece for receiving and transmitting the vibrations made by the voice to the connecting line. I found that the brass would not answer. If a sheet of iron or other metal is used, what is the shape, and how is it held in position? A. The transmitting instrument consists of a simple electromagnet, in front of which is a tightly stretched membrane of skin; just opposite the poles of the magnet, on the membrane, is a small permanent magnet which vibrates with the former when set in motion by the air. The receiving instrument is a tubular electromagnet formed of a single helix with an external soft iron case, into the top of which is loosely fitted a light iron plate which is thrown into vibrations by the action of the magnetizing helix. 2. Does it require a circuit to transmit the electrical current? A. Yes. The helices of both electromagnets are included in one circuit, which may also include a battery.

(27) J. A. T. says: I have an engine 1½ by 4 inches. What power will it give with a horizontal boiler 18 inches x 12½ inches with tubes 1½ inches in diameter? A. Possibly you may realize ½ a horse power.

(28) J. A. C. asks: What is the easiest method by which a conducting surface can be imparted to cloth, leather, etc., for the purpose of electro-plating? I have tried plumbago, but it will not do for my purpose. A. Try the following: Immerse the object in a solution of nitrate of silver in wood naphtha. When partially dried, treat with ammonia. After being thoroughly dried, the object should be exposed to the vapor of mercury, when its surface will become completely metallized in a few moments; transfer to bath immediately. Great care must be taken not to breathe the mercury fumes.

(29) D. C. W. asks: 1. Which solution in a Bunsen battery requires to be changed, and how often? A. The nitric acid requires to be changed first, but the frequency of change depends upon the work done. The best rule is to change whenever the battery becomes too weak to do the work. 2. How can I make an electrolyte of an autograph? A. You must photo-engrave it first. See p. 373, vol. 32.

(30) F. D. H. asks: If I connect one cell of a carbon and one cell of a Leclanché battery, for either quantity or intensity, do I utilize the entire energy of both, or is there a waste owing to the elements being dissimilar? A. It is a bad plan to connect batteries differing in electro-motive force, for quantity; connected in series, the resulting electro-motive force is equal to the sum of all the electro-motive forces of the different cells.

(31) C. E. J. says: Inclosed find sample of battery wire. The wires have been in use in an hotel for two years. About 6 months ago, a portion of the house telegraph ceased working. Upon examination, I found the battery wire corroded and eaten off; since then I have had the same trouble about a dozen times, and in every case was the battery wire eaten off, as in the sample. The floor is double, with cement in between. The wires run in a groove cut in the cement; the battery wire is precisely the same as the room wires, and runs in the same channel. In most cases, the battery wire would be in the middle of the other wires; but I failed to find that any of the other wires were affected. A. If the wires are in a damp place, the action of the battery probably causes the corrosion. Better use kerite covered wire, and be sure the covering is perfect.

(32) T. J. L. asks: Is there such a word in the nomenclature of telegraphy as "telehiro" or "telehiero"? A. No.

(33) E. W. W. asks: What form of battery will be the best to work a set of alarm bells (four large gongs and six small gongs) all controlled by one large vibrator on a circuit of about 500 feet length? The main requisites in the battery are to be strength of action

with permanence and requirement of the least possible care. A. If all are in one circuit, and only used for a few seconds at a time, four or five Leclanché cells will probably be found to give satisfaction.

(34) H. L. C. says: I wish to make some permanent U magnets 8 inches long, of cast steel $\frac{1}{4}$ inch thick and 1 inch wide. If I make an electromagnet of 1 inch round iron of the same size and shape as the steel, and wind it with 150 feet of No. 14 cotton insulated copper wire, and use for battery two Hill cells, will it be sufficient to charge the steel magnets so that they will each support 8 or 10 lbs.? A. Yes, if the plates are so large that the battery resistance is very small. You had better use one or two Grove cells.

(35) E. D. G. asks: Does the latest authorized survey show Gray's Peak to be the highest altitude in Colorado? If not, what is the greatest altitude? A. We believe that the latest information shows that there are several peaks slightly higher than Gray's.

(36) R. B. C. says: 1. I am about to have a propeller wheel made, of 32 inches diameter, and would like to know how much pitch to give it. I have an abundance of power, and would like to get the greatest possible speed? A. Four feet pitch. 2. I have a horse-shoe boiler, and would like to know if it would be advisable to heat the feedwater in the back breeding of the boiler by means of pipes, in the form of return bends. If so, where shall I locate the check valves, between the pump and pipes? A. If your boiler steams well at present, there is no necessity for the change.

(37) W. L. asks: In what book can I find how to calculate the times of rising and setting of the sun for each day in a year, for any degree of latitude? A. There are many special methods used by computers which are not given in ordinary treatises on astronomy; but you will find a good discussion of the subject in Norton's "Astronomy."

Which of two horses pulls more on the double tree of a wagon if one is a little ahead of the other? A. Usually the one that is a little ahead.

Why does a gun barrel scatter the shot? A. Generally it is due to the fact that the barrel is not true or is foul, or to the shape of the breech.

(38) T. L. says: How many horse power will be developed by using 100 inches of water (miner's measure) on a 20 foot overshot wheel, and also on an 18 foot wheel? A miner's inch of water is an amount that will run through one inch square aperture under a five inch pressure or head. A. About six and five horse power respectively.

(39) J. H. H. says: 1. I propose making a wrought iron jacket cylinder, 24 feet in diameter and 6 feet long, with a steam space of 14 inches, to be run by superheated steam. I understand that steam can be superheated to 1200° Fah. The outside of the cylinder is to be covered with a non-conducting covering. With a cylinder of this construction, how many degrees of heat will be radiated to the interior of the cylinder? We expect to use between 25 and 40 lbs. of steam. A. You do not send sufficient data. 2. Would an elliptical cylinder be as good as a circular one? A. No. 3. How thick would you make the non-conducting coating? A. From $\frac{3}{4}$ to 1 inch.

(40) S. asks: What is the rule by which shipbuilders calculate the carrying capacity of vessels, and find the weight of a ship as she stands in the water? A. The rule is too long for insertion in these columns. You should consult a standard treatise on shipbuilding.

(41) E. M. asks: 1. How can I use and make dipping acid for cleaning gas fixtures? A. Use sulphuric acid diluted with about 5 parts of water. 2. How can I put on the bronze powder used on zinc covering pipe? A. Use boiled oil as a size. 3. How can I make lacquer used after bronzing? Can any kind of clear transparent varnish be used? A. Use shellac in alcohol.

(42) J. K. says: 1. We have an upright tubular boiler of the following dimensions: Shell 8 feet by 3 feet, plates $\frac{3}{4}$ inch thick, single riveted, having 51 tubes each 6 feet long by $2\frac{1}{4}$ inches diameter. Firebox or furnace is 30 inches by 23 inches high. Heads $\frac{3}{4}$ inch thick; and the boiler is made of best iron. The water space around firebox is 2 inches. How many horse power (at 20 feet heating surface per horse power) do you consider this boiler to give? A. About $7\frac{1}{2}$. 2. What pressure per square inch should it be worked up to? A. From 80 to 100 lbs.

(43) A. P. H. says: We have two 60 flue boilers, 14 feet long and 60 inches diameter. They were tested with 100 lbs. cold water pressure and did not leak. But as soon as we started fire under them they began to leak in the seams over the fire on top; where the fire did not strike them they were perfectly dry. We called them, and that stopped the leaks for a day or two. We tried the caking over again several times, but with the same result. When we had run about four weeks, all the flues in the back end of one of the boilers began to leak. Why did the flues in one boiler leak and not those in the other? A. We judge from your account that the boilers have been badly built, badly managed, or both, the probability being that they are very poorly constructed.

(44) J. H. N. says: I need a 6 horse power steam engine to do my work. Can exhaust steam from an engine be used to warm a house, through pipes, after the manner of heating now in use? If so, what increased capacity of power would be required to warm an ordinary village residence? A. With properly arranged heating apparatus, the increase of steam required will not be more than 10 per cent.

I prepared gummed labels with a solution of gum arabic; these labels rolled up, resembling little pipes. What can I use to prevent this curling up? A. Mix some refined sugar with your gum solution.

I am using an incubator for hatching queen bees' and hens' eggs. I need a temperature governor. What metal or substance in the form of a bar is most susceptible to and expands most by heated air? In liquid form, mercury is most expansive, is it not? If mercury is confined in a cylinder by a close-fitting piston, will it exert considerable power or will it compress like air?

A. Mercury inclosed in a tube will answer very well. Zinc and lead are among the most expansible solids.

(45) W. E. N. says: I have a small copper boiler 18 inches high and 12 inches in diameter, made of $\frac{1}{4}$ inch copper. The heads are of $\frac{3}{8}$ inch copper. What size engine will it run? A. You can use an engine $1\frac{1}{4}$ x 3 inches.

(46) J. H. T. asks: 1. I have a 10 horse power engine which ordinarily works well, but when at heavy work it will (while pumping water into boiler) overflow the exhaust pipe in smoke stack, when I have scarcely two gages of water. What is the cause of it? A. We presume, from your account, that the boiler has not sufficient steam room when the engine is working at full capacity. 2. What is the best paint or varnish for boilers? A. A black varnish made from petroleum is sold for that purpose, and answers very well.

What is the rule for finding the number of revolutions per minute of certain pulleys? A. Divide the diameter of the driving pulley by the diameter of the driven pulley, and multiply the quotient by the number of revolutions of the driving pulley.

(47) J. S. W. asks: What number of blades should a propeller wheel have to be used on a small yacht, model and power being able to give the highest speed, and length being from 24 inches to 38 inches? A. Three.

(48) W. N. R. says: 1. Will you explain the process of laying very thin veneers? A. The veneer having been cut to the proper shape, the surface to which it is to be applied is coated uniformly with glue and the veneer is directly placed in position. The exterior surface of the veneer is then sponged over with warm water to prevent its curling. 2. What is the meaning of the word "caul," as applied in this process? A. If the surface to be veneered is a plain one, the caul is simply a plain smooth board, covered with canvas, and clamped on over the veneer to insure its perfect contact in every part with the glued surface until the glue has properly set. If the surface is uneven, the caul is made up of canvas to which thin slats of wood have been previously glued to give it the required shape.

Please give me a recipe for aquarium cement? A. Heat up a small quantity of pure caustic lime in fine powder with a sufficient quantity of white of egg to form a thick paste, and fill the angles of the aquarium with this immediately before it sets. When perfectly set, give the seams a coating of fused paraffin.

(49) W. A. M. says: I have a quantity of nitric acid of 30° Baumé. How can I increase its density to 50° Baumé? A. Distill it with a quantity of strong oil of vitriol in a large glass retort.

(50) W. L. R. asks: How much will eight spans of horses pull in one wagon, provided one span will pull 20 cwt., all other things being in proportion? A. Where the horses are accustomed to work together, 8 spans will pull about 8 times as much as 1 span. But if 8 separate spans were hitched to the same wagon, even though they might all pull well when working in single spans, it is doubtful if they would pull more than 5 or 6 times as much as a single span, and the aggregate pull might fall even lower. The same thing may be noticed in the effect produced by gangs of men when pulling, pushing, or lifting.

(51) R. L. H. says: 1. How large should a current wheel be, and what should be the shape of the paddles, to realize 15 horse power in a current running at the rate of about 5 miles per hour? A. Make the wheel 15 feet in diameter, with floats at an angle of 15° to the radius, each float being 3 feet deep and 18 feet long. 2. How should the current wheel be geared to give a speed of about 350 revolutions to a 24 inch corn mill? A. Ordinary bevel gearing and cogwheels will answer.

(52) W. B. P. asks: How is the ribbon for the type writers, and for the ordinary ribbon stamps, made? A. It is saturated with a solution of one of the aniline dyes, alizarine, or alcoholic extract of madder, in glycerin.

(53) C. C. F. asks: How is the so-called French kid, made from goat skins and used in ladies' shoes, worked out and tanned? A. The process is that known as tawing. It is too long for publication in detail here. The skins, having been soaked in water and scraped on the flesh side (the hair being loosened and removed by soaking in lime water and plucking), are passed through singly, and then digested for about 10 minutes in a boiling bath composed of 12 lbs. alum, 21 lbs. salt, in 12 gallons water; 15 lbs. wheat flour, and the yolks of 50 eggs are then added to the warm alum bath, and the skins are soaked in this for a day or more. The proportions here given are for 100 skins. The skins are then stretched in lots to dry for a week, when they are soaked in water for a few minutes, softened by stacking, and ironed.

(54) W. D.—Referring to the reply given to W. D. (No. 16, p. 200, vol. 36), who asked about the use of galvanized iron pipes, for conveying spring water, etc. Our Professor was in error in advising the use of galvanized iron pipes. Probably a better material would be pipes of wood. With some waters, the use of galvanized pipes has proved disastrous, and the safer rule is to banish them altogether. Perhaps we cannot do better than to repeat the inquiry and reply we gave on this subject on p. 251 (No. 4), SCIENTIFIC AMERICAN of October 16, 1875.

J. G. W. asks: Will galvanized iron tubing in a bored well be durable? Would the water from such a well be wholesome? A. The use of galvanized iron pipes for family water supply is not desirable. For a short pipe, if the water is pure, and the precaution is taken not to use water that has stood too long in the pipes, perhaps no bad effect would result. But there have been repeated examples of poisoning from the use of galvanized iron conducting pipes. In a case at Portsmouth, N. H., a family of four persons were thus poisoned, and Dr. Jackson found four grains of oxide of zinc in the water. In another case, near Boston, where the house was piped with galvanized iron pipes, one of the young members of the family died, and a post mortem examination revealed the presence of oxide of zinc in the stomach and other organs. Death was directly attrib-

uted to the use of the above pipes. They are made by heating and dipping the iron pipes in melted zinc.

See also the letter of Mr. Balch given on another page of this issue.

(55) W. A. E.—The temperature of ignition of dry pine is about 600° Fah., of oak 900°. The temperature of ignition of charred wood, if perfectly dry, is not sensibly different from the above. Wood or charcoal, perfectly dry, generally requires the actual contact of a spark to produce ignition.

(56) C. G. D. says: I read the following: "Venus is twice as near the sun as the earth is, and consequently receives four times as much light and heat as we do, and the average temperature of the earth being 77° Fah., the average temperature of Venus would be four times 77°, or 308° Fah., etc. Now as the zero point is not at the true zero—the point of absolute cold—heat cannot be multiplied except by indicating it, as five or ten times as much, never expressing the amount in degrees. This can be proved by comparing the results of the temperature of Venus by the two most common scales, the Fahrenheit and the centigrade. The result given by Fahrenheit is 308°; on the centigrade scale 25° corresponds to 77° Fah.; so, by that scale, the temperature would be 100°, or that of boiling water, which is 96 Fah. degrees lower than the first result, a considerable difference. By means of freezing mixtures, an artificial cold of -239° Fah. has been reached; placing this as the zero point of a new scale (and it is unquestionably nearer the true zero than the zeros now in use), the temperature of Venus would be 96° Fah., a much greater difference than ever. So, we see, the result varies with each scale with a different zero; Réaumur and centigrade, starting from the freezing point of water, give the same result. If my reasoning is incorrect, what is the temperature of Venus, our temperature being 0° Fah. or -30° Fah.? A. Your reasoning is based on correct principles; and the absolute zero, which must be taken to obtain the same results when multiplying temperatures on different scales, is fixed by theory at about -273° Réaumur, -273° centigrade, and -461° Fahrenheit.

(57) N. L. R. asks: 1. How much water will I have to turn on an overshot wheel, 20 feet in diameter, to get six horse power? The water will flow on the wheel from a trough. I will not have any head of water at all. A. About 230 cubic feet a minute. 2. Will it take less water if I have a head of five cubic feet above the wheel, that is, just over the wheel? A. Yes.

(58) J. A. B. asks: 1. Is 18 inches too long a beam for an engine whose stroke is $4\frac{1}{2}$ inches? A. It will answer very well. 2. In a parallel motion, does the cylinder require to be under the ends or the center of the arc described by the end of the beam? A. Under the ends of the arc. 3. What power can be obtained from two engines, $3\frac{1}{2}$ by $4\frac{1}{2}$ inches, making 300 revolutions, with steam at 120 lbs. in boiler? A. Between 8 and 9 horse power. 4. Would one of them give half the power? A. Yes.

How will an ice boat make 60 miles per hour, the wind having a velocity of 15 miles per hour only? A. This matter has been frequently referred to in recent back numbers.

(59) E. B. K. asks: What pressure does a column of mercury, of 1 inch area, give in ascending 1 inch in the tube? A. About $\frac{1}{16}$ lb.

Is there not an expeditious method of cutting firebricks other than by chipping them with a hammer? Are there not saws made for the purpose? A. We are not sure. If there are such tools, some of our readers will, we hope, send us word.

(60) G. A. R. asks: Is a pine log lighter when it is frozen than when it is thawed, or not? A. There is little or no difference in the weight of timber under such conditions. Ice is lighter than water, volume for volume, but 1 lb. water when converted into ice will weigh neither more nor less than 1 lb.

(61) R. C. says: 1. I wish to make an incubator heated by horse manure. I filled a box three feet square with fresh manure; it heated in about a week, and in two weeks it was as cold as when I put it in the box. How can I retain the heat for three weeks? A. Moistened the manure with a little molasses water, and keep covered with sawdust. 2. Will quicksilver placed in a glass tube work a stopper in the tube resting on the quicksilver, as a regulator of heat? A. If the tube is provided with a proportionately large reservoir or bulb at the lower extremity, it will answer well enough for the purpose, but it will be necessary to make a table for it by comparing the indications with those of a good thermometer.

(62) N. R. asks: What is the best preparation for restoring hair to its natural growth? A. Make a strong aqueous solution of Liebig's extract of beef, and add about 2 per cent of neutral citrate of iron, and a little wine. Take a few spoonfuls of this every day.

(63) W. C. M. says: Please give me a cheap process for clarifying vinegar, either before or after acetification has taken place? A. It is usually purified by distillation in large tinned iron vessels. This is the cheapest method.

(64) G. S. says: 1. I have heard of a newly discovered light, besides the electric and the calcium, the latter of which I am in the habit of using for the magic lantern. Is there something new in this line? A. A. The lime or calcium light, the magnesium light, and the argand gas and oil lamps, are the only sources of illumination that have thus far proved of any practical value for projection with the magic lantern. 2. Can the zoetrope be used in connection with the magic lantern or the wonder camera, so as to throw the motion of figures on the screen? A. Modifications of the instrument you name have been used in the magic lantern. The pictures are painted or photographed on glass disks, which are rotated before the condenser with the interposition of a similar opaque disk, bearing the slits, which is simultaneously rotated in the contrary direction.

(65) A. B. G. says: I have a quantity of oxide of zinc. How can I convert it to the metallic state again? A. Mix with an excess of powdered charcoal and a little molasses, pack into black lead crucibles, cover with a lining of fire clay, and heat strongly. Con-

sult Bloom's "Handbook of Metallurgical Operations."

(66) T. J. M. says: I have an engine $\frac{1}{2}$ x 1 inch bore, with 2 flywheels $\frac{1}{4}$ inches in diameter, weighing together about 14 lbs. Boiler is upright, 5 x 8 inches inside, with two $1\frac{1}{4}$ inches copper flues. Boiler heads are cast, $\frac{1}{4}$ inch thick, and shell is of $\frac{1}{8}$ inch iron, riveted. How can I steam it? A. We think you can use a lamp with two burners, one for each flue. The best forms of lamps used for heating purposes are patented, and we advise you to purchase one in preference to making it.

(67) R. A. J. says: 1. Our town is situated on a river. At the back of the town and about one mile from the river is a bluff, on which is a cemetery. I wish to know whether the close proximity of the cemetery will injure the water in the wells in that part of the town which is close to the cemetery? The water in the wells runs in a direction from the cemetery to the river. The cemetery has been there for over twenty years. A. It is improbable that this will, in any way, affect the quality of the water. 2. How can I test for impurities in the water? A. Make a dilute solution of permanganate of potassa in water, and add to a sample of the well water a little of this solution, just enough to impart to it a perceptible tint. If the color thus imparted disappears, even after an hour's standing, the water may be considered unfit for drinking purposes.

(68) P. A. T. asks: What size of boiler of the firebox locomotive kind and what size of engine do you recommend for a boat 65 feet long by 18 feet beam, and 3 feet depth of hold? The said boat is to be a high pressure sternwheel and the engine double. A. Make a boiler 4 feet in diameter and 12 feet long, cylinders 10 x 20 inches, with a steam pipe 3 inches in diameter. Feed pump 3 x 20 inches, pipes 1 inch. 2. How many cords of wood ought said boat to be able to carry? A. Capacity of boat, 60 to 70 cords of dry wood.

(69) T. C. B. says: 1. I would like to build a model locomotive of the following dimensions: Cylinders $1\frac{1}{2}$ inches in diameter, stroke $1\frac{1}{2}$ inches, steam ports $\frac{1}{2}$ x $\frac{1}{2}$ inch, and exhaust ports $\frac{1}{2}$ x $\frac{1}{2}$ inch, with a plain D slide valve. Drivers are to be of 4 inches diameter, and four in number, coupled. Front or swing truck is double with 4 wheels. Boiler is of $\frac{1}{4}$ inch copper, diameter $4\frac{1}{2}$ inch, and length, including smoke box, 15 inches. Firebox has a height of 4 inches, length of $4\frac{1}{2}$ inches, and width of 4 inches. Pump has a bore of $\frac{1}{2}$ inch connected to crosshead. Injector has a discharge diameter of $\frac{1}{2}$ inch. Will these proportions do? A. We think your proportions are generally very good, and we are glad to publish this letter for the guidance of others. 2. What would be the best for fuel, charcoal or canal coal, a blower being conducted to stack? A. It will be best, on several accounts, to use charcoal for fuel.

(70) C. S. says: 1. I wish to build a cider press. I intend to use a single cast iron screw, of about 4 feet in length. What should be the diameter of the screw to support a pressure of 100 tons? A. Make the screw large enough to have the area of the thread in the nut equal to 25 square inches at least. 2. What would be the friction, supposing the nut to be placed in the upper end of the screw, and the lower end of the screw to turn on a flat metal surface? The screw will, of course, be well lubricated. A. Friction will probably not exceed 10 per cent of the force applied to the screw.

(71) J. F. says: 1. We have not got enough natural draught for our stationary boiler. We propose putting on a fan blower. Would it do as well to let it blow up through the stack as under the grates? Our exhaust goes into the stack, but our engine does not run continually, and we see that the exhaust has but very little effect on the draught or fire. A. The arrangement of blower which you suggest will answer very well. 2. We have also a steam pipe running into the stack, which, when steam is let through it, creates a terrible roaring fire. It uses a great deal of steam, but it is a long way ahead of the exhaust. Will not our exhaust create more draught if the nozzle was closed to the top of the stack? A. We do not think any gain will be realized by carrying the exhaust pipe as proposed.

(72) D. M. M. says: 1. I have an iron tank for supplying water to a steam boiler 4 feet long by 20 inches diameter. The shell is $\frac{1}{4}$ inch boiler plate, and the ends are cast iron, having a rod passing through the center. Can I insert 40 two-inch tubes by drilling holes through the cast iron ends of sufficient size for the tubes without weakening the strength of the tank? The tank is guaranteed to stand a pressure of 60 lbs. per inch, or will it be better to have the ends replaced with boiler plate? A. It will be better to use wrought iron heads. 2. What is the comparative power for water and air to absorb heat, both being of the same temperature? A. The amount of heat that will raise the temperature of 1 lb. of water 1°, will do the same for about 4 lbs. of air.

(73) R. J. asks: 1. How can I dissolve rosin in large quantities in something that will evaporate and leave the rosin hard? A. Turpentine, naphtha, benzole, etc., are solvents for rosin, and will deposit the same upon evaporation. 2. How can I dissolve rubber? A. Use bisulphide of carbon mixed with 6 or 8 per cent of best alcohol. 3. Can old rubber shoes be dissolved? A. Vulcanized rubber may be dissolved in the above mixture by heat, pressure, and agitation, in strong vessels of boiler iron. The solution, however, is somewhat difficult, and, owing to the volatility and inflammability of the solvents, not without danger when the operation is conducted by inexperienced hands.

(74) T. J. C. asks: Will a circular saw with 16 teeth cut better and more easily in hard wood generally than one with 24 teeth, each saw being 54 inches in diameter? A. This depends upon the thickness of the saw and the amount of feed to each revolution. For a 54 inch saw of No. 8 gauge, cutting 1 inch at each revolution in hard wood, I should say that, if the teeth were spread at the points in place of bending each alternate tooth for the set, 16 teeth would be better than 24. All of the conditions should be given in order to permit a definite decision to be arrived at.—J. E. E., of Pa.

(75) C. D. R. asks: What is the reason that tubes in an upright boiler do not burn out at the top

where there is no water? A. The steam in the boiler ordinarily reduces the temperature of the products of combustion to a point where they will do no damage to the iron.

(76) E. C. asks: 1. Will a portable engine rated at 6 horse power do more work in a day than 6 horses? A. Yes. 2. Is an upright boiler as durable as a horizontal one? A. Ordinarily, yes.

How many revolutions should the cylinder of a thrashing machine make, the diameter being 13 and length 30 inches? A. This depends on the construction of the machine. You should address the manufacturer.

(77) B. A. W. says: Given a propeller with a 24 foot keel and 7½ feet beam, rather flat on the bottom at midship, with an upright boiler, with two inch tubes and shell 2 feet by 4 feet; which is best, an engine 3½ x 6 or 3½ x 5 inches? or is there a better size than either? A. Use one 3 x 5 inches. 2. What size and pitch of wheel, and how many blades are necessary? A. Use a propeller of 3 blades, 24 inches diameter, of 3 feet pitch. 3. Where should the boiler be placed to allow a cabin to be built in front, projecting at the sides on the guards 5 inches each side, the roof covering the whole boat? A. You do not send sufficient data; but probably it can be placed 12 or 14 feet from the bow. 4. What speed would such a boat make? A. Probably 6 miles an hour.

(78) S. L. S. says: I have a forebay or penstock to a mill; it is 8 by 10 feet, and the water is 6 feet deep. In the center of the forebay I wish to place a wheel, with a gate 17 by 18 inches. How many lbs. pressure of water will thus be on the gate at the bottom of the forebay? A. About 2½ lbs. per square inch, as we understand the question.

(79) G. W. R. says: A man is using a hydraulic pipe, with a 22 inch pipe at the head or penstock. He takes out the 22 inch pipe at the head, and puts in a 36 inch pipe. Will the pipe throw the water further from the nozzle, and will the pipe take more water than before? A. Your question is rather incomplete; but, as we understand it, the change will make no material difference in the discharge.

(80) A. W. F. asks: 1. How many lbs. of anthracite coal would an upright tubular boiler, measuring, say, 4 feet high by 34 inches diameter, with ordinary grate surface and draft, consume? Boiler carries from 30 to 110 lbs. steam, and engine runs at 300 revolutions per minute. A. Such a boiler would probably burn from 40 to 50 lbs. per hour. 2. What should be the proportionate depth of a steam yacht to its length, and how high should a boat of 30 feet long rise out of water at its bow, the boat being used where the water is oftentimes quite rough? A. Draft, from ½ to ¾ length. The boat in question might rise from 24 to 30 inches at the bow.

(81) L. M. C. asks: How can I prepare color, such as red, blue, green, etc., to mix with a glue size, to be used on cotton cloth, which, when stretched on a frame and dry, will look clear and transparent, and be smooth and free from streaks on the flat surface? A. The aniline colors will give the best satisfaction. You can obtain them with instructions from almost any druggist. They are brilliant and economical. Some of the vegetable dyes would answer; but it would require too much space to give you the various methods for their extraction here.

(82) D. W. says: A very singular phenomena recently occurred in a mill, run by an eight horse power steam engine. The upper stone is stationary, the lower stone standing on a 1½ inch spindle, resting on a step. This step is movable, so as to gauge the rate of feed. The spindle is of hardened steel, resting immediately on a steel plate, ¼ of an inch in thickness and 2 inches square, resting on a cast foot, in a square bed, secured against revolving. Above this bedplate is a loose collar of cast iron resting in the step plate surrounding the spindle in a manner to secure stability of motion to the spindle. The foot plate is of hardened steel, its upper surface being flat, and the point of the spindle resting on this plate is slightly oval. A few days ago, while the mill was running at its usual velocity with a full head of steam, the stones stopped instantly, the belt sliding in the pulley until steam was shut off. The miller supposed that something had got between the stones, and at once set to work to raise the upper stone from its bed, but only the ordinary amount of grain was found between the stones. The lower stone was then lifted from its bed, and the spindle was found firmly attached to the steel foot plate in the step. An attempt was made to drive this foot plate off, the corners projecting sufficient to give a full blow with a heavy hand hammer, such as blacksmiths usually use. The corners of this plate were bent down by repeated blows, without any effect on the attachment to the spindle. The spindle was then taken to a smith's forge, heated and cut off above the step plate, so as to leave a small portion of the spindle attached to the step plate. On close inspection, a small portion of the outer surface of the end of the spindle was found not attached to this step plate. Oil was found above the step plate and collar around the spindle, in sufficient quantity, and no evidence of heat or unusual friction could be found. And yet the spindle was firmly welded to the step plate. This process of welding must have been instantaneous, as no abatement of speed was noticed by those standing about. All the above facts can be verified by testimony. Can anyone explain this fact? A. We prefer to throw this open for general discussion. If our correspondent can conveniently forward the corroborative testimony of which he speaks, we would be glad to see it.

(83) W. H. says: 1. Why is it that, in winter or spring, when it is warm enough to cause slush ice to break up and follow the current of the streams, at night some of the lightest of this slush will sink to the bottom of the stream and freeze to rocks, etc.? A. Your account is not sufficiently detailed to enable us to answer your question. 2. A pump used for pumping water from a river often refuses to take water on account of this slush freezing to the strainer of the suction pipe, but it is only at night; and as soon as the sun rises we do not have any trouble with it. A. Probably the trouble is caused by the manner in which the strainer is located. In general, stoppages of this kind are more influenced by atmospheric conditions than by the time of day.

(84) W. D. P. asks: If I were to put a piece of vulcanized rubber (such as combs are made of), 10 inches wide, 22 inches long, and ¼ inch thick, into a hydraulic press (the box of the press fitting the rubber), how much pressure would it stand without breaking or altering its shape? A. It would probably stand several tons; but we have no data on this subject.

(85) A. L. E. asks: Do you know of any chemical compound or method by which the hair on the head can be turned permanently gray or white without injury to the scalp or skin? A. We do not know of anything of this nature that we care to recommend. All such agents are more or less injurious.

(86) R. L. D. asks: How can I harden the shell of a hen's egg without impairing the egg? A. We do not know of any practicable method of accomplishing this.

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

J. W. B.—They are small, well formed garnets.—C. C.—If the colors constituting the pattern of your carpet are not affected by the solvents, the green stain may be removed by means of a little warm alcohol and ammonia (aqua ammonia). Otherwise it is not advisable to attempt the removal of the stain.—W. H. H.—It is a sand consisting of iron pyrites. See p. 7, vol. 36.—W. L. W.—It is a small fragment of quartzose rock, containing bright specks of iron pyrites. See p. 7, vol. 36.—E. P. C.—No. 1 contains lime, magnesite, alumina, silica, sesquioxide of iron, and iron pyrites. The cubes of No. 2 are crystals of sulphide of iron—pyrites. See p. 7, vol. 36.

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

J. C. R. asks: What is the greatest depth ever attained by a diving bell?—G. G. asks: How can I mend a stiff hat with a tear in it?—B. A. F. asks: Can you give me information concerning the dark day said to have occurred in New England at the commencement of this century? It was not occasioned by an eclipse or any other explainable cause.

COMMUNICATIONS RECEIVED.

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

On a Demand for a New Business. By H. D. R.
On Patent Rights and Wrongs. By J. R. R.
On Diptheria. By S. S. S.
On Perpetual Motion. By D. H. M.
On the Bourdon Gauge. By A. B. W.
On Cartesian Physics.
On Trisection of an Angle. By H. C.
On Theories of Light. By P. S.
Also inquiries and answers from the following:
M. C.—M. A. F.—S.—J. B.—A. C.—W. M. K.—H. P.—W. P. E.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Whose is the best generator, for the manufacture of vinegar? Who are the largest steel manufacturers in the United States? Who makes cast-steel? Who sells stamped tissue paper? Who makes machines, actuated by weights or springs, for raising water? Who lays narrow gauge railroads, and what is the cost per mile? Who sells electro-plating materials?" 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

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March 13, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

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

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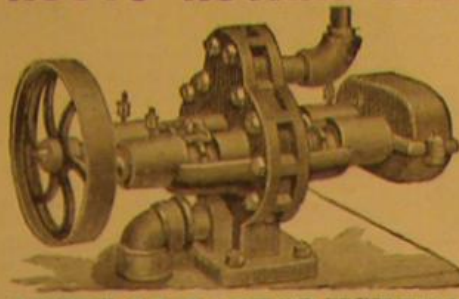
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