

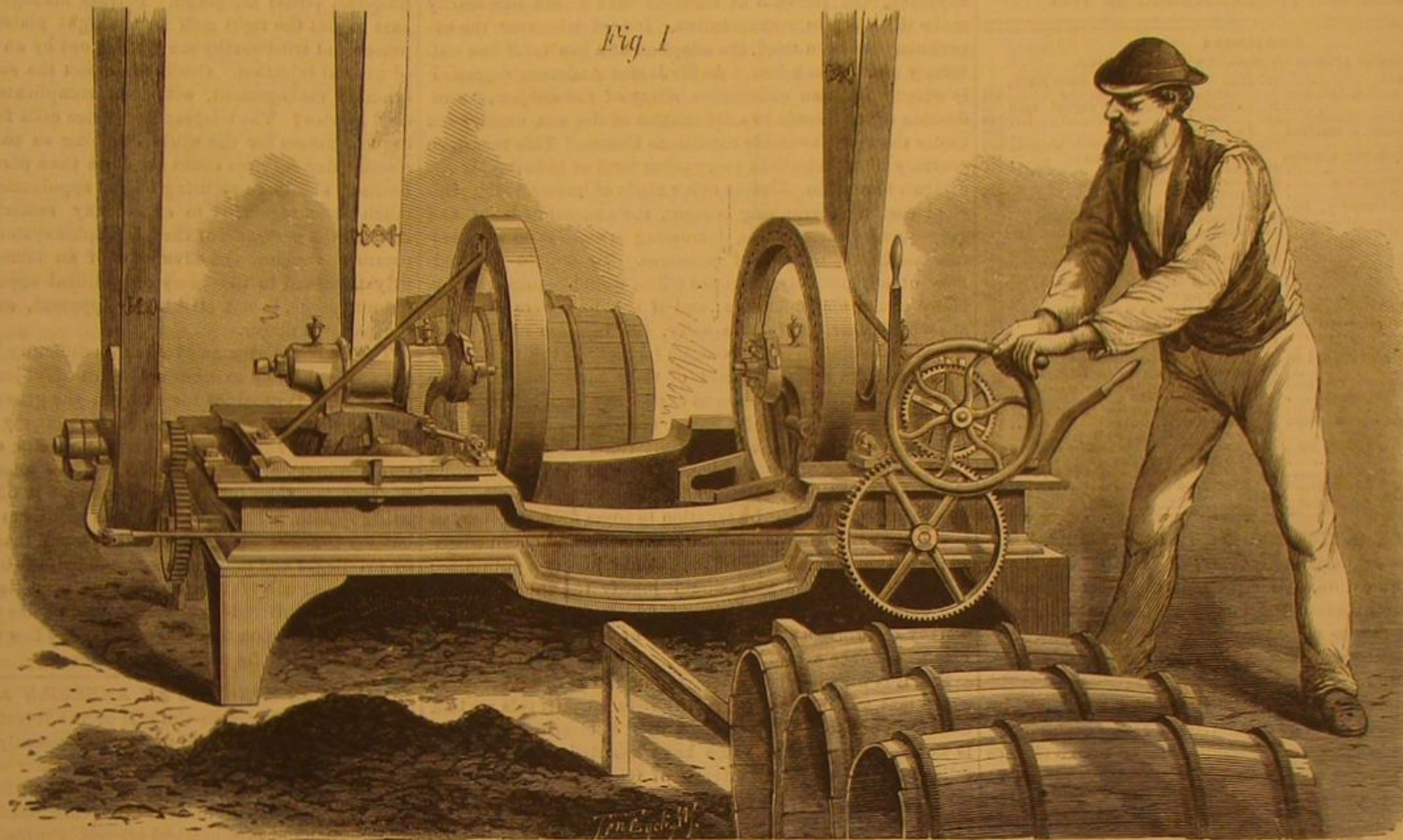
SCIENTIFIC AMERICAN

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HOLMES' BARREL MAKING MACHINERY.—THE CHAMFERING AND CROZING MACHINE.

HOLMES' IMPROVED BARREL MAKING MACHINERY.

Our readers, and especially those interested in the manufacture of barrels, or who use the article to any great extent in their various callings, are doubtless aware that, not long since, strikes of considerable magnitude occurred among the coopers of this State. These movements owed their origin, among other causes, to the introduction into the market and use, by barrel manufacturers, of improved machinery by means of which the labor of skilled mechanics was, in a large measure, dispensed with, and the work readily accomplished by ordinary day laborers. The point maintained by the coopers was, first, direct opposition to the machines as a substitute for hand labor; but this position they afterwards abandoned, and fell back on the demand that they, and not men out of the trade, should be employed to run the shops. The question in some localities is still at issue; but in others, and especially in the manufactory which we recently had occasion to visit, the employers have prevailed, and are consequently carrying on their business with both a decrease in expenses and an increase in the quantity of their products. We allude to these uprisings, in the present connection, not to discuss their merits or demerits, but as a point of interest in reference to the machines represented in our engravings, which are the principal devices which have already caused in a certain degree, and we do not doubt are in the future destined to effect, an important revolution in the coopers' trade.

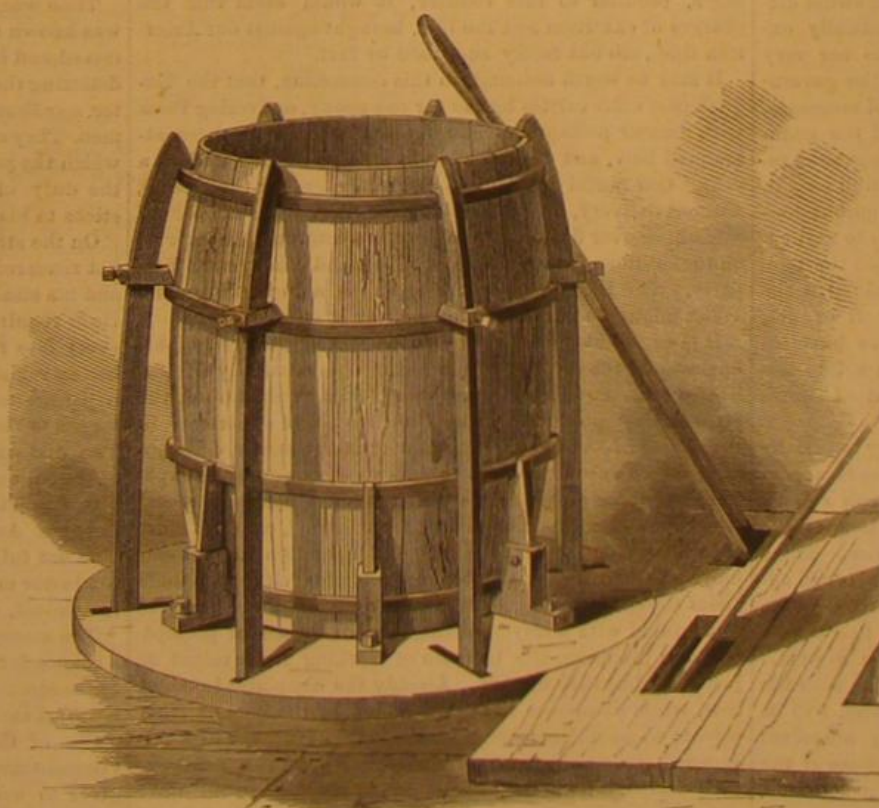
We recently devoted a few hours to the inspection of the barrel factory attached to the extensive sugar refining works of Messrs. Havemeyer & Elder, in Brooklyn, our object being to examine the operation of barrel making as performed by the machinery we are about to describe. With the superintendent of the establishment as a guide, we were conducted through various rooms heaped to the beams with thousands of bundles of staves and hoops, across courtyards, and, finally, into the long apartment which formed the principal shop. We cannot describe the noise which saluted us as deafening, for the word fails to express it; it was equal to that of a regiment of boiler riveters, and worse than a few dozen steam hammers, so that remarks of an explanatory nature were out of the question, or else were imparted by the aid of pantomime. Picking our way between belts, and dodging the barrels which were constantly flying about the room, we reached a space where loose staves were heaped, and where the

workmen were busily at work setting up the barrels before delivering them to the machinery. The setting up form is composed of two heavy circles of iron, secured together and bolted to the floor; from these rise short standards which support a hoop. The staves are set in between the iron circles, and fitted carefully together. The iron truss hooks, which are previously placed in proper position, are lifted up by hand so as to embrace the lower portions of the staves and hold them in place, when the whole is lifted out of the frame. One half the barrel is now tightly held together,

with a sheet iron cover, which was let down from above. Here the wood was well warmed through.

The leveling machine, to which the cask first passes, is a simple contrivance, the construction of which will be readily followed from our illustration (Fig. 3, on page 194), little explanation being necessary. Its object is to bring the cask into a shape that, when on end, it will stand in a perpendicular position and not lean in any direction. The barrel is placed between the two disks shown, where it is held by the projections on the inner faces of the latter. As we looked on, a workman moved the handle, a clutch was thrown into action, and the right hand disk quickly advanced, powerfully compressing the cask. There was no blow or jar; and in less time than we have taken to pen the words, the barrel was out of the machine, perfectly leveled and true. From three to four hundred casks per hour, we were told, could be thus manipulated.

Following our barrel, as it went rolling across the room, we next found it placed on end, and in the clutches of a number of hooked bars which protruded up through the floor, as represented in Fig. 2. The longer arms just caught above the upper truss hoops, and sliding collars on them similarly caught on the second bands. The lower hoops were pressed against notched standards, which also stood up from the floor, but did not pass through the same. The long arms, as we came to the machine, were spreading themselves outwards and apart, and at this moment the barrel was inserted. Then, as they came together, they caught the hoops in the manner above stated, and pulled down, dragging the heavy iron rings over the more bulging portion of the cask, and of course wedging them on the more tightly. The same effect was produced by the stationary short lower standards, by their resistance to the lower hoops moving as the barrel was forced down. The simple mechanism which actuated this device, we found located in the cellar. It is a screw suitably connected with reversible gearing, the latter being governed



BARREL MAKING—Fig. 2.—THE TRUSSING MACHINE.

by the lever handle shown in the engraving. The machine, we noted, was operated by a single man and with great ease. A very strong power was brought to bear on each hoop, which thoroughly trussed the barrel with remarkable rapidity. We were informed that, although we saw it operating on slack work, which, such as sugar barrels are termed, it was equally efficacious in trussing sirup or

[Remainder on page 194.]

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THE POST OFFICE AND THE TELEGRAPHS.

Shall we have a postal telegraph? Excepting the financial policy of the nation, this is perhaps the most important question just now before the country. Certainly there is none involving results more far-reaching or significant.

As the matter stands, the parties to the discussion are, roughly speaking, these four:

1. The Postmaster General, and those interested with him in extending the scope and authority of the postal department, either for personal and political ends, or from a sincere desire to cheapen the telegraph and extend its facilities to all parts of the country.

2. Certain capitalists, who wish to monopolize the telegraphic business of the country, and who offer low tariffs in return for the privileges of monopoly, free offices, freedom from taxation and other substantial benefits.

3. The telegraph companies, which are naturally opposed to any measures likely to lessen the value of the properties they have acquired, or take from them the business they have built up.

4. The users of the telegraph, who so naturally desire the quickest, cheapest, and truest means of communication attainable, caring little whether it is the result of public or private enterprise, so long as the system is self-supporting and reasonably free from financial or political risks.

The arguments of those who would have the general government take possession of the telegraphs are somewhat diffusely presented by the Postmaster General. Critically examined, they appear to be neither very numerous nor very cogent. Chief among them is the assertion that the government could and would largely reduce the cost of messages, and at the same time extend the lines to parts of the country not likely to be reached so long as the telegraphs remain under private management. As Mr. Creswell puts it, the telegraph now follows the march of civilization, but does not lead it. Why it should not do so he neglects to say, assuming, as not to be questioned, the theory that the telegraph is an educator which the government should give the people whether they are conscious of needing it or not, trusting to their future enlightenment to make business enough to render the system profitable. As an aid to this beneficent work, a low and uniform tariff would of course be exceedingly potent.

In addition to their neglect to do missionary work by extending their lines faster and farther than there is a paying demand for telegraphic facilities, the telegraph companies consult their own interest in preference to that of the public at large in fixing their charges for service. These the Postmaster General characterizes as exorbitant, and aggravated in many cases by enormous charges for the delivery, the lack of restraint upon the companies in this matter being "perhaps the greatest evil of the American system." And even if the rates are reduced from time to time with the increase of business, the good effected, we are told, will be more than counterbalanced by evils inevitably attendant upon private management, such as the possible abuse of the wires for personal ends by the men controlling the business, the discrimination made between the messages of different customers both as to cost and order of transmission, the enormous and dangerous extent of the free message business, and the vast and irresponsible influence of the telegraph managers upon the press of the country. For these and other evils, actual or possible, he sees but one preventive and cure, and that is the purchase of the telegraphic lines by the government under the provisions of the act of 1866, or else the erection of a new system commensurate with the present and respective needs of the country.

In support of this position, Mr. Creswell presents an imposing array of telegraphic estimates and statistics, domestic and foreign: but lacking a practical acquaintance with the workings of a telegraphic system, his deductions and assertions are for the most part singularly at variance with the legitimate inference to be drawn from the facts he presents.

His tables furnish a perfect arsenal of weapons for his opponents, who have not delayed to turn them with damaging effect upon the measure he proposes. That any considerable extension and cheapening of telegraphic facilities would induce a great many people to use the wires instead of depending on the slower post, no one questions. But it is far from clear that the benefit to the community, educative or otherwise, would be at all commensurate with the cost.

Low tariffs would certainly increase the number of messages; but if the experience of the rest of the world is worth anything, the increase of business would not necessarily make the low rate remunerative. Indeed wherever the experiment has been tried, the adoption of a low tariff has uniformly resulted in a loss. As Sir James Anderson regretfully admits, after an exhaustive study of the subject, "a reduction of tariff leads to a diminution of the net profit, even under the most favorable conditions known." This result, so contrary to experience in every other form of industry, is not difficult to explain. Unlike other kinds of business, the principal cost in telegraphing is labor, the amount of labor, and consequently the expense, increasing in close ratio with any increase in the number of messages. To double the business of any properly regulated office, would require twice as many clerks and operators; and if the line were working anywhere near its full capacity, the increase of business would necessitate a corresponding increase in the number of wires, and the aggregate cost of their maintenance. This fact alone makes it hopeless to expect any such reduction of rates as the advocates of a postal telegraph promise, and a self-supporting system at the same time. The full cost of the transmission of messages must be paid. If the original charge is insufficient, then the deficiency must be made up by the public at large, by taxation in some form or other, as is done in every country where low tariffs have been adopted; and the same argument that would justify the subsidizing of telegraphs as an educator would justify the subsidizing of churches, newspapers, private schools, and a hundred other worthy enterprises which the spirit of our institutions forbids us to make a public charge.

But, it is urged, existing telegraphic rates are nevertheless exorbitant, and ought to be greatly reduced. Of this we lack data for a positive judgment. Still it is clear that the case is not nearly so bad as some have asserted. Mr. Creswell relies largely on the experience of Great Britain in postal telegraphy. There the rate is one shilling. Here the average cost of messages is about fifty cents. There the extreme length of line is six hundred miles. Here it is six thousand. There the country is old, the population is dense, the highways are solid and matured, and the cost of materials and labor much less than here. [In the matter of wire, the American lines pay a duty of sixty per cent.] Here the country is largely new and sparsely settled, the routes are constantly changing, the expense of construction, repair, and maintenance relatively great. As the purchasing power of a shilling in Great Britain is not very much less than that of half a dollar here, it is claimed, with a fair show of reason, that the average American tariff, within a range of 6,000 miles, is not exorbitantly greater than the British tariff within 600 miles. Taking into account the half rate night messages, peculiar to this country, it would seem that the charges of extortion and the like, brought against our American lines, are but feebly sustained by fact.

It may be worth noticing, in this connection, that the English post office carries letters for one penny, delivering them with greater promptness and frequency than has been attempted here, and makes a profit of five million dollars a year. Our postal department carries letters for three cents, without delivery, except in the larger cities, and runs behind something over five millions a year, not counting the interest on the millions invested in post offices and other postal property. The English postal telegraph is a losing business. What might we expect of an American system?

It is urged that, under government control, the telegraphic business of the country would be more economically administered than now, making a corresponding reduction in the rates at least possible. It may be; still, our experience in the matter of canals and other government works does not offer much encouragement to this view, nor does the experience of those governments which have adopted the postal telegraph. The London office, for example, employs more than three times as many clerks and operators as are employed in the Western Union office in this city, to handle about the same number of messages daily. If messages were transmitted with a corresponding greater degree of promptness and precision, the increase of working force might be justified; but they are not. Already the complaint is raised that, while cheapness has been gained by the change from private to public management, the main advantage of a telegraphic message, speed of transmission, is, to a great extent, denied. Red tape has developed itself, as in all other government operations, and frequently a message is delayed for hours, waiting for the proper official to sign it.

As to the doubtful trustiness of private telegraph management, it is enough to observe that the fidelity of the companies to the secrets entrusted to their care certainly compares favorably with that of the post office; and it ill becomes a government responsible for the sins of the custom house and the revenue service to say much about possible breaches of trust on the part of men whose character is yet untarnished.

It is true that the newspapers are largely dependent on the telegraph companies. Would they be less dependent on the government if it should assume control of the wires? Are private companies more likely to tamper with news to suit their own purposes, or have they more purposes to suit than the government? We have the censorship established by France and Russia as a warning; and even without a censorship, the opportunity a government telegraph would have to make itself the only medium of public opinion, by discriminating against obnoxious journals, is not a matter to be lightly considered. Then the risk of government espionage, in private as well as political messages, is at once serious as well as inevitable. Think what mischief could be wrought by a few Jaynes and Sanborns as irresponsible telegraphic managers!

And here we touch the most serious objection of all to the proposed postal telegraph. Private management is pretty sure to put the right men in the right places. The incompetent and trustworthy are weeded out by an inexorable law of natural rejection. Could we expect the same under government management, with our complicated and corrupt civil service? The telegraphic service calls for special training and fitness for the work. So long as partisan zeal and election day services count for more than personal worth or business ability in securing official appointment, there is not much encouragement to expect any remarkable improvement in the personnel of the telegraphic system under federal control. Besides, the advantage of an increase of forty or fifty thousand in the army of political appointees, already too numerous, is not strikingly apparent, save perhaps to the party in power.

The Hubbard scheme avoids this difficulty in some degree, yet opens the way to other evils quite as objectionable. The partnership it provides for between the general government and the proposed Postal Telegraph Company is remarkable rather for the skill with which the profits are diverted to the corporation, and the risks and responsibilities to the government, than for any improvement it offers on the existing system. True, it promises a reduction in the tariffs, but any concessions of this sort are more than compensated by privileges and immunities demanded, the burden of which must necessarily fall upon the public at large. In other words, the multitude who rarely need or use the wires must be taxed to cheapen the telegraph for the few whose business or pleasure calls for frequent messages.

A MERITED HONOR TO AN AMERICAN ASTRONOMER.

The highest honor in the gift of the Royal Astronomical Society of England, a gold medal, has recently been awarded to Professor Simon Newcomb, Astronomer in Chief of the United States observatory at Washington, for his tables of Neptune and Uranus, and for other important and valuable contributions to astronomical science. Professors Adams and Cayley, Mr. Glaisher, Sir G. B. Airy, and many other eminent English astronomers were at the session of presentation, which took place at Somerset House, London.

The President of the Society, in his address, reviewed the earlier efforts of Professor Newcomb; and in reference to the above mentioned work remarked that it embodies results only attainable by the exercise of immense labor under the guidance of profound mathematical skill. Its title is "An Investigation of the Orbit of Uranus, with General Tables of its Motion," and it has been under the immediate supervision of the author for some fifteen years.

MACHINES TO MAKE PEOPLE HONEST.

Time was, when almost every stage driver in New York was known to abstract a greater or less share of all fares received, and his employer had no remedy and no sure means of detecting the rogue. But thanks to the ingenuity of the inventor, our Broadway Jehus have been transformed into honest men. They can't steal if they would. The patent money box, in which the passenger drops his fare, relieves the driver from the duty of handling the money, and consequently none sticks to his fingers.

On the street railway cars, the pilfering conductor although not rendered wholly honest, is considerably interfered with and his stealings reduced by means of the patent bell punch. He is required by the rules to punch a strip of paper for every fare received. The punch contains a bell, a dial numbering register, and a receptacle in which the punched bits of paper are received. The punch, paper, and money, are returned to the office by the conductor at the end of every trip. The dial pointer shows how many times the punch has been operated, and the count of holes in the paper, the punched bits within the punch, and also the money, should be all found to agree. Any discrepancy is at once shown. But this device does not fully answer the purpose of detection, because the conductor may take fares and not work the punch, especially in a crowd, without being observed.

The money box plan, is apparently the surest. There is a chance for some ingenious person to invent a portable box for conductors, which will be promotive of their integrity in crowded cars.

One of the latest dodges in this line comes to us from Constantinople. The driver or conductor of the car gives to every passenger a prize ticket bearing a number which is recorded on the company's books. A drawing takes place monthly, the company providing a certain number of prizes. We read of one passenger who lately drew a prize of \$100 in this way. The hope of drawing a prize makes the passenger careful to send in his tickets; and if the money returns of the driver or conductor are not equal to the number of tickets returned, there is a showing of dishonesty, and the particular culprits may be detected by comparing the return tickets with the records of the tickets issued to the several conductors.

THE PALACE OF MONTEZUMA.

The ancient palace of Montezuma, in the heart of the city of Mexico, where that unfortunate monarch was seized and made captive by the treachery of the Spaniards under Cortez, is described as having been a place of great magnificence. It was full of sculptured arches, pillars, and beautiful fountains. On the consummation of the Spanish conquest, it was converted into the Roman Catholic convent of San Francisco, and became one of the most wealthy and powerful religious institutions of the kind in the New World.

Church and State have, until within the past few years, been always united in Mexico; but a few years ago, under President Juarez, the Congress decreed a separation, and ordered the sale of all church property.

The [American Methodists bought the palace last year for mission purposes, for the sum of \$16,500, and, on last Christmas day, having cleaned up and repaired the building, it was publicly dedicated to Protestant worship. The walls are five feet thick, and it is built in the most strong and enduring manner. Much of the beautiful original sculpturing still remains, and it could not now be recut, it is said, for less than \$100,000. The Methodists have room upon the premises for printing offices, schools, parsonages, etc., and expect, one of these days, to make it the center of a very extensive scene of educational operations.

THE SUPPLY OF CARBON FOR GUNPOWDER.

It is a very remarkable fact that, with all the discoveries of modern chemistry in the field of explosive compounds, the old-fashioned gunpowder, made of saltpeter, sulphur, and charcoal, has, for the purpose of fire arms, large as well as small, been adhered to and found to be the best, safest, and most reliable of all.

The proportion of these ingredients is of course such that the oxygen required for the combustion of the charcoal is present in the niter, while the sulphur combines with its potassium. Theoretically, gunpowder should therefore consist of one atom each of niter and sulphur, and three atoms of charcoal, corresponding to the formula $KO, NO_3 + S + C_3$. Reducing this to percentage, according to the atomic weights, we have 75 parts niter, 11.77 sulphur, and 13.23 charcoal, which is very nearly the proportion of the best qualities of gunpowder, and is adopted for the Prussian army. Theoretically considered, the combustion changes this formula into $KS + N + C_3 O_6$, or about 40 per cent potassic sulphide, 10 nitrogen, and 50 carbonic acid; but experiments instituted in Austria, by burning gunpowder in small quantities at a time in closed vessels, revealed the fact that the products of combustion are much more complex, producing, besides carbonic acid gas and nitrogen, also carbonic oxide and traces of sulphide of hydrogen, about equal in weight to the solidifiable vapors, which consist of 64 parts per cent sulphate and sulphite of potash, and some 30 per cent carbonate and hydrate of potash; while 10 per cent unburnt carbon and 5 per cent niter were among the solid residue. It has, however, been objected, and not without ground, that the explosive combustion in mass in a gun produces results other than those of the gradual combustion to which the gunpowder was submitted in these experiments.

The strength of gunpowder is augmented by increasing the niter and charcoal, and diminishing the sulphur, of course within certain narrow limits; 76 parts niter, 10 sulphur, and 14 charcoal is the strongest powder, while 77.4 niter, 8.5 saltpeter, and 13.5 charcoal is the quickest; 62 niter, 20 sulphur, and 18 charcoal is slow, and "strains," as the workmen call it; it is capable of raising large masses, and therefore is used for blasting.

The temperature of the ignition of gunpowder is at least 3,000°, and the pressure exerted against the walls of the confining vessels is estimated at about 5,000 atmospheres, or 75,000 lbs. to the square inch.

The quality of the powder depends, of course, on two conditions, the quality of the materials and the manipulation, the latter being the mixing and graining. The object of graining is to afford an instantaneous passage of the flame through all the mass, by the interstices between the grains; and this effect is shown by the fact that meal powder will not explode powerfully. In regard to the materials used, it is easy to obtain sulphur in a condition of sufficient purity, or to purify it when necessary. The saltpeter, also, gives now no difficulty, although in former ages it was sometimes scarce; but since the discovery of the deposits of Chili saltpeter (nitrate of soda), and its easy conversion into common saltpeter, and the deposits of chloride of potassium in Germany, there is no longer any trouble. But with the charcoal, there is always a permanent difficulty. Ure, in his "Dictionary of Arts and Manufactures," says that: "Charcoal is considered by the scientific manufacturers to be the ingredient most influential, by its fluctuating qualities, upon the composition of gunpowder, and therefore it ought always to be prepared under the vigilant and skillful eye of the director of the establishment."

Experience has shown that willow, poplar, and dogwood are the best woods for making charcoal for gunpowder. They are burned in retorts, and care is taken to burn them not entirely black, so that some of the hydrogen remains in the wood. Analysis of the charcoal, found by experience to be the best adapted for gunpowder, has shown that it contains a much greater proportion of hydrogen than ordinary charcoal. It is not a little singular that we possess (in Western Virginia) an extensive deposit of a carbonaceous mineral, which has been called grahamite, and has the same composition as gunpowder charcoal. It is, like coal, a result of the carbonization of wood, but differs from coal, asphaltum, alber-

tite, and similar substances in its properties. It swells up when exposed to heat by the evolution of hydrogen gas, and is so exceedingly and powerfully combustible that the air in the mine where it is obtained, when charged with the dry dust of the mineral, has exploded like a mixture of air and coal gas. It has been proposed to use this mineral as a substitute for charcoal for the manufacture of gunpowder, as charcoal is very difficult to obtain in uniform quality, while of this mineral immense deposits are found, of perfect uniformity. Being identical with the gunpowder charcoal in its chemical composition, favorable expectations were entertained, which having been confirmed by some experiments proving it to make a most powerful blasting powder, the principal powder mill in the United States is now engaged in making powder with this material as one of the ingredients.

As gunpowder has been called the great civilizer, and nations which possessed one of its three ingredients have been envied, it is not a little remarkable that the United States should possess an inexhaustible supply of an excellent substitute for the only vegetable ingredient entering into its composition, about which there has always been some uncertainty and trouble.

OUR NAVAL EFFICIENCY.

To any one who has labored under the conviction that our navy, though small, is nevertheless, taking into consideration the class of vessels of which it is composed, of the highest possible efficiency, the reports of the late fleet drill in Florida Bay are especially discouraging.

A larger number of first class ships than ever before has been collected under a single commander are sailed around for several days; and as a result, we are informed that they, practically the cream of the navy, cannot maintain a speed of six knots per hour in company. In other words, if attacked by a squadron of fast foreign iron clads, they could not, if worsted, run away; or if falling in with swift sailing merchantmen, they could not catch them. In letters from officers of high rank, we find it stated, in brief, that our crack wooden ships are practically valueless, that they are loaded down with a mass of rigging which would hamper their efficiency in combat, and that, so far as the experience of the writers extends, the war vessels of the future should be swift steam rams, devoid of sail except such as is a necessity for their safety in stormy weather.

Another fact, equally unpalatable, is that in connection with the torpedo practice. During the course of the drill, the vessels were required to attack a floating target at a speed of four miles per hour and to explode torpedoes from the ends of booms rigged out for the purpose. Some ships fired their charges at the right time and smashed pieces off the target; more did not, and only succeeded in blowing up huge columns of water.

About the only fact evidenced was the absurdity of supposing that an enemy's ship would stand still or slow down to let a vessel stick out a long boom with a lot of rigging and a torpedo on the end, sidle up at the rate of a mile in 15 minutes, poke the torpedo carefully under her water line and fire it, when a single charge of grape at short range would smash boom, rigging, torpedo, and operators into fragments. Our ships were strictly limited to four knots speed, and the operations were supposed to be as closely as possible a reproduction of what would be done in action.

We spent millions, not long ago, for vessels which were to steam 16 knots per hour and carry powerful batteries. Their hulls may now be seen slowly rotting in the navy yards, or else altered into slow cruisers. "Isherwood's costly failures" is their generic name. We are maintaining a torpedo school, sending boards of officers to Europe to report, and trying new inventions of submarine warfare, and yet the first really practical trial of the efficiency of an important branch of the system amounts to nothing, and proves nothing except that an inventor is needed who will devise a new way of adapting the torpedo as an offensive arm to vessels of war.

THE PROPOSED IRRIGATION OF THE COLORADO DESERT.

Senator Jones, of Nevada, proposes soon to bring to the attention of Congress a scheme which, though of colossal magnitude and involving an immense expense, seems nevertheless to find a warranty in the vast benefits which, the projector considers, will be gained by the undertaking. Though great as it is: in these days when we turn continents into islands by canals as large as small rivers, when we burrow under mountains, and contemplate structures reaching almost to the clouds, when we alter river courses, and convert great tracts of swamp into available land: there is really nothing very startling in the suggestion of irrigating a great desert. The objective point of Senator Jones' plan is the vast waste known as the Colorado desert, which stretches from Lower California to Inyo county in the State of California, and from the base of the Coast Range Mountains to the Colorado River, comprising an area about 300 miles long by 150 wide. At their private expense, Senator Jones and a citizen of California recently fitted out a surveying expedition; and from the report of the engineers, it appears that the whole tract may be reclaimed by turning into it the waters of the Colorado River or of the Gulf of California. A large portion of this desert, we learn, consists of fertile soil which is a deep alluvium, susceptible to the highest cultivation. It is also shown that the prevalence of sand storms, hot winds, and deficient rain falls, evils suffered by the adjoining country as far north as the Tulare valley of California, is directly traceable to this arid expanse, from which, as from a great furnace, there constantly rises in summer a vast

column of heated air, without appreciable humidity. Thus the moisture of the rain-bearing clouds which are blown north-westerly during the summer months from the Gulf of California, is dissipated as soon as they reach the border of this superheated region, and they are prevented from reaching the dry but fertile plains of California beyond.

Mr. R. E. Stretch, an eminent civil engineer of San Francisco, in commenting on the report, points out that shells found on the surface of this desert prove that it has been at one time the bed of a sea, and at a subsequent period the bed of a fresh water lake. The shore lines of both sea and lake can still be seen and recognized in many places; and Mr. Stretch expresses the opinion that the Aztec civilization of the adjacent region in Arizona (of which there are so many traces) came to an end in consequence of the climatic changes caused by the evaporation of these vast lakes in Southern California, after the Colorado River had cut down its bed in the great cañon so deep that its course was diverted at Colville to a southerly direction.

The question is suggested whether these desert lands cannot be reclaimed by irrigation, and thus saved, instead of being totally submerged, as it is considered certain that covering them with vegetation would tend to prevent the evaporation of moisture, and at the same time act as a precipitant for whatever moisture the atmosphere may carry, or whether both plans might not be combined.

THE WHITEHEAD FISH TORPEDO.

For some time past, the European scientific and military journals have devoted considerable attention to the subject of the Whitehead fish torpedo. The secret of this invention, it seems, has been judged as of sufficient importance to warrant the expenditure, by foreign governments, of large sums for its possession. France paid \$40,000, Italy, \$42,000, and England, \$60,000; and so far as the trials instituted by the two former countries extended, the results obtained showed the device as of very high efficiency. The latest experiments conducted at Woolwich, by the English government, have, however, been less successful, and a destructive premature explosion has brought the torpedo both into greater public prominence and also engendered widespread controversy as to its value.

The secret of its construction, although heretofore well guarded, it appears, has leaked out; and from an English military contemporary, we learn that the apparatus consists in a fish-shaped body, twelve feet long by sixteen inches in diameter, with a compartment at each end closed by a bulkhead, and an engine room in the center some eighteen inches in length. The whole is constructed of malleable steel, three sixteenths of an inch thick and hammered upon formers. The motive power is compressed air, which is contained in the rear compartment and thence conducted to a little oscillating engine constructed on the compound principle.

The pressure is regulated by a powerful spring gage, the piston of which, descending, keeps a blast passing into the engine with tolerable evenness at about 600 lbs. to the square inch. The engine actuates a small screw propeller. There is an ingenious automatic steering arrangement, consisting of two balance weights suspended in the center compartment, so that, when the equilibrium of the torpedo is disturbed, these weights touch one side or the other of the shell, striking a lever which communicates with steering fans at the tail end. The fans are behind the propeller and act as rudders, so that, towards whichever side the torpedo heels over, the corresponding fan is set in motion, and corrects its movement by giving a contrary impulse. The explosive material is contained in the forward compartment.

The report of Commodore Kirkland and Master Berwind, of the United States navy, now before us, sets forth the performances of the torpedo during the trials conducted, a couple of months ago, by the Italian government. The main point to be determined was whether the fish would, after being lowered down several feet below the surface of the water in a directing tube, and then started, proceed in a direct line for several hundred feet. The result of the experiments proved that the torpedo would run 600 feet in 35 seconds, that is 10½ knots per hour, under 50 atmospheres pressure, and maintain its direction perfectly at 4 and 5 feet immersion, that it would run 4,500 feet at 7 knots per hour under 57 atmospheres with a slight deviation, that the device could be easily launched and accurately directed from an ordinary boat, and that changes of depth can be effected at the will of the operator, without impairing the qualities of the torpedo in any way. In conclusion, the reporting officers endorse the apparatus in the highest terms.

So far as we are able to judge from the account of the official investigation of the Woolwich explosion, the disaster was the result of inevitable accident, and does not militate against the invention to any grave extent, at least not to the degree which the *Army and Navy Journal*, in discussing the subject, presupposes; 319 runs of this description of torpedo had previously been without accident, and the apparatus which blew up had already been tried nine times. Its metal had been previously tested to 1,200 lbs.; and after the disaster, a fragment was subjected to a strain of 100,000 lbs., without flaw. It burst at 800 lbs. and while in a perfectly quiet state, the operators being engaged in oiling the bearings previous to starting. Dismissing this defect, therefore, as one due to faulty construction in but a single instance, it would appear that the Whitehead torpedo is thus far the most successful of any of the self-governing submarine offensive arms. The circumstances of the Italian tests were calculated to try the advantages of the invention severely, and that it went through them successfully is strong evidence of its efficiency.

[Continued from first page.]

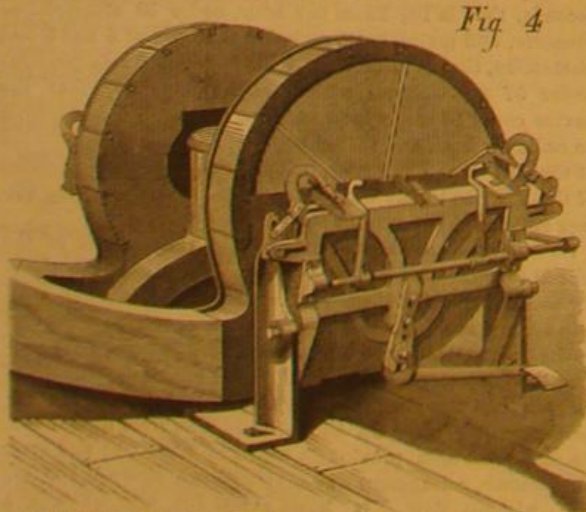
liquor casks, or other tight work. It is easily adjustable, and hence is well suited for acting on barrels of different sizes, and will, we were informed, truss with perfect evenness from three to five hundred oil, or from ten to fifteen hundred sugar or flour, barrels in a day. The manufacturers claim that it will do the work of twenty men, and require little or no repairs.

The barrel which we had followed through its various manipulations, now being leveled and trussed, was next passed to a machine which is unquestionably an invention of extraordinary merit and ingenuity. Our artist has represented it in Fig. 1 as it appears in operation, the moment selected being that just after a finished barrel leaves and a rough one enters. If the reader will notice the three casks on the skids in the foreground, he will observe that the edges are irregular, due to the varying length, etc., of the staves. Now, before the heads are put in, each cask at each end must be crozed and chamfered; that is, a groove must be cut around the inside, a short distance below the edge, while the latter must be beveled off. Besides, the ends of all the staves must be cut off perfectly true. Every one at all conversant with coopering understands that this work, when done by hand, is the most difficult and requires more time than any labor about the barrel; and this is even augmented when, in heavy casks, it is also necessary to cut a hovel, or wide semicircular indentation around just below the croze.

Some idea of the efficacy of the machine shown in Fig. 1 will therefore be formed when we state that it chamfers, howels, levels, and crozes a cask of imperfect periphery with the same exactness as if it were a perfect circle, finishes both ends at once, and runs off from 800 to 1,200 barrels per day with ease.

The barrel passes from the skids directly between the chuck rings, and its ends fit into the peripheries of the cog wheels which work within the former. The workman, in our engraving, is shown turning the wheel, which, through suitable gearing, governs the backward and forward motion of the right hand ring. The other chuck ring is stationary. As the barrel rolls into place the workman brings his ring up, thus confining it; then, by a pull of a lever, he throws a clutch into gear, which results in the rapid rotation of the barrel. Finally, by manipulating a third lever, he brings the cutters—which perform the above mentioned operations, and which are all fastened on two circular heads, the shafts of which are mounted on vibrating carriages and revolved by the two smaller belts represented—up against the inner edge of the barrel. One revolution of the latter and the work is done. The ring is drawn back and the cask rolled out, with the work of hours (by hand) finished in a few seconds. Each cutter head is controlled by a rest upon the outside, thus compelling a uniform thickness and depth of chime, while the same is leveled in a perfect manner. By proper sized chuck rings, any kind of barrel may be operated upon, and the change from one size of ring to another is very easily effected.

From this point, we were told, the rest of the work upon the barrel is best done by hand. We saw the casks, as they left the machine just described, pass to an elevator, and thence to an upper loft, where an army of men were busily putting on the hoops, setting the heads in place, and otherwise completing the labor. Barrels differ so much in shape that it would be hardly practicable, it is said, to substitute machinery in this department; but to the casual observer it does not seem impossible, in view of so many ingenious devices having already been invented for work which, not long since, it was thought impracticable to accomplish save by hand. A glance into a great store room, revealing tier after tier of barrels (twenty-five thousand in all, we were told), completed our stay in this portion of the factory; and descending to a lower floor, we were shown the device which forms the subject of our fourth figure. It is a combined fan



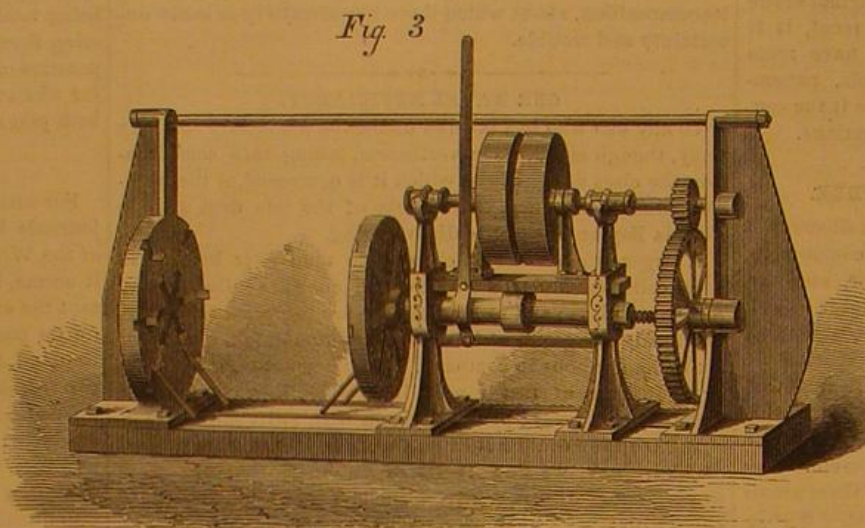
BARREL MAKING.—THE STAVE JOINTER, WITH FAN.

and stave jointer, that is, it holds the staves firmly and cuts the joints on their edges, leaving each piece in the proper form to take its place in making up the barrel. It was used in the establishment which we visited to rejoin staves which had their edges split, or which otherwise were imperfect. Its principal advantage is that, in addition to occupying but little room, it gives off no dust or shavings to create nuisances in journals and boxes, or to afford ready tinder for the re-

ception of stray sparks. All the debris is blown through suitable conductors to the fuel room. The apparatus works with great ease. When a stave is to be clamped, the stave holder is brought to bear upon it, and it is brought in contact with the jointer by the foot of the operator. As soon as the foot is removed, the clamp, by self action, releases the stave, and is ready for another. A stave, it appears, cannot become loose or move until the clamp recedes from the cutters.

Lack of space prevents our entering more in detail into these machines, or entering into explanation of other barrel making devices constructed by the manufacturers; suffice it to say that illustrations and descriptions will probably follow in these columns, of a variety of other machines for like purposes, made by the same firm, Messrs. E. & B. Holmes, of 59 Chicago street, Buffalo, N. Y. Parties desiring further information may address as above.

Cure of Rheumatism in a Horse by Electricity.
G. D. Powell, M.D., in the *Irish Farmers' Gazette*, de-

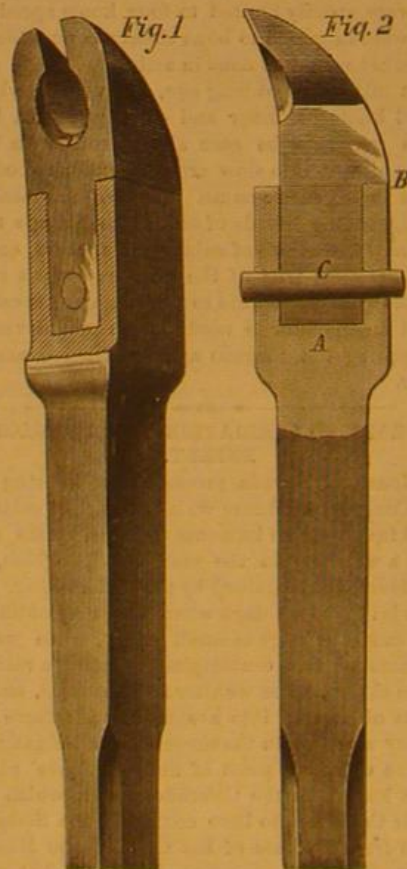


BARREL MAKING.—THE LEVELING MACHINE.

scribes the cure of a valuable horse by means of electro-puncture needles, from four to six being inserted in the principal muscles of the fore quarters, also along the spine and hind quarters. The battery employed was that of Leclanché, from four to twelve large cells, alternating in strength, and the current broken, causing the muscles to contract perceptibly. This was kept up from two to three minutes at each place. Prior to treatment, the animal was in so bad a condition that the owner was about to cause him to be shot. But within about six weeks after the commencement of the electrical treatment, the horse was perfectly restored, and is now sound and useful.

IMPROVED SPIKE BAR.

Railroad employees are well aware that bars for drawing spikes on tracks are very liable to become broken. The



point at which they usually fail is at the claws; and necessarily if one of the latter is destroyed, the bar is rendered useless until it can be repaired. This occasions much inconvenience and delay, but a remedy for the trouble is now offered in the invention herewith illustrated in perspective, Fig. 1, and section, Fig. 2, which consists in making the claws in separate pieces, and attaching them to the bar so that, if either claw fails, it can be removed and another quickly substituted.

The lever is formed with a square or angular socket, A, in its enlarged end, and the claws, B, are made with shanks which fit into and fill the space. Shoulders, B, are made

upon each claw to rest against the end of the lever. C is a pin which passes through a hole which is bored through the socket and through the jaws so as to cut a half circle from each shank. The pin is made somewhat tapering so as to be readily withdrawn.

The claws may be made in pairs to fit spikes of different sizes or to adapt the bar to other purposes, as may be desired. The pin, C, holds them in place and may be easily removed when it is desired to change them.

Patented through the Scientific American Patent Agency, October 28, 1873. For further information address the inventor, Mr. George Douglass, 19 Water street, Bridgeport, Conn.

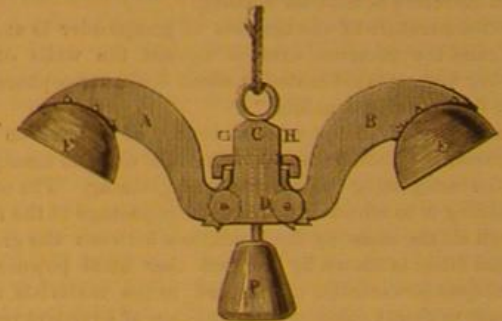
Peat Coal.

Kidd's process for carbonizing peat consists of a large chamber or drying room connected with a boiler which supplies superheated steam; from the boiler a steam pipe passes through the furnace, and from thence into the flue: the steam, in its passage over the boiler fire, becomes superheated, and, together with the smoke, passes into the drying chamber; the peat, cut into pieces about the size of bricks, is put into a framework which runs upon wheels, so that it easily runs into the drying chamber, and is run out again when finished, thus saving a great deal of labor. The object of Kidd's process is the collection of the heated gases of the furnace in a closed chamber, where they may be usefully employed in charring peat, or converting it into charcoal; artificial draft is created by jets of superheated steam, and the whole products of combustion from the furnace are forced into and retained by the closed chamber. The chamber is filled with peat, which may be dried and charred in less than forty-eight hours by the action of the furnace gases and superheated steam; the temperature of the chamber soon rises to between 300° and 400° Fah., and remains at some temperature between those limits. By charring the peat at a low temperature the loss of hydrocarbons is very small, the gases which are poured in-

to the chamber being for the most part non-supporters of combustion; consequently it is impossible for the peat to take fire during the process of charring. The fuel used in the furnace which supplies the gases and generates the steam is peat, which has been partially dried in the open air. It is estimated that a ton of peat charcoal can be produced by this method at a cost of \$3.25, which sum includes all charges for interest on capital, royalties, and labor, raw peat at 72 cents a ton that used for fuel, \$1.8 per ton. Peat thus prepared produced a gas of high illuminating power, ranging between 20 and 22 candles and 6,000 and 9,000 feet per ton; the gas is generated so quickly that three charges of peat can be worked off to one of coal, thus effecting considerable economy in the plant of gas works. The charcoal which remains after the gas has been extracted is also much more valuable than the ordinary coal gas coke. There is, no doubt, a large field open for commercial enterprise in the manufacture of peat charcoal, owing to its freedom from sulphur and its affinity for oxygen at a high temperature. It is equal to ordinary charcoal for refining iron, steel, and other metals, as a fertilizer, and for filtering water and town sewage.—*Chemical News.*

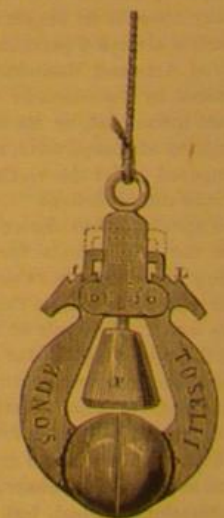
TOSELLI'S SOUNDING APPARATUS.

The *Revue Industrielle* reports the invention of the novel sounding device, represented in our engravings, by M. Toselli, an Italian engineer officer. It is composed of two



arms, A B, which are pivoted in the support, C, and which carry on their extremities cups, E F. The head, P, is fixed to a rod, D, which has a T shaped head, which, as represented in Fig. 1, drops down over the upper and curved ends of the arms and holds them open.

In using the device, it is lowered until the weight strikes the bottom, when the T head is caused to lift and free the arms, which fall by their own gravity. The depth of water is noted in the usual way, from the lead line; hence the particular advantage of this invention is that it brings up with it specimens of the bottom inclosed between the two cups, which meet as shown in Fig. 2. The T head on the weight rod, it will be noticed from the last mentioned engraving, drops, when the arms are closed, into notches on the upper end of the latter, thus securely preventing their opening.



STILES' IMPROVED CAR COUPLING.

The invention herewith illustrated is designed to couple cars together automatically, and to afford simple means whereby the mechanism may be readily adjusted for operation. The necessity which exists for improved apparatus of this description, and the general advantages to be gained by an efficient self-acting device, have already been fully detailed in these columns, so that no reiteration of the facts is here deemed necessary.

The present invention consists in an arm, A, connecting with a vertical rod, B, which leads upward through guides in the end of the car, and with a bar, C, which enters a groove in the block above the drawhead. The lower end of this bar is widened and inclined at its front portion, so as to force the upper end of the elbow frame, D, forward, and rise above it when the coupling pin, which is suspended from the arm, A, is to be pulled out. The lower extremity of the bar, C, then rests upon the elbow frame, as shown on the left of our engraving. This frame is pivoted to the drawhead at E, and is provided with springs at F, which pull its top back under the bar, C, as soon as the latter has been raised high enough to lift the pin out of the link and hold the same ready to let it fall when required. Below the drawhead, the frame, D, supports a plate, G, which rises a little above the bottom wall of the opening for the link, so as to hold the outer end of the latter up to enter the drawhead of the other car.

When the two plates, G, of the cars meet, the upper ends of frames, D, are thrown forward out from under bars, C. They therefore fall, and the pins, descending, slip through the link. It is proposed to have the rods, B, extend to the tops of freight cars, so that the brakeman on the roof can easily lift the pin and adjust the coupling.

Patented through the Scientific American Patent Agency, February 10, 1874. For further information address Messrs. Stiles & Carlow, Bloomfield, Davis county, Iowa.

A NEW MOTOR—THE ELECTRO-CAPILLARY ENGINE.

We extract from the pages of *La Nature* the annexed engraving of a curious machine which has recently been invented in France, and which relies for its motive power upon a natural force which, so far as we are aware, has never before been directly utilized to perform work. We refer to capillary attraction—the force which draws the oil up the wick of a lamp, to cite a homely and familiar example—and to the phenomena of which physicists have devoted no small amount of profound study. Although the laws governing this branch of science have been discovered and mathematical formulæ deduced in accordance with their workings, it has remained to devise a means to harness the force and compel it to drive mechanism. This means, the inventor of the present apparatus believes, is electricity.

There is a simple experiment which any one of our readers can perform for himself, and which will at once render clear the operation of the motor we are about to describe. Place a drop of mercury in the bottom of a glass and fill the latter with water slightly acidulated with sulphuric acid and also treated with a few drops of bichromate of potash. If now the mercury be touched with an iron point, it will be observed to contract quickly, and to take a new form, which it will maintain until the point be withdrawn, when it will resume its former shape. These alternate contractions and expansions, it will be found, can be made to succeed each other as rapidly as the point can be applied and removed; and when a large drop of mercury is used, they become so odd as to be quite amusing. It is the galvanic current which is produced by the iron, the acidulated water, and the mercury, which changes the force of the capillary attraction, for it is this power which, in the beginning, keeps the drop of quicksilver in its globular form and prevents it spreading or flattening out.

In our illustration, K is a glass vat filled with diluted sulphuric acid, in which are placed two smaller vessels, G, in which the mercury is placed. In each vase is plunged a bundle of glass tubes, B, all arranged vertically and open at both ends. Each bundle floats on the

mercury and is connected with a rod which carries a horizontal crosshead, U, from which extend downward other rods, which are attached to the extremities of the pivoted lever, A. The bundles of tubes, B, correspond to pistons, and by alternately moving up and down in their chambers, impart an oscillating motion to the lever, A, this to the frame, V, rod, S, crank, Z, and, finally, belt or fly wheel, R. The mechanism thus far clear, we pass to the mode of developing the power, and this a single element, D, of a Daniell battery. By means of the bent iron wires, e, the current is brought in communication with the mercury. If carried to both vessels together, it is evident that the change in both would be pro-

duced at the same instant, and equilibrium between them would result; but if so arranged as to be applied to each vase alternately, then it is clear that first one piston and then the other would be acted upon, and a vibrating movement of the lever, A, be the result. To effect this, the fly wheel, R, by means of the crank, z', is brought in connection with a commutator, W, which so governs the current as to establish or break it in either vase, on the same principle that the slide valve of a steam engine shuts off or admits steam. Then, by reason of the constant changes, is capillarity produced in the two masses; first one piston is lifted, then the other, and thus the apparatus is given a continuous motion. If, in place of the battery, a galvanometer be substituted, and

less a very ingenious device, and one which, perhaps, may prove a valuable suggestion for other applications of the same force.

SCIENTIFIC NOTES FROM THE FRENCH ACADEMY OF SCIENCES.

From the reports of recent sessions of the French Academy of Sciences, we glean the following interesting morsels of scientific intelligence.

France, it seems, has experienced an unusually mild winter. M. Tastes has investigated the matter and thinks that he has found a great atmospheric current crossing the country, which bears about the same relation to the atmosphere as the Gulf Stream does to the ocean. This current becomes displaced in longitude; and according as a given region is in the center or on the borders of the aerial flood, the winter is calm and mild or else visited with cold and storms.

Good results are communicated to the Academy from experiments in using acid tannate of protoxide of iron as a preservative of wood. The tissue on injection becomes thoroughly impregnated with a veritable ink, which prevents the destroying action of the weather. M. Monier sends some curious specimens which, though seeming to be very hard graphite, capable of scratching glass and even silex, are composed of sugar—the residuum after evaporating, probably—heated, away from the air, to a white red temperature. MM. Joly and Barbier suggest that the wires used for electric bells and similar purposes in buildings may be converted into fire detectors if they are simply coated with rubber as an insulator. The idea is that, where the wires of a circuit touch, on the heat melting the

rubber covering, the exposed copper will come in contact, establishing the circuit, and so sounding the alarms. M. Spinelli has constructed a balloon and proposes to ascend higher than 24,000 feet. He believes that pure oxygen, in a compressible state and mixed with the rare atmosphere at great elevations, will enable him to breathe without difficulty. In spite of the numberless preventives suggested, the phylloxera continues its ravages in the vineyards of France. The Minister of Agriculture and Commerce has recently appointed a commission to examine plans, and has offered a prize of \$4,000 for a means of exterminating the nuisance. M. Ballard announces that he has completed a long series of experiments of the action of water on lead, and concludes that water containing sulphates and carbonates, attacks the metal very slightly, while the effect of water charged with chlorides and nitrates is very plainly marked.

M. Cailletet has been investigating the question of the variation in volume, of a hollow glass cylinder when compressed from without or within. A tube of glass, 20 inches long and 4 inches in diameter, was broken under an exterior pressure of 77 atmospheres, half of which force, exerted from within, sufficed to rupture it. In using very thick tubes, equal to the resistance of 400 or 500 atmospheres, there is no permanent distortion of the glass.

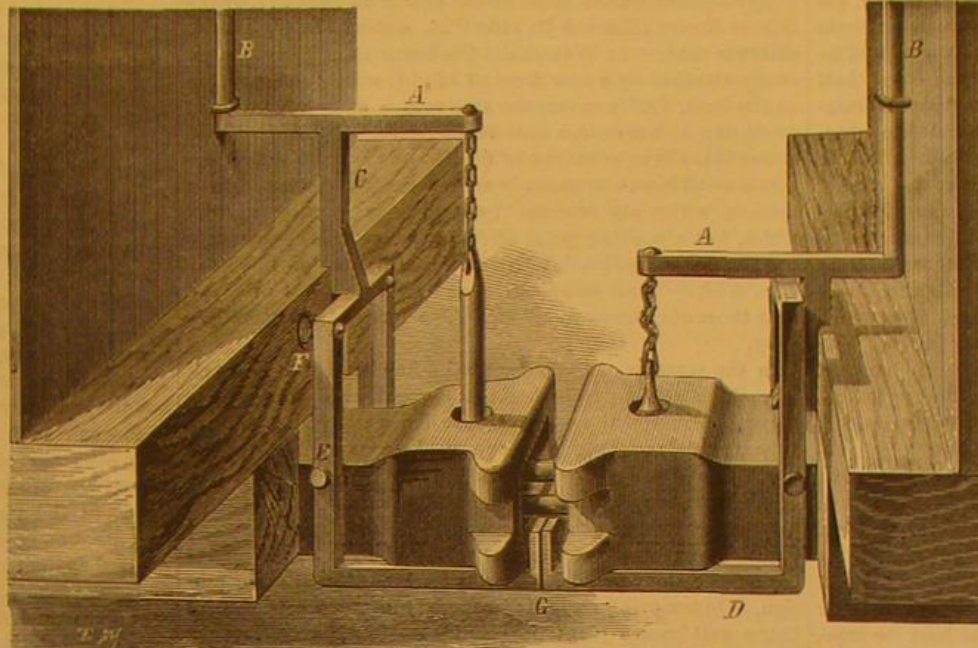
M. Vielean notes the discovery of some curious crystals of glass extracted from a furnace which had been cold for some time. They differ completely in aspect and form from devitrified glass, appearing in the form of isolated prisms, each some 0.03 inch in length. This composition is different from that of the normal glass of the furnace, as soda is absent, while magnesia is present in excess.

Simple Timber Preservative.

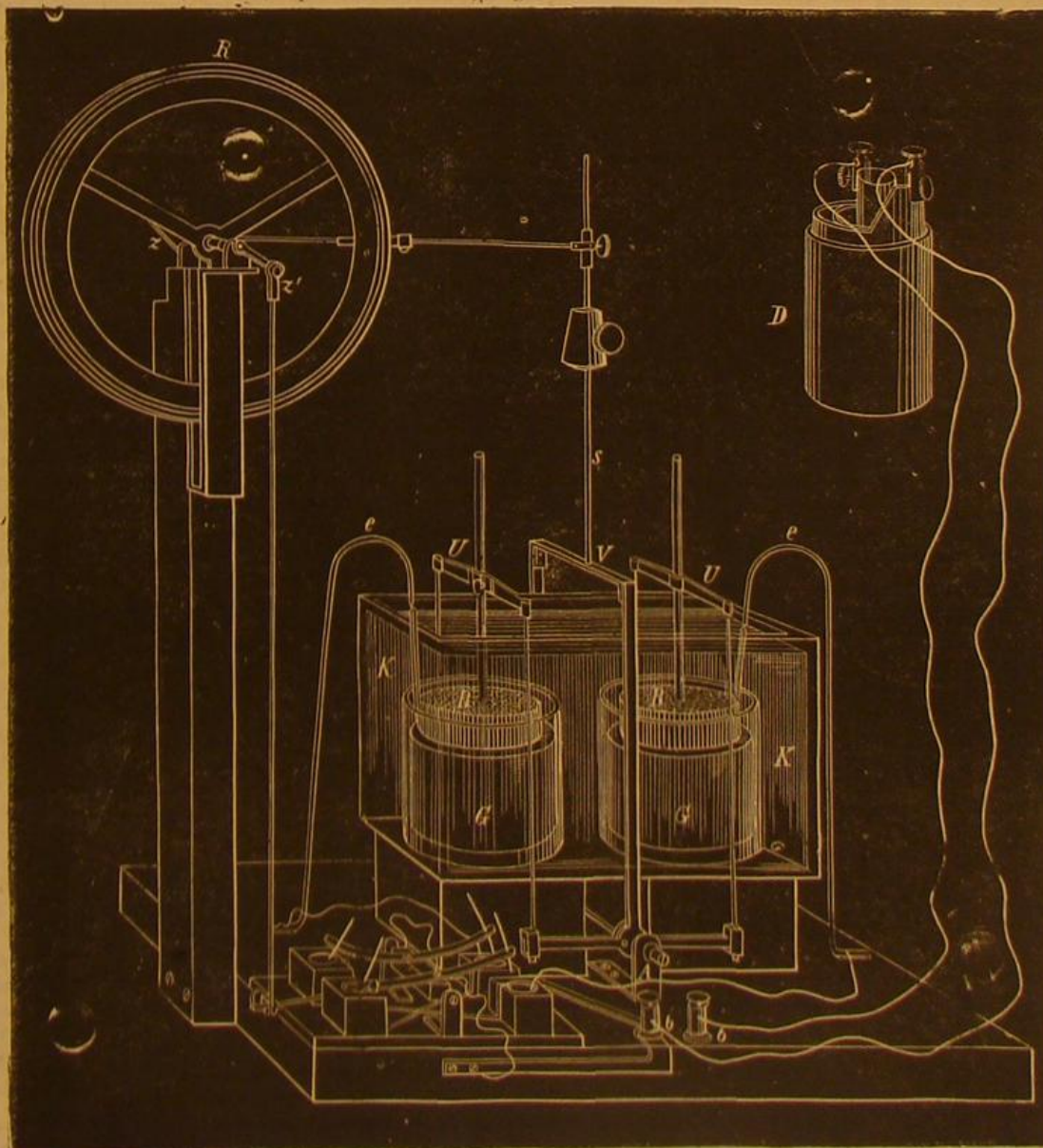
To render posts or timber, placed in the ground, practically impervious to moisture, and for a long time prevent decay, the following simple recipe has been tried and found to answer the purpose excellently. For fence and gate posts, it is particularly recommended:

Take linseed oil, boil it, and mix it with charcoal dust until the mixture has the consistence of an ordinary paint. Give to the posts a single coat of the mixture or paint before planting them, and no farmer, says one who has used it, living to the age of the patriarchs of old will live long enough to see the same posts rotten.

The posts or timber should be well seasoned and dry when the paint is applied.



STILES' IMPROVED CAR COUPLING.



THE ELECTRO-CAPILLARY ENGINE.

the wheel, R, turned by hand, the needle will at once indicate the existence of a current.

It is of course hardly probable that any amount of useful power can be gained from this machine, but it is neverthe-

Correspondence.

Ramming the Mold.

To the Editor of the Scientific American:

Having had considerable experience in the molding branch of the foundry business, I will endeavor to give your readers some information which will, if proper attention is paid to it, remove a great many of the annoyances that molders have to contend with.

As there is an endless variety of patterns from which the molds are made, it will be necessary to divide them into light and heavy work. Stove castings, as we all know, are very light. In the molding of such work, much depends upon the quality of sand used; the molder's heap should be composed of no more than one half loam, the other half being a very open sand. This makes a good strong mixture, which will not allow the sharp corners and fine ornamental work to be washed away when the molten iron is poured into the mold. In ramming such work, the molder should be careful that the sand on top and bottom of his pattern is not rammed hard; but the sides or edges should be well rammed, in order that the casting may not strain from having a soft parting. Great care should be taken to seeing that the bottom board is well bedded on the flask, after which it should be removed and the vent wire used freely. The venting of the work is often but partially done, on account of the point of the vent wire coming into contact with the pattern; and when the iron enters the mold, it finds its way into said vents, fills them up, and thus, in a measure, prevents the escape of the gas that arises from the iron coming in contact with the charcoal, black lead, or soapstone, with which the mold has been dusted to prevent the sand from adhering to the casting. The bottom board should then be carefully replaced on the flask, and dogged down so that, in the act of turning it over, it could not move, which would cover the vents over with sand. The top part of the flask (or cope, as it is termed by tradesmen) needs the same care in ramming over the pattern as the bottom, and should be well vented. If the mold has any high projections in the cope, they should be well vented; for it is at these elevated points that a large portion of the gas accumulates and needs a quick exit, in order to make sharp corners on the casting and prevent blowing. The strainings of castings in this branch of the trade is greatly due to an insufficient amount of weight being placed on the flask, or the parts not being properly dogged together, as well as to the rapidity with which the iron is poured into the mold, together with the height of the runner. Cutting short the supply of iron as soon as the runner is full, and a careful watching of the work to be poured, will, in most cases, remedy the trouble of the casting being thicker than the pattern.

As to the warping of the plates, much depends upon the quality of iron used and the judgment of the pattern maker. It can often be prevented in a measure by the molder, in making the runner from the round sprue no thicker than the piece to be cast; and, as soon as the metal is poured, by digging away in front of the sprue and breaking it loose from the casting. Where a flat sprue is used, this breaking off should invariably be done as soon as the runner is cool enough. It being wedge-shaped, with the small end of the wedge downwards, it lifts a portion of the casting in shrinking, and thus causes it to be out of shape.

In heavy work, care and judgment is needed, and it requires a man's lifetime to become proficient in. In ramming work that is to be poured on its end, having a height of three or four feet, there is no risk in well ramming the sand, for two thirds its height, around the pattern; and as you near the top, ram it as you would a pattern no more than a foot in thickness. The sand in all such work should be very open or porous, in order to prevent scabbing. As there is so large a quantity of iron used, much steam and gas is generated in the mold; and as there is no other way of escape for them but through the vents, there should be no fault in this particular part of the mold. In the pouring of such work, it is best to run it from the bottom. If a runner is used, do not raise the risers to correspond in height with the runner, as, by so doing, you increase the amount of strain on the mold; but form a little basin around the risers by ramming out the sprue holes with the finger; and on the side nearest the outer edge of the flask, form a lip for the surplus iron in the runner to run over on to the floor. When heavy work is bedded in the floor too much care cannot be taken in preventing the dampness of the ground beneath from striking through into the mold. The sand that is thrown out of the pit, if it has been of long standing, should not be used for the molding of that piece; for it is too cold and damp, and should be thrown on one side, and allowed to stand that it may dry and warm up. The two or three ladlefuls of iron, that remain in the furnace after the work on the floor has been poured, can be run into pigs in this sand, which will greatly help to fit it for immediate use. In the venting of heavy work, the small vents should terminate in a number of large ones, which should have an opening on both sides of the mold; then a draft would be formed to carry off the gas which is continually forming as the workman is in the act of pouring the iron into the mold.

All men connected with this branch of the trade have heard that sharp report which immediately follows the pouring of a large piece, the same being caused by the confined gas in the lower end of a large vent, there being no draft to drive it out. Where facing is used, much more care is needed in venting. In the making of large pulleys and gear wheels, too much care cannot be taken in this particular. I hold that not so much depends upon the ramming of such work as upon the venting for the proper exit of the gas from the

sand in the immediate vicinity of the mold; for if the mold has been rammed harder than there was any necessity for, and the venting has been properly looked after, there is not much danger of the casting being a poor one. Such work should invariably be run from the hub or center, with sufficient risers, arranged as above described. This branch of the trade is called green sand work, and it involves a large part of the art of ramming.

Newburgh, N. Y.

LEANDER CLARK, JR.

A New Beech Blight.

To the Editor of the Scientific American:

My attention was arrested by the article on page 371, of the *Science Record* (Munn & Co.) for 1874, stating that J. Köning observes that: "In Westphalia the beech trees have been recently attacked by a new form of blight, which, commencing on the bark, finally covers the tree with a snow-white down, producing sickness and sometimes death. The microscope shows this blight to consist of fine threads, among which occurs a small insect, apparently an undescribed species. These threads, which are secreted by the insect, consist of wax which has a melting point of 78° or 80°, and the percentage composition of which is: Carbon 81.39, hydrogen 13.58, oxygen 5.03. Both composition and melting point are very near those of Chinese wax," etc. The foregoing is literally a copy.

In the summer of 1857, I noticed a fine beech tree in a valley, which at first sight seemed covered, especially on the lower branches, with snow flakes, so dense and white did they appear; this novel sight, to one well acquainted with the beech tree (*fagus ferruginea*, Ait.) arrested my especial attention. Supposing it to be occasioned by some minute fungus, I cut off a lower branch for a closer inspection, when I noticed that the white incrustation was produced by a dense aggregation of cottony pellets, which had a kind of oscillating motion. On removing some, I discovered minute insects, similar to the well known plant lice (family *aphidae*), etc. It would seem that this blight is not so very new after all. Westwood figures the larva of the *psylla betula*, as also a winged specimen of the largest British species of *psylla*.

It is not my object, however, to enter upon a lengthy notice of a family comprised of very numerous and obnoxious species; but simply to put on record my own observations with regard to what I believe to be a native species, seeing that I met with them remote from introduced plants of any kind; no farm was within 2½ miles of the locality.

I would simply add that neither from Mr. Reilly, Mr. Walsh, or Mr. Harris could I learn anything further about this species, or if it were ever before noticed; nor would I have again thought of it but for the article in the *Science Record*, in which no description is given.

I hope to draw out more information on this subject, interesting to entomologists generally as well as those who cultivate the beech.

JACOB STAUFFER.

Lancaster, Pa.

Completion of the New Iron Bridge over the Saco River, Me.

To the Editor of the Scientific American:

Yesterday we received a telegram that the last span of the iron bridge over the Saco river, at Biddeford, Me., had been swung. As this has been a rapid piece of work, and well illustrates the advantages of the American system of building iron bridges—that of interchangeable parts and pin connections, as contrasted with the system of connection by rivets—we give you a brief description.

On January 20, the wooden bridge, 600 feet long, was burned down. On the 24th, the Eastern Railway contracted with the Phoenixville Bridge Company for 3 spans of 133 feet each and 2 spans of 100 feet each, to supply its place. At that time the iron lay in puddle bar. The drawings were made, the iron rolled, finished into shape, and shipped by steamer and rail to Saco, and the spans erected, ready for use, in forty days. The cost of the bridge is a little under forty thousand dollars.

CLARKE, REEVES & CO.

Phoenixville Bridge Works, Philadelphia, Pa.

Accidents by Car Coupling and Switches.

To the Editor of the Scientific American:

Your assertion, in a late number, that 400 men were killed on the Pennsylvania Central Railroad alone, in 11 months of 1873, is no doubt true. In our village alone, a man a month is slaughtered, besides numerous losses of hands and feet. The men who pursue this terrible calling are all in the prime of life and fullness of manhood. They go forth each day, knowing what their ultimate fate is to be, a terrible death, mangled almost out of semblance to humanity. Yet each one that is thus killed has a dozen ready to step into his bloody shoes. Can nothing be done to avert this slaughter? Have the hundreds of self-couplers ever had a chance for trial on any railroad? Not that I ever heard of. Yet surely some of them must have merits.

It is generally asserted that most of these men are killed by catching their feet in the frog. This is in no case true. The feet are caught at each end of the "guard rail," on each side of the frog, where the rail curves out, so the car wheels will not strike it. If a wooden block were placed in each end of this guard rail, large enough to keep the feet from being caught, yet so that the wheels would pass between it and the rail, these slaughters would be comparatively unknown.

Burlington, Iowa.

EXPERT.

THE American sleeping and hotel cars are now coming into use in England. A late number of *Engineering* speaks very flatteringly of a recent trial of Pullman cars on the Midland Railway.

[For the Scientific American.]

Why do Grindstones Burst?

In olden times, grindstones were always made with a square hole in the center, about six inches across, in which a square iron shaft was placed and the stone adjusted by means of wooden wedges, driven around the shaft with sufficient force to hold the stone securely in its place, and to resist the power applied to the shaft when dressing the stone off. This resistance at the edge, being equal to a lever purchase of half the diameter of the stone, has a tendency to burst the stone by the pressure, of the shaft in the eye of the stone, which is also frequently augmented by the swelling of the wood employed as wedges.

Bursting of grindstones was a common occurrence under these circumstances, happening sometimes soon after the stone was hung, but frequently after being weakened by wearing away a part of it. Grindstones are generally hung at nail works by means of two heavy cast iron plates with square holes and a heavy square boss cast on the outside. Four holes are bored through the stone near the corners of the eye, corresponding with the four similar holes in the plates, through which four bolts pass and fasten the plates securely to the sides of the stone by means of nuts. A square shaft passes through the center of the plates, and the stone is adjusted by means of eight set screws passing through the boss, and resting against the sides of the square shaft. This relieves the eye of the stone from any strain, but the tendency of the four holes in lines with the corners of the eye is to weaken the stone in these directions. A case occurred of grindstones having been burst by using cast iron plates with a square boss 4 inches long, cast on the inside of the plates and tapering towards the end, which was fitted snug into the eye of the stone; and the plates being pressed against its sides, the tapering boss acted as a wedge, and two stones were burst in this way before the cause was discovered. The best mode of hanging a grindstone is on a round shaft of wrought iron on which a collar is forged, with two cast iron plates of about one third the diameter of the stone in size and dished so as to bear on the outside edge only. A screw is set on the shaft and fitted with a heavy nut, by means of which the two plates are pressed against the sides of the stones, holding it firmly by pressure and friction alone and relieving the eye from all strain. A stone hung in this manner should not burst except by centrifugal force, caused by the stone being run at a very high rate of speed; but stones do burst even when hung so, and when not running at a dangerous rate of speed. As the bursting of a grindstone is always fraught with great danger to the workmen using it, and in its vicinity, it becomes of considerable interest to know the cause. Grindstones vary very much in the composition and in the manner in which their particles are held together. Some stones are composed of grains of pure sand, which have been pressed together with little or no cementing material, leaving numerous interstices among their particles. In others the particles of sand are cemented together with clay, rendering the stone much more compact and strong. A stone of the first kind, being porous, will weigh less to the cubic foot than the latter and will absorb more water when in use, thereby rendering it still less strong. The quantity of water absorbed by a stone of this character has been proved by actual experiment to be equal to 12 lbs. to the cubic foot, while in the closer and more compact stones it is but 5½ lbs.; so that, if a dry porous stone of 6 feet diameter by 12 inches thick contain 27 cubic feet, it will absorb 324 lbs. of water when in use; and when such a stone is allowed to stand over night a considerable portion of the water will settle in the lower half of the stone, while the upper, being exposed to a free circulation of air, will lose its water by evaporation and be left comparatively dry; so that, no matter how true the stone may be dressed, the effect when in motion will be the same as of a badly balanced fly wheel; and with a little increase over the usual speed, the tendency will be, of the wet side, to fly off from the rest of the stone, or in other words to burst the stone. A case of this kind recently occurred in New Jersey. A workman had been using a stone of this character for grinding sad irons. The stone being completely saturated with water over night, the following morning he started the stone (which was about 6 feet diameter by 1 foot thick); and after working a short time, had occasion to step aside for a few moments, when the stone burst, a quarter of it passing through the roof and lodging in the side of an adjoining building. Another struck a heavy driving shaft in front of the stone, and a third fell in the pit in which the stone was running. The usual speed of this stone was about 180 turns a minute, which it is supposed was somewhat increased by the absence of the grinder. The increase of the speed of an unequally balanced stone of a porous character caused it to burst. Great care should be exercised in examining a stone for defects before hanging it. This can best be done by washing off the sides and edge with water and a broom; and if any crack be discovered, the stone should be rejected. No part of a grindstone should be allowed to stand in water when not in use, as this would but increase the tendency to burst in the manner above referred to, besides causing a soft place.

J. E. M.

SLUGS AND SNAILS.—A correspondent of the *London Field* suggests an easy and, he says, most effectual way of getting rid of these garden pests, namely: Put small heaps of bran (about two handfuls) close to the plants which they destroy most, and then, about 10 or 11 o'clock at night, go round and put a handful of quicklime on each heap; the number of slugs found killed in the morning will be almost incredible. Slugs prefer bran to any fruit or vegetable, and will congregate on these heaps from all parts of the garden.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW SACCHAROMETER AND A MONOCHROMATIC SODIUM FLAME.

The new instrument invented by M. Laurent, of Paris, is composed of an ordinary bi-refracting prism for a polarizer and a Nicol for an analyzer. The latter is fixed, with a small Galilean telescope, on an alidade with which it turns. The novel portion consists in a thin plate of cloven gypsum, covering the half of a diaphragm, situated between the polarizer and analyzer. Placed between two Nicols, of which the principal sections are perpendicular, this plate gives yellow of the second order, corresponding to the D sodium line, either with white or with yellow light. If the Nicols have their sections parallel, with white light, the complementary color, a blue violet, is obtained: with yellow light, black. The plate of gypsum produces therefore in very simple manner the effect of a polarizer in two portions, of which the principal sections make to each other a certain angle; and moreover it permits, without complication, the rendering of this angle variable between 0° and 45°, a point of considerable advantage in practice; for on a liquid more or less discolored being given, the angle which will give the maximum of precision may be chosen.

In order to render the sodium flame quite monochromatic, it suffices to interpose between the flame and the polarizer a plate of bichromate of potash, a substance which has the property of absorbing the violet, blue, and a part of the green rays present in the sodium light, which diminish precision when it is desired to establish the equality of shades in giving different colors to the two portions of the diaphragm.

COMPARATIVE VALUE OF ARTIFICIAL ALIZARINE AND MADDER.

The Industrial Society of Mulhouse, France, have recently published a report on the effect of the introduction of artificial alizarine upon the consumption of madder. The employment of the former product is constantly augmenting, and it is manufactured on a large scale in Alsace, Germany, and Russia. It is believed, however, that the large demand will not effect the normal consumption of madder; or in other words, the proportion of pure madder used in the arts, before the introduction into commerce of extracts of madder, will remain unchanged. It is with these extracts that artificial alizarine comes in competition, but only to a certain extent; for while it produces violet shades of greater brilliancy and beauty, its red are inferior. In order to completely replace madder, another principle of that material must be present in the artificial product, namely purpurine, which furnishes fine orange reds, but of which at the present time even the chemical constitution is not definitely known. Hence it is considered that the best tints can be obtained by artificial alizarine and madder extract combined, employing the latter of the shade of red most closely approximating orange.

THE WILD PLANTAIN AS PAPER STOCK.

The Belgian Consul General in British India reports that the fiber of the wild plantain, found in great quantities in the Andaman Islands, has been successfully used in paper making. The directors of the Bally paper mills, in the above mentioned country, state that the material is worth \$40 a ton, and that they are purchasing it in quantities at that price.

DETECTION OF ACETIC ACID IN WINES.

M. Kissel says that, in separating acetic acid from wines by distillation, the acid may escape undetected, because it forms acetic ether with the alcohol. This inconvenience may be avoided by saturating the wine with baryta. The alcohol is then distilled off, and phosphoric acid added to the residue. On distilling again, the acetic acid is found in the distillate, and may be determined.

FRACTURE OF A FLY WHEEL.

At the Chatham Dockyard recently, the great fly wheel of the rolling mills steam engine, weighing nearly thirty-five tons, broke to pieces while revolving at great speed, and the fragments were violently hurled in all directions. No one was hurt. The second motion cog wheel, weighing several tons, was broken by pieces of the other wheel falling upon it, and most of the machinery was more or less damaged by the iron fragments. The cause of the disaster is not yet known, but it is supposed to have been a tooth of the great cog wheel breaking off and falling among the machinery. The extent of the damage cannot be known till all the machinery has been examined, but it will probably amount to several thousands of pounds. The accident will cause work to be stopped for four or five months. The loud report made by the wheel breaking was heard at some distance, and numbers of men rushed to the scene, fearing that a boiler had exploded.

A REMEDY FOR HYDROPHOBIA.

Professor Maisch recently presented to the Philadelphia College of Pharmacy a sample of *trompatilla*, a new remedy for hydrophobia, from Mexico, where it is said to have been successfully used in the cure of the terrible malady mentioned. It is administered in the form of a decoction. *Trompatilla* is obtained from the stems and branches of *Boucardia triphylla*.

LIFE OF ATLANTIC CABLES.

The Anglo-American Telegraph Company have contracted for an additional cable, to be laid by the steamship *Great Eastern* during the coming summer. The expense to the Company will be about \$2,500,000. The company now has four cables on the bottom, one of which, the cable of 1865, failed last year. From the fact that the company, instead of repairing that cable, is now about to lay a new one, En-

gineering concludes that repair is useless, and that the life of an ocean cable, of the kind used by the Company, is only seven years.

ADULTERATIONS OF COFFEE, TEA, AND PEPPER.

At a recent meeting of the Chemical Society, London, Mr. J. Bell gave some interesting particulars about the adulterations of these articles.

The adulteration of coffee can only be successfully accomplished after it is roasted and ground, but has, perhaps, been carried to as great an extent as in almost any other article of food. A very simple way of detecting the presence of chicory in coffee is to sprinkle a little of it on the surface of water in a test tube or wine glass, when each particle of chicory becomes surrounded with an amber colored cloud, which spreads in streaks through the water until the whole acquires a brownish tinge; with pure coffee, however, no cloud is produced until the lapse of about a quarter of an hour. Another method of detecting adulteration is by the depth of color obtained by the infusion of a given weight of the suspected article in water, and by the density of the infusion. The use of the microscope, however, is indispensable. The ash of coffee, remarkable for the minute quantity of silica it contains, and for the absence of soda, afforded a valuable indication of its purity.

ADULTERATIONS OF TEA.

Tea is adulterated to a very large extent, not only with leaves of various kinds, including exhausted tea leaves, but also with inorganic substances, such as quartz, sand, and magnetic oxide of iron; these latter substances are rolled up inside the leaf, and one sample of green tea examined was found to contain no less than 20 per cent of quartz and 8-6 of the magnetic oxide. The latter may readily be separated by grinding up the tea and removing the magnetic oxide with a magnet. The facing employed for green tea usually consists of French chalk and Prussian blue. In the preparation of exhausted tea leaves, they are rolled up with gum water and then dried, catechu being added in some cases to restore the astringency. The article known as the "maloo mixture" consists essentially of exhausted tea leaves. In searching for the presence of leaves other than those of the tea plant, the best method is to heat a small quantity of the suspected tea with water until the leaves are sufficiently softened to admit of being unfolded. They should then be spread out on a piece of glass and carefully examined as to the nature of the serrations and the character of the venation, also the appearance of the epidermis and the stomata, and the peculiarities of the hairs as shown by the microscope.

ADULTERATIONS OF PEPPER.

The two kinds of pepper, known in commerce as black and white pepper, are derived from the same plant, but differ in the latter being bleached, or having the husk removed by washing; but neither kind can be adulterated with success before it is ground. The most common adulterants for ground pepper are linseed meal, the husks of mustard seeds, rice, bean and pea meal, and the flour and bran of the ordinary cereals, ground chillies being added to restore the pungency. Some of these substances can be readily detected by diffusing the pepper in water, and pouring the mixture on to a muslin sieve. The deep red particles of the chili can then be recognized, and also the camphor-like fragments of rice. The mustard husks are known by their cup-like shape, while the smooth, shiny appearance of the linseed readily distinguishes it from the dull brown of the pepper.

RECENT SCIENTIFIC PROGRESS IN EUROPE.

Sir G. B. Airy, Astronomer Royal and President of the English Royal Society, in the course of his address announcing the distribution of medals of that learned body to various eminent scientists, took occasion briefly to review recent events in the progress of Science, especially in Europe. While the discourse omits many discoveries and indeed lightly passes over all, as a necessary consequence of its synoptical form, it nevertheless mirrors sufficient of the doings of the past twelve months to be both interesting and valuable as a retrospect. We need not remark that, by reference to the volumes of our journal, many of the discoveries and researches noted will be found in fuller detail. Those ascribed in the following paragraph to English investigators constitute the principal communications to the Royal Society.

In astronomy, Messrs. Lockyer, Seabroke, and Huggins, have made extensive observations of the chromosphere and solar protuberances. Lord Rosse has produced a very complete treatise on the radiant heat of the moon, with all the modifications dependent on the lunar phases, and on the absorption produced by our atmosphere at different lunar altitudes. In oceanic science, Wells has found the unlooked for fact that the sea on the coast of Spitzbergen is warmer than on the opposite coast of Greenland.

Commander Wharton has verified the existence of a current running from the superficial waters of the Black Sea, through the Bosphorus and Dardanelles, that is met by a deeper current setting in the opposite direction. In biology, Messrs. Bastian, Ray, and Lankester have made important observations on life in organic infusions. In paleontology, Professor Williamson has examined the structure of fossil plants in coal, and Professor Owen has extended his investigations of fossil Australian mammals. In botany, the most complex arrangements of leaves about a mother stem have been reduced to the primary formation of leaves ranged in two opposing directions by simple mechanical considerations. In chemistry, various analyses and experiments have been produced, but no new general principles established. In optics, Stearn and Lee have described

the effects of pressure on gases, by the alteration of the character of the spectra. In magnetism, some interesting facts have been adduced, relating to the magnetic influence in large iron tubes, such as tubular bridges. In mechanics, Sir W. Fairbairn has contributed valuable information on the durability of iron ships and strength of riveted joints, and Captain Galton has devised a mechanical apparatus which shows to vessels the best course to pursue.

The progress made elsewhere in Europe, President Airy sums up as follows: In astronomy, Leverrier has completed his theories of Jupiter and Saturn. Vogel and Plummer have verified Huggins' discovery, by the spectroscopy, of the traces of carbon in the composition of comets. Huggins has examined seven nebulae, in order to discover whether their apparent movement be toward or away from our system. The research was facilitated by a coincidence of a spectral line of the nebulae and a line in the spectrum of lead. The results indicated no appreciable motion. Father Secchi has remarked the sudden appearance of a brilliant point in the sun, which gave the spectrum lines reversed, indicating an ignition with a distortion of the lines, showing that the igneous mass was approaching us, in other words, that an explosion had taken place. Preparations by the various governments have been made for observing the coming transit of Venus, and by some German astronomers for observations of Flora, for measuring the solar parallax.

In geodesy, MM. Cornu and Baille have computed by experiment the mean density of the earth to be 5.56. In France, preparations are being made to repeat the observations of the great circle of the meridian.

In geography, the Challenger expedition may be noted as eliciting many important additions to our knowledge. Young's Congo expedition has explored the African continent in the neighborhood of the Congo river. A Swedish arctic expedition, blocked in the ice all winter, at the northern extremity of Spitzbergen, has been rescued. We have recently published an extended paper on geographical progress in 1874, to which the reader is referred for a fuller record of progress.

In anatomy, the most remarkable labor is the experimental discussion of the action of various portions of the brain, by Professor Ferrier.

In natural history, the works of Buller on New Zealand and of Viscount Walden on the Celebes, have added greatly to our knowledge. The new aquarium at Brighton, England, has also been the means of valuable observations of habits of marine animals.

In paleontology, Professor Von Brandt, of the St. Petersburg Academy, gives the results of a long series of observations on the cetaceous fossils of Europe, a work which may form a supplement to Cuvier's great treatise. Dr. Burmeister, aided by the public museum of Buenos Ayres, has almost entirely reconstructed the extinct species originally indicated by the names of *tozodon*, *glyptodon*, and *macrauchenia*. Professor Owen has continued his reconstruction of extinct birds of New Zealand, and has discovered traces of a huge bird without wings.

In medicine, improved methods have been adduced for the study of contagious diseases, and for the investigation of "nervous storms." The spectroscopy has been largely introduced into medical jurisprudence, and in surgery much valuable progress has been made.

In botany, Drs. Hooker and Bentham have continued the preparation of their catalogue of all known flowering plants, and the latter author has further prosecuted his studies of Australian flora. Considerable discussion has appeared as to the question of whether lichens are or are not parasites of a more simple form of algae. Much attention has been given to the bacterides, and their supposed influence on the production of putrefaction. The mode of reproduction of fungi has been the subject of much examination and speculation. The curious fact has been discovered that the movement of the leaf of the *dionea muscipula* produces electric phenomena analogous to those which accompany the motion of a muscle.

In chemistry, President Airy says that no fundamental theory has been announced, except in the doubt expressed, whether the existence of four isomeric lactic acids, in appearance demonstrated by Wislicenus, agrees with the actual theory of organic chemistry.

In optics, a new determination of the rapidity of light, by M. Cornu, shows the velocity in a vacuum to be 546,700 miles per second, mean solar time. Quincke in his experiments on diffraction has demonstrated that there is often an unexpected accompaniment of polarization.

TO NEW SUBSCRIBERS.

The present number (13) completes the first quarter of the year. It has been our custom to commence all subscriptions at the beginning of the year and to send the back numbers from the first of January. Hereafter the paper will be sent from the date of receipt of subscription; but to those who wish them, the back numbers from the commencement of the volume will be furnished, and the subscription dated from the first of the year.

EXHIBITING PHOTOGRAPHS.—The effect of photographic transparencies in the microscope, as well as on the screen, is greatly improved by placing a pale blue glass in the path of the illuminating beam. This corrects the brown or "foxy" tone which they too often present, and gives depth and richness to the shadows.

GOLD may be hammered into sheets so thin that 282,000 of them, placed one above the other, will only occupy the height of one inch.

IMPROVED DIAGONAL PLANER.

To mechanics familiar with the ordinary form of wood planing machinery, the only feature in the device herewith illustrated to which attention need be directed is the position of the cutter head, which, instead of being at right angles to the longitudinal axis of the apparatus, is placed at an inclination of about 45° to the same.

The inventor claims that, by this arrangement, surfaces presented by knotty cross-grained lumber, and by made up articles such as doors and blinds, are planed much more expeditiously and thoroughly, and with a saving of half the power required to turn the machines having cylinders at right angles.

Our engraving is prepared from a photograph of the apparatus in use in a factory at Whitehall, N. Y., which, we learn, is constantly in operation, smoothing doors and blinds at the rate of 500 per day. The articles are made up either of unsurfaced or surfaced lumber, and, after being glued together, are run through the machine in the same way and as easily as ordinary timber. It is stated that a boy, able to handle the doors, can pass fifty per hour twice under the cutters. The surface left upon the wood, it is claimed, is much smoother than is produced by ordinary planers, and hence labor and time are saved in finishing.

The frame of the machine is of iron. There is one set of six inch iron feed rolls and expansion gear. The diagonal cutter head is shown at A, and the cutters, three feet eight inches in length, make 3,500 revolutions. Motion is communicated by pulleys on a countershaft either over or under the apparatus, which must be detached from the latter on account of the angle of head and feed. A 2½ inch belt runs the cutter head, and a 2 inch belt actuates the feed, trimming, and jointing portions. The trimming saw, B, which cuts the wedges simultaneously with the smoothing operation, is shown, in the engraving, on the side of the machine close to the feed rolls. The capacity for work is stated as fifty 2 feet 6 inches by 6 feet 6 inches doors per day, and the cost of the operation is claimed to be less than one fifth that of hand labor. The inventor estimates that, if the machine be kept constantly in operation, its savings will be at least \$30 per day of 10 hours.

Parties wishing to manufacture these machines for the proprietor of the patent, or on royalty for general trade, will address W. R. Norris, 115 West street, New York city.

THE QUICK SIGNAL RAILROAD LANTERN.

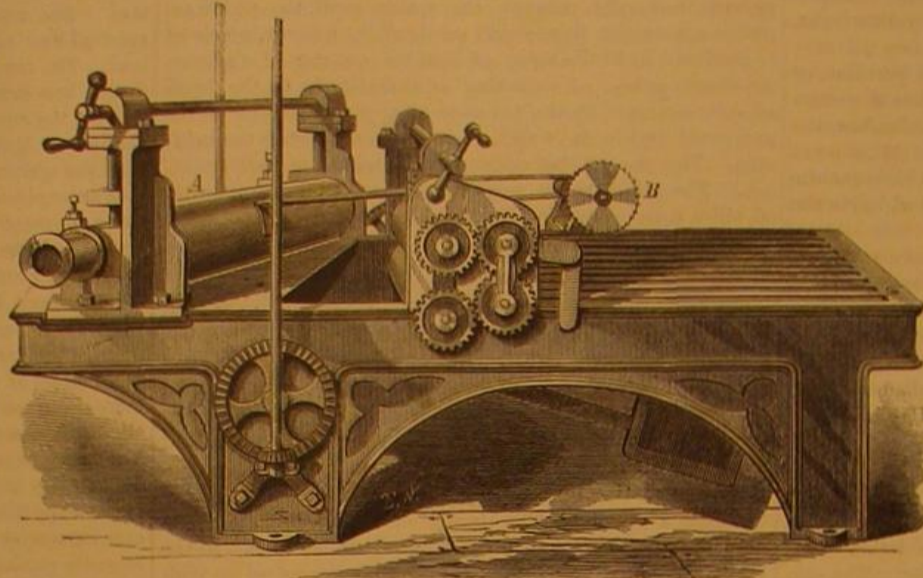
Not many months ago, a night train on one of our Eastern railways was interrupted in its progress by a serious obstacle in its path. Hardly had the nature of the difficulty been apprehended, and fairly before time had been given to consider a means of surmounting it, the unexpected sound of a swiftly following express was heard. The next instant the head light of the locomotive appeared around a curve. The conductor and brakemen of the stopped train were forward. Each realizing the imminent peril, instinctively sprang for a red light to make the danger signal, but too late. The colored lanterns were in the baggage car, in the rear, in fact everywhere but in their hands. In the few inevitable seconds of delay, the approaching train thundered over the intervening distance and crashed into the rear cars, scattering destruction and death. Fire added its horrors to the calamity; the slaughtered were numbered by dozens, and the loss of property measured by hundreds of thousands of dollars; and this because a single ruby light was not at hand at the instant it was needed.

Instances of this description might be readily multiplied; and possible cases, the imagination requires but little exercise to suggest. A switch tender, for example, suddenly discovers a rail broken, or that his switch mechanism has become clogged and refuses to operate. Not expecting any such circumstance, he has left his danger light in his station house; a lightning express may, at that instant, be due. The man has no time to go for his lantern, perhaps one or two hundred feet distant; down comes the train, and in a few moments a fearful accident has taken place. It might be supposed, in view of such facts and possibilities, that long ago railroads would have adopted some device which would render the presence of a danger signal in the hands of every employee on duty not merely obligatory, but as much a necessity as carrying of the ordinary white lantern. But there is no such invention at present in use. Separate lights are adhered to, and those on which the safety of life and property depend are still left here or there, in positions which, at one moment handy, may, at the next, be the most inconvenient and inaccessible.

We have lately had brought to our attention a new form of railway lantern which meets all the requirements indicated in the above lines. It is an invention which absolutely insures the carrying of a red light by every individual in

whose hands is the common lantern. In other words, it is an arrangement whereby, in a fraction of a second, a white may be changed to a ruby light, and vice versa, and this by mechanism so simple that failure is practically impossible. The details of construction will be readily understood from the annexed engraving.

A, in Fig. 1, is an inverted cup of ruby glass surrounding the flame of the ordinary lamp and, of course, having an opening above for the escape of smoke, etc. This cup rests upon a small circular metal platform, B, Fig. 2, and is held in place by a wire spring, C, Fig. 3, catching on its rim. The platform, B, is movable, and has an aperture in its center for the wick tube. To its under side are attached rods which



NORRIS' DIAGONAL PLANER.

pass down in short tubes extending through the body of the lamp, as shown in section in Figs. 2 and 3. To the extremity of the rods is hinged a prolongation or handle, D, the ends of which are connected. The reader has doubtless already divined the operation of this simple contrivance. Ordinarily, when the piece, D, is folded over against the bottom of the lamp, the upper extremity of the wick tube extends a little above the ruby glass envelope, as represented in Fig. 3. The lantern is then a simple white light. If now it be desired to show a red illumination suddenly, the operator merely grasps the piece, D, bends it straight, and pushes it up. He thereby raises the ruby glass so as to cause it to inclose the flame completely, the parts become as shown in Fig. 1, and the danger signal is ready for instant service. There is one more point of construction which requires notice before passing to a more careful consideration of advantages, and that is the locking mechanism, at E, Fig. 4, which holds the lamp firmly in the body of the lantern. This is an ingenious little automatic device, the subject, by the way, of a separate patent, and consists merely of a bolt, having a T head at its lower

“have money in them.” Hence the following brief calculation: A road, let it be supposed, uses 4,000 lanterns, of which 1,000 ruby ones is a fair proportion. It is proposed to substitute 3,000 lights of the form we have described, which serve already a double purpose. What is to be made by the operation? 3,000 common white lanterns cost about \$3,000; 1,000 ruby lanterns cost \$1,750. Oil for 1,000 ruby lanterns, at \$15 per year each, \$15,000. Total, \$19,750. Cost of improved lantern, \$2 each. Total, \$6,000. Balance in favor of improvement, \$13,750 per year.

Having thus, we think, sufficiently indicated the merit of this invention as a preventive of accident, and having shown its direct money value, a few minor though important advantages remain to be noted by way of conclusion. And first, the red light thus arranged gives a much greater illumination, one of three times the intensity of the common ruby lantern, the inventor tells us. This is probable, from the fact that the clear glass shade serves to diffuse and reflect the rays while not obstructing them; whereas, in the large shade of entirely dark glass, little more than the strong direct rays from the flames reach the eye, the others being absorbed in traversing the colored medium. At a certain distance, for instance, where simply a dot of red flame is seen in the ordinary lantern, this device would appear as a ball of red fire.

The fittings and construction of the lanterns generally are of improved description, and are of durable and strong material. The probabilities of breaking the red glass are, of course, much less than those of injuring the large red shade of the common form of signal; while, in event of such happening, the small cup can, necessarily, be much more cheaply replaced.

The inventor informs us that the invention has been ordered for use by every railroad to the managers of which its advantages have been exhibited. In order to afford a full examination, a single lantern will be sent by express, as a sample, to every road desiring to test it in actual employment. Further particulars may be obtained by addressing Mr. E. W. Taylor, sole agent, 271 Pearl street, New York city.

Caviare.

This is an article of food prepared from sturgeon roes, and is extensively used in Russia, where it is considered a great delicacy. The preparation of this food has been begun in this country; and as our supplies of the fish are very great, the new industry promises to become important.

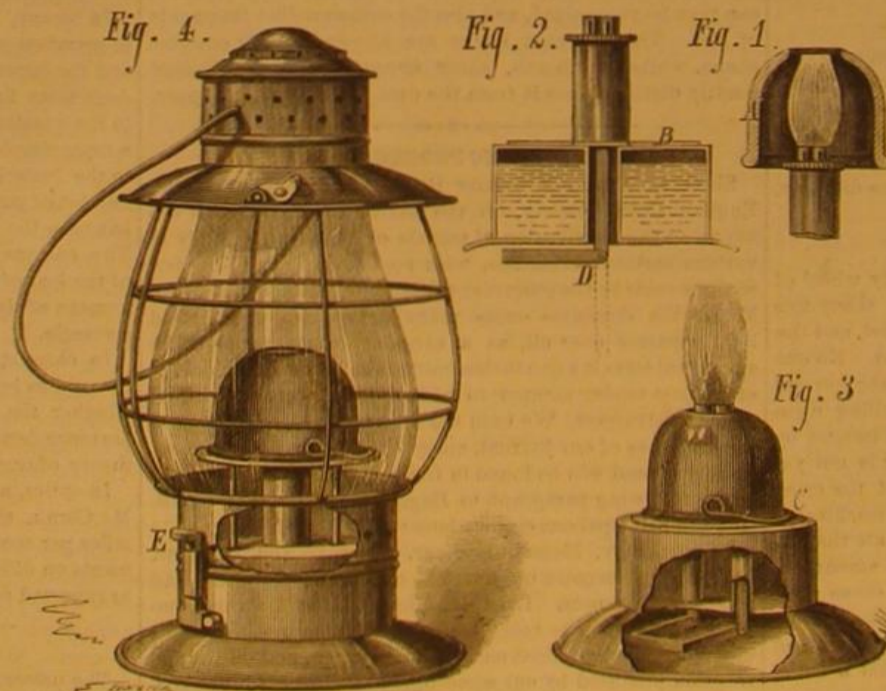
Some firms on Lake Erie have undertaken the utilization of the sturgeon, receiving immense numbers from various places on the lakes. They smoke the flesh, which is cut up into strips, and prepare the roe.

There are many peculiarities connected with the treatment of the sturgeon roes and their conversion into caviare; and it may be of some service to those interested in the trade to

know how this is prepared in the White Sea and the Caspian, the headquarters of the business. According to Mr. Alexander Schultz, two kinds are made; one fresh or grained, and the other hard or pressed. In both cases the roes are placed upon a web or network, with narrow meshes, forming a kind of sieve stretched over a wooden hoop. Possibly a fine wire gauze would answer a still better purpose. The fish eggs are then forced through the meshes by pressing the white mass lightly, until nothing is left on the upper surface but the cellular tissue, the fat, and tendons. The eggs fall into a wooden receptacle placed beneath, and are next sprinkled with very fine salt of the best quality, the mass being stirred with a large wooden fork having eight or ten teeth. The quantity of salt necessarily varies, according to the season, from 5 to 1½; that is to say, in the month of August 3 to 5 pounds of salt are used to the pound (36 pounds) of roes, and 1½ to 2½ in the winter. The less the caviare is salted, the more it is esteemed.

At first the eggs, mixed with salt, exhibit a pasty appearance when stirred; but after each grain is thoroughly impregnated with the salt, the mass swells; and when stirred there is a slight rustling, similar to what would be the case in the stirring of fine particles of glass. This is a sign that the preparation is complete. The caviare is then placed in casks of linden wood, which imparts no unpleasant taste, as might be the case with most other materials.

To prepare the pressed caviare, a tub half filled with pickle, more or less strong with salt, according to the temperature of the season, is placed in the network. To secure a thorough impregnation of the eggs by the pickle, the mass is stirred with a wooden fork, turning it always from the same side. Then the eggs are strained out, and, when thoroughly drained, a quantity of about 100 pounds is placed in a sack and subjected to the action of a press, in order to remove all of the pickle, and convert the whole into a compact mass, as curd is converted into cheese. In thus preparing the caviare a number of the eggs are broken, and a portion of the contents runs off with the pickle, so that for each pound there is a



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extremity. The projection on the lamp is slipped into a right angled slot on the cylinder, first up, then to the right. As it is pushed upward it raises the bolt, then, on being turned, slides along its lower side, until the extremity of the horizontal part of the slot is reached. The bolt by this time is cleared, and, being no longer supported by the lug, falls back by its own weight, and locks the latter in place. The advantage of this is that the lamp can be inserted in an instant by feeling alone; and once caught, it is rigidly secured.

It is perfectly well understood by the inventor that, in order to insure the attention of users, of any apparatus which has been long and exclusively employed, to the merits of a new device, designed as a substitute, the novelty must be shown to have, not only great advantages, but advantages which will be productive of increased economy, in a word, that

loss of 10 to 12 pounds. After removing the pressed caviare from the box, it is placed in casks, holding about 30 pounds, the interior of which is lined with napkin cloth, on which account in commerce this always bears the name of "napkin caviare." The better quality of the pressed caviare, that is to say, that which has been less mashed and salted, is placed in narrow, cylindrical cloth bags, and it is then called bag caviare. Caviare is also transported in boxes of tin, hermetically sealed. Fresh caviare is always preferred to the pressed, but is more expensive. Thus, at Astrachan, fresh caviare is worth from 30 to 35 roubles the pound, while the pressed is worth only 24. It is much more profitable to prepare the green caviare than the pressed, as it brings a better price, takes less salt, and requires less labor. There are exported every year from Astrachan about 11,000 pounds of caviare, which goes especially to Berlin, Dresden, and Vienna.

In commerce, the caviare from the roe of the Belouga sturgeon (*acipenser huso*) is more esteemed than that from the *a. stellatus*. The best of all is that of the sterlet (*a. ruthenus*); but this scarcely enters into commerce. The different kinds of sturgeon have roes differing in size, this depending upon the quality of fish, the season, and the particular place of capture. The roes of sturgeon which are taken in the sea, between the 8th of July and the 15th of August, are allowed to remain only a few hours in the pickle, and they are then removed, and placed, without being pressed, in casks of 5 to 10 pounds. If, on touching the roes, they are found to be tender, and the ovaries have already begun to decay, the roe, ovaries and all are thrown into the pickle, so that the whole may be impregnated with salt. This is the most inferior quality, and is shipped in casks of 27 pounds each, and is worth only three or four roubles per pound. This is known as summer caviare. The total amount of caviare obtained in the Caspian Sea fisheries amounts in one year to 139,000 pounds (about 5,020,000 lbs.) worth 1,390,000 roubles, or \$1,103,000.

THE CLEPSYDRA IN ROME.

It is not very often, in these progressive days, that we find the ancient methods of measuring time in actual employment. The sun dial, it is true, occasionally serves as an ornament to some country lawn, but little dependence is placed on its slowly creeping shadows. The hour glass has disappeared from the pulpits of the parsons; for twenty minute sermons, instead of many-headed dissertations prolonged through hours, are now sufficient for the spiritual needs of their flocks. The divided candle exists only in history, and is linked with the story of good King Alfred. But the water clock remains; not in this country, to be sure, but where it was

used a thousand years ago. Julius Caesar, tradition tells us, found by its aid that the summer nights in Britain are not the same length as those in Italy. Cicero relates that the length of speeches made by senators was regulated by clepsydræ kept in the senate chamber; and the same parliamentary practice, which now holds in our own legislative halls, of a member yielding the floor for a certain number of minutes of his time to another speaker then existed, for a grave senator often gave so much of the water as remained in his clepsydra to a colleague, who was thus enabled to obtain a longer or an extra water time for his speech than would have been otherwise at his command. If a legislator in those days, however, was interrupted by absurd questions—something after the fashion which occasionally appear when our learned representatives indulge in discussions on patents—or was embarrassed by the somnolent habits of his associates during a long-winded speech, he did not ask permission to have the latter printed and distributed at the country's expense, but simply stopped the flow both of his water clock and his rhetoric, and calmly waited until the house became ready to listen to his further remarks. The clepsydra of antiquity, in fact, while really a very useful and ingenious invention, of course was very crude in form, and hardly of the nice construction of the apparatus represented in our engraving. The clock there shown stands in a pond in the Pincio, the latter being a very elegant public park located on the summit of the Pincian Hill, one of the famous seven eminences on which Rome is built. The grounds are a favorite resort for the people, and serve the same purpose to the city that Central or Fairmount Park does to New York or Philadelphia.

The apparatus, in its present form, is the invention of Padre Embriaco, a Dominican monk; and from the pages of *L'Illustrazione*, a new illustrated weekly, published in Rome—a significant fact, by the way, of the influence toward progress exerted by the new régime in united Italy—we take both our illustration and the following brief description:

The water is led by pipes to a reservoir in which a constant level is maintained, and from an orifice in which the stream escapes into a receptacle divided into two compartments. Below the latter is an arrangement in the form of an anchor, the curved portion of the latter serving as a rocker on which the divided receptacle vibrates. This oscillation takes place under the entering stream; so that when one compartment is carried down by the weight of water within, the second is raised to receive its supply. A pendulum, beating seconds, is suspended from two springs, parallel to and equidistant from the resting point of the rocker, and regulates the movement of the receiver. The springs are prolonged in the direction of tangents to the

curve of the anchor arms and maintain the pendulum in motion with a constant force, so that each oscillation of the latter corresponds to one of the rocker and of the receiver. The water from the latter falls upon balanced mechanism which is so constructed as to oscillate every second minute, and to transmit motion to a suitable train of wheels, which move the hands upon one or more dials in the usual way.

The sounding apparatus consists in a cylindrical reservoir, which is suspended by chains to the axis of a wheel and is arranged to empty itself every fifteen minutes. Its weight turns the wheel and thus sounds the hours and the quarters. Water is carried to the reservoir when empty, by a simple siphon arrangement.

The case of the clock, as represented in the picture, is of cast iron, made in a handsome rustic design, in excellent keeping with the general surroundings. We should imagine our inventors could easily devise a simple form of similar apparatus, which, mounted in some appropriate casting from the iron founders who make that class of work a specialty, would form an elegant and useful ornament to either public or private pleasure grounds.

Formation of Octahedral Borax.

It is known that borax forms two hydrates—the one containing 5 equivalents of water, and crystallizing in regular octahedrons; the other containing 10 equivalents, and forming oblique rhombic prisms. The octahedral crystals are commonly considered stable only at relatively high temperatures. M. D. Gernez, however, finds that both the prismatic and the octahedral forms can be produced at low temperatures. The temperature of 56°, which has been indicated as the inferior limit for the production of prismatic borax, is in reality only a temperature near the higher limit at which the production of prismatic borax has been observed, since this salt loses a part of its water at this temperature.

Absorption of Dry Ammoniacal Gas by Cane Sugar.

On employing absolutely dry sugar, and submitting it to the action of the current of ammoniacal gas, dried over a long column of quick lime, the sugar becomes at first opalescent, and takes the waxy consistence described by Raspail, but in the course of twelve hours it liquefies, and flows on the surface of the tube in which it is contained: 100 parts of sugar absorb 7.83 of ammonia. On exposure to the air, the sugar loses the ammonia which it had absorbed. At the end of three months, the sugar retains only about 0.37 per cent, and has still a very pungent flavor. Glucose similarly treated liquefies very rapidly, becoming colored, and forming a crystalline product.—M. E. Laborde.



CLEPSYDRA OR WATER CLOCK, ON THE PINCIAN HILL, ROME.

Seasonable Hints on Gardening.

Winter has no sooner passed than every one possessing a patch of land considers how he will cultivate it in the coming season. In the country, the farmer is already at work with his sub-soil plough, and he has decided which acres shall be sown with grain and which with vegetables. Parties owning country seats adjacent to the towns and villages along the Hudson River, in Connecticut, and Jersey, says the *Commercial Advertiser*, are just now making trips to their rural homes, to give directions concerning the vegetable gardens and flower beds. Fancy gardening has of late years become so fascinating to men of means that much money is annually invested in vegetables which cost, after they are ripe, their weight in gold. One of our representative citizens estimated the value of his cabbages raised at his country seat to be twelve dollars apiece. However, the pleasure of "seeing them grow," of exhausting the skill of expert horticulturists upon them, of feeding the soil around them with the finest guano, and then of believing that, when grown, they are a little larger and better flavored than any raised by neighbors, is the height of satisfaction.

It is becoming a favorite employment with ladies to superintend their flower and vegetable gardening to devote a certain portion of the spring days to selecting and purchasing the choicest seeds, and to oversee their starting in hot beds. The early radishes and lettuce found on so many tables before their regular season are often the product of the labor and care of the female members of the family. Since window gardening has been so successfully introduced by our leading florists, and ladies have given their attention to planting and nursing flowers, the study of horticulture has been pursued by many of them until they understand the science of propagating plants.

WINDOW GARDENING.

This is an especial appropriate season of the year to make the windows beautiful with plants. There is great pleasure in bringing spring indoors by collecting the flowers which are now in bloom in the hot house, and planting them in the handsome boxes or baskets made for that purpose. Window gardening is delightful in winter time; nevertheless, there the hardest plants suffer more or less for fresh air. At this time there are hours at noon when the windows can be thrown open, and the plants which have been housed in greenhouses will apparently speak their thanks for the drink of fresh air and the contact with the sun's rays. The plants now in blossom are the hyacinth, narcissus, tulip, daffodil, cineraria, heath, violets, lilies of the valley, and several other varieties which are charming as companions in the sitting room. Shallow cigar boxes are very useful for planting seeds, and can be arranged to look nicely in the windows. In two or three weeks from this time, it will be proper to plant mignonette and sweet elysium, those fragrant and most suitable plants for window boxes. The vine seeds should then be put in the hanging baskets. They are for the most hardy vines. The morning glory is easily cultivated and is exceedingly graceful in leaf and flower. It will grow readily in any sunny window. Violets, early flowering snowdrops, anemones, forget-me-nots, and primroses are the best plants for culture in outside window boxes. The exquisite loveliness of the rose will not permit it to be omitted from the window garden, notwithstanding it is with difficulty kept in a thriving condition. Tea and China roses are the best adapted for culture in boxes.

For keeping plants healthy which are indoors at this season, close the windows of their room by three o'clock. Great attention must be paid to their cleanliness to promote their rapid growth. Flower pots need washing on the outside weekly. Never leave water standing in the saucers of the flower pots. Water must be given to the plants plentifully in these spring months. Rain water is always best for vegetation. Stimulate plants once a week with liquid manure. A large sponge is good for a watering pot for house plants. This is the month to prepare the ground for a successful crop of vegetables and flowers.

The Warm Springs of Costa Rica.

A. v. Frantzius states that these springs, more than 30 in number, may be regarded as a continuation of the remarkable series of warm mineral springs discovered by Humboldt in Venezuela, and extending for 150 miles from Cape Paria to Merida. The Costa Rica springs begin indeed 13 degrees of longitude farther west, but are situated under nearly the same parallel of longitude, namely, 10° N. in a strip of land running for 30 miles from east to west. Most of them occur in narrow mountain gorges on the banks of rivers, or are even overflowed by the rivers, so that they are visible only in the dry season. Their temperature is higher in proportion as they are situated at a lower level. The highest observed temperature is 157° F. The water contains some salt.

Mr. E. P., a correspondent, adds his testimony to that of Mr. J. A. Field, as to the value of using glue as a healing agent for cuts, bruises, etc. "I have used glue for this purpose for the last 22 years, mostly in the cabinet shop, and never employ anything else. I have received many severe cuts and bruises, and never lost any time, to speak of. Often a piece of thin cloth is sufficient after gluing over the wound. I use the best imported glue. I never took cold in a wound yet, and it is the most speedy healing agent I ever employed. Last autumn an acquaintance of mine came in the shop with his hand all banded up. He had received a severe bruise on the back of his hand, and took cold in it; and it was badly inflamed. I spread a glue plaster over the wound and bound a moistened cloth over to keep the glue from becoming dry. In one week his hand, was entirely well."

The Laughing Plant.

The London *Garden copies*, from Palgrave's work on Central and Eastern Arabia, an account of a plant whose seeds produce effects similar to those of laughing gas. It is a native of Arabia. A dwarf variety of it is found at Kaseem, and another variety at Oman, which attains to a height of from three to four feet, with woody stems, wide-spreading branches, and bright green foliage. Its flowers are produced in clusters, and are of a bright yellow color. The seed pods are soft and woolly in texture, and contain two or three black seeds, of the size and shape of a French bean. Their flavor is a little like that of opium, and their taste is sweet; the odor from them produces a sickening sensation and is slightly offensive. These seeds contain the essential property of this extraordinary plant, and, when pulverized and taken in small doses, operate upon a person in a most peculiar manner. He begins to laugh loudly, boisterously; then he sings, dances, and cuts all manner of fantastic capers. Such extravagance of gesture and manner was never produced by any other kind of dosing. The effect continues about an hour, and the patient is uproariously comical. When the excitement ceases, the exhausted exhibitor falls into a deep sleep, which continues for an hour or more; and when he awakens, he is utterly unconscious that any such demonstrations have been enacted by him. We usually say that there is nothing new under the sun; but this peculiar plant, recently discovered, as it exercises the most extraordinary influence over the human brain, demands from men of science a careful investigation.

Chemical Composition of Fuel.

Professor T. S. Hunt gives the results of the analyses by various chemists, taken chiefly from Bischof's "Chemical Geology," showing the relative proportions of the elements in wood, peat, coal, asphalt, and petroleum. He states that the "nitrogen, which, in most cases, was included with the oxygen in the analyses, has been disregarded, and the oxygen and hydrogen, for the sake of comparison, have been calculated for twenty-four equivalents of carbon."

1. Vegetable fiber or cellulose.....	C ₂₄ H ₂₀ O ₉₀
2. Wood, mean composition.....	C ₂₄ H _{18.4} O _{16.4}
3. Peat (Vaux).....	C ₂₄ H _{14.4} O ₁₀
4. Peat (Régault).....	C ₂₄ H _{14.4} O _{9.6}
5. Brown coal (Schrötter).....	C ₂₄ H _{14.3} O _{10.6}
6. " (Woskresensky).....	C ₂₄ H ₁₃ O _{7.6}
7. Lignite (Vaux).....	C ₂₄ H _{11.3} O _{6.4}
8. Lignite passing into mineral resin (Régault).....	C ₂₄ H ₁₅ O _{3.3}
9. Bituminous coal (Régault).....	C ₂₄ H ₁₀ O _{3.3}
10. " " " ".....	C ₂₄ H ₁₀ O _{1.7}
11. " " " ".....	C ₂₄ H _{9.4} O _{1.2}
12. " " " ".....	C ₂₄ H ₈ O _{0.9}
13. " " " ".....	C ₂₄ H _{7.4} O _{1.3}
14. Bituminous (mean comp.) (Johnson).....	C ₂₄ H ₉ O _{2-0.4}
15. Albert coal (Wetherill).....	C ₂₄ H _{15.9} O _{1.6}
16. Asphalt, Auvergne.....	C ₂₄ H _{17.7} O _{3.2}
17. " Naples.....	C ₂₄ H _{14.6} O ₃
18. Elastic bitumen, Derbyshire (Johnson).....	C ₂₄ H ₂₃ O _{0.3}
19. Bitumen of Idria.....	C ₂₄ H ₈
20. Petroleum and naphtha.....	C ₂₄ H ₃₄

These analyses are very attractive and valuable.

Christian Sharps.

Christian Sharps, inventor of the celebrated breech-loading firearm known throughout the world as Sharps' rifle, died recently at Vernon, Conn., in the 61st year of his age. Sharps' rifle was, for a long time, the only effective breech loading gun in use, and its remarkable efficiency for military purposes soon rendered the old style of muzzle-loaders obsolete. Sharps' original patent was granted in 1848, before the invention of metallic cartridges, when paper cartridges only were used, fired by percussion caps. The inventor's task was to make an effective breech loader, in which paper cartridges and caps could be employed, and this is what Christian Sharps successfully accomplished. The breech plug was made to slide vertically; its lower edge was sharpened into the form of a knife. The operation was such that the breech plug, in descending to its place, cut off the rear end of the paper cartridge, leaving the powder open to the flame of the percussion cap. Subsequent improvements on the gun were made by the inventor, which increased its value. Mr. Sharps was the inventor of many other useful devices besides firearms, from all of which others reaped pecuniary benefits, his own share being small. He was a most kind-hearted man.

Contamination of Water by Copper Pipes.

E. Reichardt points out that most waters take up more or less metal from iron and lead pipes, and that copper is not in any way a better material. Water which, when freshly laid on in 1859 through copper pipes, contained 7.2 parts of copper in a million contained 0.8 of copper per million in 1872. Even this latter water gave a perceptibly green metallic soap. Although the quantity has diminished during the thirteen years, yet at the end of that time a most objectionable amount of copper was still taken.

A HAM, well packed in pulverized charcoal, after the usual smoking, will keep for years. Butter in pots, well surrounded with charcoal, will keep for twelve months. Each atom of charcoal can absorb 1,000 times its bulk of deleterious gases—*Hall's Journal of Health*.

Treatment of the Teeth.—Root Filling.

Many of the most experienced and able members of the profession still advocate the use of solid gold filling in roots as the best and most reliable method. Admitting the value of such a filling, I think we can, at present, entirely do without it.

One object in filling the pulp canal is to prevent the collection of fluids, and to avoid the deleterious effects resulting therefrom. If we can accomplish this more readily by cheaper processes, it is our duty to do so.

This, however, is not my main reason for objecting to gold fillings. Observation has taught me that many times periostitis, and even the loss of the tooth, ensues, when the operation has been performed in the best manner and by the most experienced dentists. I therefore resolved at the commencement of practice to attempt another method, not being aware, at that time, that this practice was being used by others.

Considering the relations of dentistry to the public, and those of the latter towards dentistry, it is not surprising that at the present time, in Germany, we have a larger proportion of dead and exposed pulps to treat than have our colleagues in America.

I shall not dwell upon the preparatory steps necessary to be taken in different cases, as these are familiar to the profession; but when the root is in a proper condition for filling, I proceed as follows:

Select a thread of lint, separate or loosen the fibers as much as possible, and then moisten it with chloride of zinc from the cement boxes; then rub oxide of zinc well into it, omitting one extremity of the lint, which is reserved for the application of a small quantity of carbolic acid. The thread is simply the medium for conveying the cement to the extremity of the canal, and is entirely imbedded in it. The end of the lint saturated with carbolic acid is, of course, the first inserted, and is carried directly to the apex. After the root or roots are filled, the cavity in the crown is temporarily closed with cotton and sandarac, and an appointment made with the patient several days subsequently. If, in the meantime, the tooth has been perfectly comfortable, and the patient in a healthy condition, I insert a gold filling in the crown cavity. If, on the other hand, the pulp had been deprived of vitality for a long period, and the tooth easily irritated during preparatory treatment, I fill the cavity with cement, and dismiss the patient for the time. By operating in this cautious manner, I am able to assert that I never had periostitis occur in the large number of teeth treated in this way.

As none of these teeth had given any trouble, I never had an opportunity to satisfy myself in regard to the condition of the root and the filling until, by an unfortunate accident, a young patient split off the labial surface of a first superior bicuspid, treated in this manner two years previously. The tooth was extracted, at her request. On splitting the root to the apex, I found, as I expected, the filling hard and perfect, and the periosteum in a healthy state.—*Dr. Henricite Hirschfeld. —Dental Cosmos.*

A RED INK WHICH RESISTS THE ACTION OF MOST CHEMICALS.—This ink is a solution of carmine in soluble glass, and must be kept in a bottle, with a well oiled cork.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT REFLECTORS.—ISAAC P. FRINK vs. GEORGE PETERY & CO.

[In equity.—Before Blatchford, Judge.—Decided January 27, 1874.]

The plaintiff's patent was for a reflector of which the principal features were a metallic surface above the source of light, reflecting the light downward below its source, and a glass surface in sections under the other, serving as a lining to it, and aiding in reflecting the light, with a space between the two surfaces for the circulation of air and ventilation; and his first claim was, in substance, for a reflector having a reflecting surface of glass in combination with another reflecting surface placed above the first with a space between the two for air, etc.

His second claim was in these words: "The combination with the metallic body of a reflector of a glass covering or lining therefor applied in sections or panels, substantially as and for the purposes described."

Both claims were held to be infringed by a reflector in which the reflecting surface was composed entirely of silvered glass contained in a metallic case or body, large portions of which were cut away, and the inside of the rest was covered with paint.

Prior to the plaintiff's invention one Boyle had obtained an English patent for a reflector, in which the reflecting surface consisted of silvered glass in sections arranged in several series around the light, one series above another, and diminishing in circumference upward, and all contained in a wire or metal frame.

As it had no upper reflecting surface, it was held to be no anticipation of the plaintiff's first claim.

In view of Boyle's patent the second claim was interpreted by reference to the specification, and construed to embrace a metallic body which throws the light down below its source, and which is lined or covered with glass that may be applied to the metallic body by molding or blowing, if not attached in sections or panels, and, thus construed, the second claim was held not to be anticipated by Boyle's patent.

The employment of a glass lining over the reflecting surface of a known reflector is patentable, since it protects the surface and increases the reflected light.

E. W. Stoughton and M. B. Andrus, for the plaintiff.
S. S. Fisher, S. A. Duncan, F. H. Bell, S. J. Gordon, and D. S. Riddle, for the defendants.

IMPORTANCE OF ADVERTISING.

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

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

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

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

NEW BOOKS AND PUBLICATIONS.

SCIENCE PRIMERS: CHEMISTRY. By H. E. Roscoe, Professor of Chemistry in Owen's College, Manchester. **PHYSICS.** By Balfour Stewart, Professor of Natural Philosophy in Owen's College.

These two volumes are likely to prove very valuable to teachers of juvenile science classes, as they begin the subjects of which they treat, and assume that the mind of the pupil is still open to initial impressions. It is gratifying to find such men as these eminent authors occupying themselves with this work, which, though highly necessary and important, is frequently slighted as being unworthy of the attention of great minds.

QUADRATURE OF THE CIRCLE, containing Demonstrations of the Errors of Geometers in finding the Approximations in Use, with an Appendix, etc. To which are added: Lectures on Polar Magnetism, and Non-Existence of Projectile Force in Nature. Price \$2.50. By John A. Parker. New York: Wiley & Son, 15 Astor Place.

This book is another contribution to the literature of the search for the infinite and the discovery of the undiscoverable. It resembles most other treatises on the subject in that it assumes much and then proceeds to point out the symmetry and beauty of the assumptions. The author claims to have demonstrated, in his work, the exact distance between the earth and the sun, in advance of the observations of the coming transit of Venus.

THE CARRIAGE MONTHLY, a Practical Journal for All Engaged in Carriage Building. Per annum, \$3. I. D. Ware, 737 Sansom street, Philadelphia, Pa.

A well written, liberally illustrated technical journal of the highest class. It covers the whole art of carriage building, design, construction, upholstery, painting, and varnishing; and its working drawings are very numerous and explicit.

THE EMERY GRINDER. Vol. I, No. 1. Stroudsburg, Pa.

The Tanite Company, whose special manufactures are known over both hemispheres, forward us the first number of a monthly publication issued by them. One of the chief features in it is the announcement of premiums, \$50 for the best, and \$25 for the second best, original essay, of a practical nature, on the exact results attained by the use of solid emery wheels and emery grinding machinery. The subject is a good one, and deserves the attention of mechanics.

AN ELEMENTARY TREATISE ON STEAM. By John Perry, B.E., Whitworth Scholar, Fellow of the Chemical Society and Lecturer in Physics at Clifton College. Price \$1.50. New York: Macmillan & Co., 38 Bleeker street.

A complete practical handbook, concise in style, explicit as to facts, and convenient in form. It embodies the latest data on all branches of the perpetually progressing science.

LINCOLN AND SEWARD: Remarks on the Memorial Address of Charles Francis Adams on the late William H. Seward. By Gideon Welles, Ex-Secretary of the Navy. New York: Sheldon & Co.

Ex-Secretary Welles attempts herein to defend the late President Lincoln from some attacks, supposed by him to be implied in Mr. Adams' eulogium of the deceased Ex-Secretary of State. It is a political matter, and our readers will not expect any expression of opinion from us on the subject.

STUDIES OF BLAST FURNACE PHENOMENA. By M. L. Gruner, President of the General Council of Mines of France, and lately Professor of Metallurgy at the Ecole des Mines. Translated with the Author's Sanction, with an Appendix, by L. D. B. Gordon, F.R.S.E., F.G.S., Emeritus Regius Professor of Civil Engineering and Mechanics in the University of Glasgow, etc. Price \$2.50. Philadelphia: Henry Carey Baird, 406 Walnut street.

Professor Gordon has here added to our literature of iron metallurgy the master treatise on the construction of the principal apparatus, a book which, as he truly says, is not written in a style that "those who run may read," but which is worth the labor of a thorough investigation by all who study the economy of the processes of iron smelting. It will be largely read in this country, and its teachings reduced to practice in many of our thriving iron manufacturing centers.

THE SCIENCE OF LANGUAGE, or the Seven Hour System of Grammar. Third Edition. \$1.00, bound; 50 cents in paper. By Professor D. P. Howe, Union College, Boston, Mass.

A very compendious elementary treatise on the parts of speech and their uses, written with clearness and originality.

THE UNITARIAN REVIEW AND RELIGIOUS MAGAZINE. Edited by the Rev. Charles Lowe, Vol. I, No. 1. Per Annum, \$5. Boston: Leonard C. Bowles, 36 Bromfield street.

This new comer is evidently intended to appeal to the minds and tastes of the higher intellects of the class of theologians whose name it bears. Most of the articles in this monthly number are well written, temperate, and thoughtful; and the editing shows much appreciation of literary merit.

Messrs. Glendinning, Davis & Amory, bankers and brokers of 17 Wall street, in this city, have recently compiled a chart of stock quotations for the past eleven years. The highest and lowest quotations, monthly in each year, since January 1, 1863, are shown of some of the principal railroad steamship, express, and telegraph shares. References explanatory of the course of the market, and memoranda of the leading and remarkable events in speculation, during the above period are added. The chart is prepared from official and private sources, and affords a large amount of information not, we believe, otherwise attainable, which must be both of interest and value, not only to those engaged in banking and other financial pursuits, but to investors generally. It is published and for sale by Ivers & Anderson, 67 Wall street, New York, and is mounted on mullin and rollers. The price is \$10.

Inventions Patented in England by Americans.

- [Compiled from the Commissioners of Patents' Journal.]
- From February 12 to February 23, 1874, inclusive.
- BALL CASTER.—J. Johnson, Brooklyn, N. Y.
- BOTTLE STOPPER, ETC.—N. Thompson (of Brooklyn, N. Y.), London, Eng.
- CAST METAL HOLS, ETC.—R. Sleath, Pittsburgh, Pa.
- DRESS PIN.—F. Armstrong (of Waterbury, Conn.), London, England.
- FENDER FOR VESSELS.—C. Wacker et al., New York city.
- GAS RETORT JOINT.—J. R. Floyd, New York city.
- INVALID BEDSTEAD.—O. G. Cosby, Richmond, Va.
- SCIPITATING COPPER.—T. S. Hunt, Boston, Mass.
- SEWING MACHINE.—G. W. Baker, Wilmington, Del.
- STRETCHING BOOTS, ETC.—D. Harris, St. Louis, Mo.

Recent American and Foreign Patents.

Improvement in Refining Petroleum and other Oils.

Emil Schalk, New York city.—In refining petroleum, the product of distillation has, up to this time, been first treated with sulphuric acid (SO₃), the acid then being washed out with water, and the product next treated with caustic soda, or the ammonia of commerce. It is now proposed to use sulphurous acid (SO₂), either gaseous or dissolved in water, for the first treatment, instead of the sulphuric acid, and for the second treatment ammonia gas instead of the caustic soda or ammonia of commerce. Both to be employed in the common intermittent process, in which the oil is fed in batches in a single tank, and in the continuous process de-

scribed in the patent (No. 133,593) granted to same inventor, either using the same apparatus described therein, with the exception of larger conduits for conducting the gases to the agitators, or the following: First, a vertical cylinder lined with lead or iron, filled with empty bottles, glass or earthen balls, to afford the largest possible amount of surface. Over these balls or bottles the oil is allowed to flow down slowly, and at the same time the sulphurous acid is caused to enter at the bottom of the cylinder and pass up through in contact with the falling oil. From the bottom of this cylinder the oil is drawn into a tank, to separate the clear oil from any oxidized portion, and then, by means of a pump or by air pressure, brought to a second cylinder, similar to the first, where it is subjected to the action of the ammonia gas in the same manner. Finally, in a third cylinder, similarly constructed, the oil ascends from the bottom upward by a pump, and at the top a stream of water is let in, to wash out any remaining acid or ammonia, or combination of the two. From this last cylinder the oil passes to the bleaching tanks.

Improved Fix for Furnaces.

Lars Nelsen and Thomas McNeef, Chicago, Ill.—This invention consists in a compound of fire clay, fire sand, and ground coke. The above ingredients are finely pulverized and mixed together with sufficient water to form a mass of the consistency of common mortar. This can be applied when the surface is hot, and without interrupting the usual operations of the furnace. No fire bricks are required, and no time is lost in lining or repairing the lining of the furnace.

Improved Shoe.

Edwin C. Burt, New York city.—The outer sole has a channel located at a short distance from the edge, and beveled upwardly to the top of the middle, which has the full thickness of ordinary soles. When the soles are to be united to the upper, the latter is sunk in the channel of the outsole, and the insole caused to overlap said channel, thereby doing away with the usual projection of upper and of insole, while the middle or wearing part of the outsole is preserved in its full thickness. By this construction the upper is very effectually protected and rendered more durable, while a closer joint is formed for the exclusion of water and dust.

Improved Well Tube Clamp.

Ephraim Shaw and Joseph H. Beatty, Tar Farm, Pa.—This invention consists in combining, with the collar or socket of a well tube clamp, a pivoted haap, which is hinged to a bolt-shaped extension of said socket, and hooked at its outer or free end, so as to engage with a second extension of the socket. Provision is also made for adjusting the latch in respect to the socket, through the medium of nuts. The invention further consists in applying to the inner side of the pivoted latch one or more serrated gripping jaws, which serve to securely hold the object inserted into the socket.

Improved Rotary Churn.

Charles M. Oliphant, Oeeola, Iowa.—This invention is an improvement in the class of rotary churns in which the dasher is arranged obliquely, and relates to the relative construction of the dasher and churn box. The former is composed of a series of bars which are arranged inclined to the shaft, forming thus the outline or skeleton of a truncated cone, and the latter is of irregular polygonal shape corresponding thereto, so that the dasher may be placed diagonally, and, in rotation, thoroughly agitate the cream from the bottom. Interfering or cross currents are thus created, thereby speedily producing the desired result.

Improved Hog Trap.

John H. Peggs and George M. Overshiner, Elwood, Ind.—This invention has for its object to furnish an improved device for catching hogs and holding them securely while being ringed, marked, etc. The hog, in seeking to escape through a gap in the trap, steps upon a tilting board, the tilting of which pitches him forward so that his neck may be between levers. The levers, by suitable mechanism, then close and clasp the hog around his neck, and around his body in the rear of his fore legs, where he may be held securely by hooking the straps upon pins.

Improved Car Axle.

George W. Miltmore, Janesville, Wis.—This invention consists, first, in so combining a revolving sleeve with a solid stationary axle that the lubricating material is introduced into the oil chamber between them from oil cups attached to the bearers; secondly, in an elastic or flexible ring on the journal of the axle box, constructed and arranged so as to be compressed on the axle, to prevent the escape of the lubricating material; thirdly, in a novel oil feeder, attached to the lower side of the fixed axle; fourthly, in such an adjustment of the axle sleeve and bearers that the friction caused by lateral motion is taken up on a bearing surface near the center of motion, and within the limits of the sleeve where the oil is stored; fifthly, in certain spaces as provision for lateral motion.

Improved Combined Grate and Ash Sifter.

George Washington Pettit, Fairmount, West Va.—This invention relates to a pivoted weighted grate or screen plate and a coal and cinder pan, which is cut out on one side to adapt it to receive and support the front end of the same, in combination with a stationary grate, forming the bottom of a fire pot. The pieces of coal or cinders falling from the grate will be conducted, by the screen, into the pan, while the ashes fall through the perforations of said screen, thus becoming separated from the matter that may yet be used as fuel.

Improved Eaves Trough Hanger.

Samuel W. Jones and Benjamin D. Evans, Nelsonville, Ohio.—This invention is an easily applied hanger for eaves troughs, and consists of splitting and twisting a piece of hoop iron of suitable strength, and attaching the twisted ends to the eaves trough, while the main piece is applied to the roof at a suitable inclination.

Improved Center Board for Boats.

Thomas Hartley, Gilman, Ill.—This invention relates to vessels which are expected to carry sail in deep or shallow water, and consists in a novel means whereby the tendency to capsize is to a great extent obviated.

Improved Fire Place Stove.

John B. Oldershaw, Baltimore, Md.—This invention relates to stoves set in fire places for the purpose of heating the apartment in which the fire place is located, and also one or more thereabove. These stoves are ordinarily constructed with two horizontal and two perpendicular plates to form flues through which pass the products of combustion by an indirect draft to or from an ash pit base or ash receptacle. These require a flat grate and cylinder to be arranged on top of the base, the latter extending upward. These differences are entirely overcome by a novel and very ingenious construction.

Improved Vapor Bath.

Samuel A. Miller and Uriah L. Shaffer and John Beal, Leon, Iowa.—This invention has for its object to furnish a vapor bath apparatus which shall be comparatively inexpensive, and capable of folding into very compact form, so as to occupy little space and be conveniently handled or transported. To this end the frame is jointed and braced in a peculiar way, and covered with oil cloth, enameled leather, or some equivalent material, which is made in sections or parts, attached by means of pins so that it may be readily applied to, or removed from, the frame.

Improved Heating Apparatus.

Thomas H. Price and Theodore F. Wade, La Fayette, Ind.—This invention relates to a portable receptacle for containing and heating or keeping hot roasted peanuts, chestnuts, etc. It is formed of a sheet metal bucket or vessel, provided with a handle and having a perforated diaphragm with a central centrally projecting tube, thus forming a compartment above the plate or partition for the reception of the nuts, and a smaller one below, in which is placed a lamp to supply the required heat.

Butter Mill for Working and Reworking Butter.

Alexander May, Jeffersonville, Ind.—This invention relates to means whereby butter may be more thoroughly worked or reworked without manipulation, and in an easy, convenient manner. It serves to thoroughly work out the water and milk, thereby greatly improving the color and quality of the butter, which is solidified and condensed so that it can be packed for market without any apprehension of spoiling, but with perfect confidence that, after transportation and the lapse of considerable time, it will be sweet and in fine condition, bringing the highest price of the market.

Improved Saw.

Charles D. Lothrop, New York city.—The teeth are like any ordinary cross-cutting teeth, except that they are beveled a good deal more to make sharp knife edge points for cutting off the fibers nicely, and they are set by bending them outward a little near the points. They are arranged in groups of four or thereabout, and between each group is a planing clearing tooth, filed square to the saw plate and arranged on a pitch, by which it is adapted to plane out the stuff cut off but left in the kerf by the other teeth. In front of each planing tooth is a wide notch for clearance, with the bottom beveled acutely to the saw plate, so that the dust kept in the notch, while passing through the log, by the walls of the kerf, will shoot off at the side as soon as it emerges from the log. By thus arranging the teeth, the saw is rendered equally as useful for cutting one way of the grain as the other.

Improved Hog Pen.

Patrick Burke, Malone, N. Y.—This invention relates to a hog pen which is so constructed as to offer protection from cold to the animals; and it consists in dividing the pen into two compartments by means of a partition wall, which is provided with self-closing doors opening in opposite directions, and operated by the pigs, so as to enable the same to pass from one compartment into the other. The invention further consists in applying to the side walls of the compartment employed for sleeping purposes a series of strips, which are placed at such distances apart from each other as to form spaces for permitting the young pigs to enter the space in the rear of or between the fender plates, so as to prevent being injured or crushed by the senior members of the pen.

Improved Sash Pulley.

Amos Halladay, Westfield, Mass., assignor to Duane D. Griffin, of same place.—This invention is a sash pulley face plate, formed of the series of conjoined disks, each of the same diameter, the end ones centrally perforated, and the middle ones having one common slot, so that, with an auger, the plate may be inserted in the window frame, while the pulley will require no special mortise.

Improved Stretching Machine for Bed Bottoms, etc.

Henry D. Goldsmith, New York city.—The object of this invention is to furnish better facilities than now exist for stretching canvas bed bottoms, skins, leather, and all similar materials or articles, for drying or other purposes. A central block or plate, supported by stanchions, is attached to the bed frame, and a post, confined in the center of the block, carries upon its lower end a disk. There are holes in this disk, and cords attached thereto at one end. The other ends of these cords pass through eyes and take hold of the edge of the article to be stretched. The cords, being attached to the canvas and passed through the screw eyes, are attached to the disk eyes, which are opposite and nearest them. It will be seen that, by giving the disk a turn or partial revolution, the cords will be drawn taut, and the article be stretched equally from the center. The disk is revolved by means of a key or lever on the top of the post. When sufficient tension is given the cords, the disk is held in position by means of a ratchet wheel on the post and spring pawl on the block.

Improved Machine for Assorting Potatoes.

David A. Banker and Amos B. Banker, Schaghticoke, N. Y.—This machine consists of long rollers, a hopper, assorting board, and grading chutes, so combined and arranged that the potatoes being shoveled into the hopper at one end and caused to run along the assorting board and the rollers, the smaller potatoes will escape between the roller and assorting board, while the larger ones will be discharged at the end. The distance between the roller or rollers and the assorting board increases from the head toward the tail, and the potatoes escape through the space, varying in size in the same measure, so that they can be separated into two or more grades by suitable partitions in receptacles below. The assorting board is adjustable toward and from the roller, so as to change the grade at will.

Improved Mold for Casting Glass Letters.

Theodore H. Banks, New York city, assignor to himself, William H. Banks, and James E. Hill, of same place.—The mold, which is made of and in two parts, hinged to each other at one end. In one part is formed a recess of such size as to contain a die, in which is formed the mold of the letter or other object to be cast. In using the device, the mold is heated to such a temperature that it will not cool the melted substance, which is poured into the recess, too quickly. The plunger is then forced into the recess, pressing the melted substance into the cavity of the die. In this way, by having a number of dies, which are comparatively inexpensive, a variety of letters or other small objects may be cast with the same mold.

Improved Weft Stop Mechanism for Looms.

Thomas Isherwood and William Nuttall, of Westerly, R. I., assignors to National Fancy Woolen Loom Stop Motion Company, same place.—This invention relates to looms having guard wires to rise up in the lathe behind the weft thread to insure the action of the weft fork or feeler for raising the latch when the weft is present to prevent throwing off the shipper lever. The invention is more particularly an improvement on that for which the inventors obtained letters patent No. 138,899. It consists of a cam on the cam shaft, a bell crank, and a rock lever combined with said wires for operating them; and it also consists of an arm connected to the rock lever which carries the latch and feeler arranged relatively to the lathe, so that immediately after the feeler has performed its function, the lathe strikes said arm, and by it moves said rock lever and the latch and feeler out of the way of the lathe at the moment of beating up. It also moves the rock lever, which throws off the shipper lever whenever the weft is not present, and it is caught by the latch. The invention also comprises a novel arrangement of devices by which the rock lever, which the atch acts on to throw off the shipper lever when the weft is not present, is connected to said shipper lever.

Improved Wagon Rack.

Joseph Bolt, Warsaw, Ind.—The object of this invention is to furnish to farmers an improved fodder rack, by which corn and other fodder may be easily and rapidly unloaded from the wagon. The invention consists of a tilting frame, on which the load is placed and firmly retained by suitable uprights and a binding pole, and which frame is pivoted to one side beam of a rack, and locked to the other by suitable mechanism. The tilting of the frame and depositing of the load are performed by taking off the binding pole, unlatching it and lifting it by means of a handle and foot lever off the rack, and swinging it to the side of the rack into a vertical position.

Improved Whiffletree.

George R. Edwards, Galena, Ill.—This invention relates to that class of whiffletree in which means are employed to release therefrom the traces in cases of a runaway or other accident, so that the horse will at once leave the vehicle, thus preventing its fracture or the injury of its occupants.

Improved Charger for Stoves.

John H. Mahrenholz, New York city.—Stoves are now supplied with fuel in small quantities, through a door opening in the side above the grate, or, in larger quantities, through a cylinder opening at the top. In either case, the fuel is conveyed to the stove in a hod or other analogous receptacle. A frequent escape of gas and dust, much noise, and considerable labor attend the operation, which are in a great degree avoided by this invention. The same consists in a magazine of cylindrical or other suitable form, having a combustible bottom, which may be filled with coal before being placed in the stove, and thus, when said bottom is burned out, the coal will feed downward till entirely consumed. A filled charger is then substituted for the empty one, and this operation repeated as often as is requisite, or so long as the fire is to be kept up. The chargers may be used in any kind of stove adapted to receive them and are provided with a cover having a handle by which to carry or transport them.

Improved Machine for Cutting Iron and Steel.

Charles M. Robinson, Newton, Iowa.—This invention relates to the peculiar construction of hand shears for cutting metal, so that either angular or round bars or bolts may be severed with the same knives, and to a novel mode of combining the means for actuating the two cutters, so as to produce a compact and handy tool.

Business and Personal.

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

Wanted, for Cash—An Engine Lathe, 20 to 24 inch swing, new or second hand. Address, with description and price, W. M. Preston, Monticello, Jones County, Iowa.

For Inventors—Book and Documents showing how to make money on Patents. Plain directions and practical advice for selling meritorious inventions. Send stamp for circular and synopsis of contents. S. S. Mann & Co., cor. Linden Av. and Hoffman St., Balt., Md.

Chemicals, Drugs and rare Minerals used by manufacturers, constantly on hand and sold by package and quantities to suit, by L. & J. W. Feuchtwanger, Chemists, 33 Cedar St., New York.

Waterproof Enamelled Papers—all colors—for packing Lard and other oily substances, Chloride of Lime, Soda and similar Chemicals, Cartridges, Shoe Linings, Wrapping Soaps, Smoked or Dried Meats, and Dehydrated Vegetables, Shelf Papers, and all applications where absorption is to be resisted. Samples on application. Crump's Label Press, 75 Fulton St., New York.

Wanted—A Situation as Foreman in a first class Door, Sash, and Blind Shop. Address Box 142, Arlington, Vermont.

Machinist's Grindstones in iron boxes, prices reduced. J. E. Mitchell, Philadelphia, Pa.

Any one interested in machine, brass foundry, or japanning work, see advertisement signed Machinist, on last page.

Best Philadelphia Oak Belting and Monitor stitched. C. W. Army, M'r, 301 Cherry St., Philadelphia, Pa.

Wanted to know who builds J. A. Reed's Patent Oscillating Engines. Address H. G. Wagner, Box 657, Georgetown, D. C.

Fine Machinery Oils.—We believe that E. H. Kellogg's Spindle, Engine, Signal and Cylinder Oils, although costing a little more per gallon, are really the most economical for the consumer, for the reason of their durability and freedom from injury to machinery. If parties requiring oils will make known the uses for which they are wanted, he will not only guarantee satisfaction, but that the goods shall prove precisely as represented. These oils are not only largely used and deservedly popular throughout the United States, but have considerable demand for export, from foreign manufacturers and agents.

R. Y. Crockett, Bath, Me., wishes information concerning the preparation of oil cloths for car linings.

Parties making hand reawing machines, send prices to Castro Box and Basket Co., Castro, Ill.

Wanted—A mechanical draftsman, well recommended, experienced in designing wood working machinery. For a permanent situation, address Lock Box 336, Hamilton, Ohio.

Amateur Astronomers can be furnished with good Telescopes at reasonable prices. For particulars, address L. W. Sutton, Optician, Box 218, Jersey City, N. J.

"Font Pen."—The proper address is No. 7 Murray St., New York, not 27. See adv., page 188.

For descriptive circulars, and terms to Agents of new and saleable mechanical novelties, address Ames H. White, Newark, N. J., Manufacturer of Sheet Cast Metal Small Wares.

Recutting Old Files—New process—From 50 to 75 per cent saved. Send 25 cents for receipt to A. Edmunds, Pilot Center, Ill.

Manufacturers of Brick Machinery, send Circulars to J. Brunaugh, 2741 Lafayette Av., St. Louis, Mo.

For Sale—A beautiful Horizontal Steam Engine, almost new, five horse power, built to order for an amateur. Address P. Meigs, Box 3, 757, P.O., N. Y.

Best Grain Cleaner ever introduced to the public. State and County Rights for Sale. Agents wanted. Patented October 15th, 1873, by P. Provost Little Chute, Wis., who may be addressed for particulars.

Wanted—A 2d Hand Steam Engine and Boiler of about 1/2 H.P. Must be cheap and in good order. Address Geo. L. Lamson, LaFayetteville, N.Y.

10 H.P. splendid Baxter Engine, but little used, good as ever. I. H. Shearman, 45 Cortlandt st., N.Y.

A responsible firm, having a large and centrally located store in Boston, well adapted for exhibition of machinery and manufactured goods, would like the New England agency of some well established Manufacturing Company or firm whose goods are introduced and favorably known. Address Reed & Bowen, 36 Kilby St., Boston, Mass.

The best Gold Pens, for all purposes, are made by C. M. Fisher & Co., 102 Fulton St., New York.

Self-Cleaning Lard and Butter Cutter. Sample 30c. Agents wanted. Wm. M. Beakley, Verplanck, Westchester County, N. Y.

One No. 4 Root Blower for Sale. Price \$25. Used two years. In good order. I. H. Sternbergh, Reading, Pa.

Engines, Boilers, Pumps, Portable Engines (new & 2d hand). I. H. Shearman, 45 Cortlandt St., N.Y. Soluble Glass, Silicates of Soda and Potass, manufactured by L. & J. W. Feuchtwanger, New York.

Patent for a cheap constructed Wash-mangle for sale. Address M. V. & Co., 5 Frankfort St., N.Y.

Wanted—The Superintendency of a Foundry and Machine Shop. Can extend the business in the line of Blast Furnace, Pumping, and heavy machinery in general. Address J. Simmel, Philadelphia, Pa.

Bar Lead—Machine made, of Extra Soft Lead, each bar exactly 5 oz., put up specially for the jobbing trade. Bailey, Farrell & Co., Pittsburgh, Pa.

Nickel Salts and Anodes for Plating, sold by L. & J. W. Feuchtwanger, New York.

Scale in Steam Boilers—how to remove it. Address Geo. W. Lord, Philadelphia, Pa.

Automatic Wire Rope R.R. conveys Coal Ore, &c., without Trestle Work. No. 61 Broadway, N.Y.

A. F. Havens Lights Towns, Factories, Hotels, and Dwellings with Gas. 61 Broadway, New York.

Steam Traps and Boiler Scale Preventive. A. G. Brooks, 425 Walnut St., Philadelphia, Pa.

Johnson's Universal Lathe Chuck—Absolutely protected from dirt and chips. Lambertville Iron Works, Lambertville, N. J.

Pat. Double Eccentric Cornice Brake, m'fd by Thomas & Robinson, Cincinnati, O. Send for Circular.

Rue's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

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

A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1871, for "Best Telegraph Instrument for private use"—is offered for sale by the Merchants' Mfg and Construction Co., 50 Broad St., New York. P. O. Box 496.

Woolen and Cotton Machinery of every description for sale by Tully & Wilde, 20 Platt St., N.Y.

Steam Engines—Special Machinery, Shafting, Pulleys & Flangers. D. Frisbie & Co., N. Haven, Ct. Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

"Superior to all others"—for all kinds of work—Limet & Co.'s French Files. They are better, forged, better cut, better tempered, and cheaper than English files. Send for Price-List. Homer Foot & Co. Sole agents, 20 Platt St., New York.

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G. E. C. and others will find the correct definition of a billion, etc., in Webster's "Dictionary."

C. B. L. will find an explanation of black spots in the vision on p. 200, vol. 26.—H. J. will find instructions for transferring prints to wood blocks on p. 138, vol. 30.—F. W. D. should consult a maker of musical instruments.—G. G. will find directions for polishing wood on p. 266, vol. 29.—H. H. will find full instructions for making parchment paper on p. 568, vol. 26.—A. B. M. will find directions for drawing an ellipse on p. 299, vol. 29.—D. H. S. will find a good recipe for black ink on p. 208, vol. 29.—P. D. can plate articles with silver, without a battery, by following the instructions on p. 315, vol. 29.—O. V. can try fastening rubber to tin with the paste described elsewhere on this page.—J. M. S. can cement meerschaum by the process described on p. 203, vol. 29. Cleaning copper coins is described on p. 217, vol. 26.—M. W. is informed that the direction of the earth's rotation is the same all over the globe.—L. E. O. should write to the Hackney Scientific Association London, England, for a copy of the paper about comets.—C. H. H. will find directions for gliding on black walnut on p. 75, vol. 28. See our advertising columns as to scroll saws.—A. W. is informed that the belt covering is patented. He should address the inventor.—L. H. is informed that we have not heard of the casting process which he alludes to.—J. B. S. is informed that gold becomes brittle when cooled too quickly; for directions for annealing it, see p. 299, vol. 23.—P. L. will find a recipe for best sealing wax on p. 251, vol. 28. For a cheaper article, increase the proportion of rosin.—G. B. F. should advertise for practical information about making wintergreen oil.

C. W. B. says: I am about to build a small frame house, and would like to know how to construct the walls so as to make it warmer than the usual weather boarding and plastering will do. Is there any better way than to fill in between the weather boards and lath, with one course of brick laid in cheap mortar? A. There is no better way than the one you suggest, and the bricks may be laid on edge; but it is better to use good rather than cheap mortar, and flush it in against the timbers, etc. It is usual also to lay a thin strip of board, nailed at the ends, in the brickwork at about every 3 feet in height, to stay it.

C. R. M. says: I see it stated that ordinary wood saturated with crude petroleum becomes as lasting as cedar. Is that so? A. A sufficient length of time has not elapsed since petroleum has been used to settle this point definitely, but it is highly probable that its preservative power would be great.

F. C. A. says: I have a house to paint, with slated roof and a piazza all around it. What paint ought I to use, that I may take the water from the roof of my piazza into my cistern for family use? Would it be safe to use lead paint, if the water is filtered through brick before being pumped for use? A. The best paint for your tin roof is Rochelle ochre, in linseed oil; the wash from the vertical boarding of the house will probably be too little to make it a matter of importance, as to whether lead or other paint is adopted.

T. D. H. asks: 1. Will you give me a recipe for skeletonizing leaves, etc.? A. See p. 315, vol. 29. 2. What will deaden the echoing sound in a room? The dimensions are 50x80 feet. Some people recommend building a gallery. My theory is that the walls must have a fluted surface. Am I not right? If not, what is the best and cheapest mode? A. On p. 356, vol. 29, we answered a correspondent in reference to the echo developed in a building very similar to yours. By consulting that article, you will find an answer to your question, both in regard to the best method of changing the character of the surface of the walls, and also as to the effect of inserting a gallery.

W. E. M. asks: Can I make pure carbureted hydrogen or coal gas by heating coal to a white heat in an oven of brick, with sheet iron bottom, and (for purification) passing it through heated iron tubes? A. You can make carbureted hydrogen gas in the way you mention, but only from bituminous coal. You cannot purify it in the way you indicate. It is purified by "scrubbing" with water, and passing through lime and sometimes oxide of iron. The present price of gas in New York is from \$2 to \$3 per thousand feet.

W. C. McM. asks: Which is best to paint the outside of a church with, pure white lead or the best of the chemical mixed paint? A. If you are careful to obtain a pure white lead, you will certainly have an excellent paint. If you decide to take some prepared paint, you cannot be certain as to its ingredients, and may be deceived, so that the white lead would seem to be the best.

J. H. R. asks: Is there anything that will take the stain of nitric acid out of marble, without injury to the marble? A. As the stain is merely superficial, rub with another smooth piece of marble, using water, until removed, and afterwards polish with tripoli, followed by putty powder, both being used with water.

H. asks: How much gum opium is 1 grain of sulphate of morphia equal to, in medicine? A. 3/4 of a grain of sulphate of morphia is said to be equal as a dose of medicine to 1 grain of opium, but it is evidently unsafe to experiment personally with these substances without the advice of a physician. The statement about the separation of hydrogen is utterly false.

W. H. C. asks: 1. What is the best application to preserve metal maple sugar sap spouts, that will not injure the sugar? A. Galvanize the spouts. 2. If galvanizing will do, how is it done? A. By immersing in melted zinc, which is kept covered with powdered sal ammoniac. 3. How is iron wire coppered? A. By immersion in a solution of blue vitriol. 4. What is the most durable paint for a farm wagon? Would you recommend red lead? A. For books, see our advertising columns.

E. C. W. asks: What is the common method of manufacturing lead pipe? A. The metal, heated to a semi-plastic condition, is forced by a press of great strength through an orifice, within the mouth of which a core is set. The complete pipe, having an exterior diameter equal to the orifice, and an inner diameter equal to the core, then issues in one continuous piece, to a length equal to the quantity of metal first placed in the press.

E. M. W. says: My feet break out in sores, like poison from ivy, only much worse. I have known several similar cases caused by woolen socks colored green, and I suppose it must proceed from arsenic. A. The arsenical colors are poisonous, and the effect you speak of might have been caused by it. It would be well to submit a specimen of the dyed wool to a chemist for analysis.

A. S. asks: 1. What are the principal substances that lampblack is made from? A. From tar and resins. 2. What is common clothes starch made from, and does it contain anything detrimental to its uses as food? A. From potatoes, and should contain nothing detrimental when properly made.

J. H. H. asks: 1. How can I make good gun cotton? A. By steeping dry clean cotton for a few minutes in equal measures of concentrated nitric and sulphuric acids, washing and carefully drying by hot water, not warmer than 180° Fah. 2. Will it explode from concussion, or only on same conditions as powder? A. It will sometimes explode from concussion. 3. What is its relative expansive force compared with common gunpowder? A. In general, it is found that 11 lbs. of gun cotton occupying 1 foot of space produces a greater force than 50 or 60 lbs. of gunpowder filling the same space, and having a force required for ordinary artillery.

S. & B. ask: 1. Is a patch put on the inside of a boiler stronger than one put on the outside, both being put on with rivets? A. Ordinarily it would be. 2. What is the best thing to put on yellow pine fence posts to keep them from rotting? How would it do to paint the portion that goes in the ground with hot coal tar? A. The plan you mention is in very general use.

F. O. P. asks: 1. How does a turbine water wheel receive its power, by percussive force at the first entrance of the water, or by the reactive force of the water as it leaves the wheel at the discharge points? A. In general, a turbine wheel acts in both ways. 2. Can the same amount of power be got by a draft tube, placing the wheel half way between head and fall? A. If the draft tube is properly constructed, there will not be much difference.

J. F. S. asks: 1. When measuring the height of the column of mercury in a barometer, shall I measure each inch, beginning at the surface of the mercury in the cup, thus making the inches somewhat shorter than the standard inch? A. You should take the height in standard inches. 2. With what shall I coat the parts of an article which I do not wish to plate? A. With wax. 3. How can I give brass a dark olive appearance, such as is sometimes put on optical instruments? A. Use vinegar and sal ammoniac. 4. How can I give it a silvery appearance, as is seen on the backs of thermometers? A. Make an amalgam of mercury and silver, rub it on the article to be silvered, and then volatilize the mercury by heat. 5. How can I tan large skins with the hair on, and buckskin without the hair? A. See p. 314, vol. 31, and pp. 233, 266, vol. 26.

A. & B. asks: What size should an oscillating engine be, to run an iron boat 25 feet long? A. A cylinder 7x7 inches.

M. asks: 1. Can any incombustible substance be mixed with anthracite coal so as to economize its use? A. We do not know of any. 2. Is anthracite coal injured by remaining in water or by exposure to the water? If so, what changes take place? A. Yes, a slow combustion takes place, and frequently some of the combustible constituents are washed out. 3. If a steam fire engine at the foot of a hill has a pressure on the engine of 50 lbs. to the inch, and the height of the hill is sufficient to cause the water at the bottom press 50 lbs. on the hose, what pressure in the engine will a pressure of 50 lbs. on the delivery nozzle at the top of the hill require? What will be the pressure on each end of the hose when the water is at rest? What will be the pressure on engine and hose when the engine is discharging a stream of half an inch of water from the nozzle on the top of the hill with a force equal to 50 lbs. to the inch? A. See article on "Friction of Water in Pipes," p. 148, vol. 29.

J. K. asks: How must I treat asphaltum, so that when spread on a surface it will remain adhesive, become somewhat elastic, and not crack? A. Try heating the surface before applying the asphaltum.

C. H. M. asks: It is stated that aluminum is now cheaply produced by M. Deville, who had charge of the private laboratory of the Emperor of the French, and that he discovered a process by which it can be obtained in large quantities, and at as low a price as silver by weight. Is this the process described in your paper of January 17? A. We believe this process was not so successful as had been anticipated, and that aluminum was produced in Paris, by Deville, so that it could be sold for about twice the price of silver by weight. 2. What is the best and most specific work treating exhaustively of electricity and magnetism? I wish a book that not only treats of manipulation, but of all the correlative facts appertaining to these forces. A. Watt's "Dictionary of Chemistry," and Ure's "Dictionary of Arts and Manufactures" cover the ground. 3. Can dynamical electricity be converted into statical? A. Yes. 4. Can you charge a Leyden jar from a chemical battery in any way? A. A Leyden jar can be charged from an induction coil. 5. Are the nickel five cent pieces pure nickel? If not, what is the alloy? Where does the government procure the nickel from to make them? A. They are composed of nickel and copper. 6. Is there any other finished railroad in Mexico besides the one from Vera Cruz to the City of Mexico and Puebla? A. Not that we know of. 7. At the Cincinnati water works in 1866, they were putting in a new engine with a cylinder 100 inches in diameter, said to be the largest ever made. It was to operate in a peculiar manner. Was this engine a success, and is it in operation now? A. Perhaps some of our readers in that locality will answer this query. 8. What do they mean out west by a ton of ore? Do they mean the weight of 2,000 lbs. or the bulk of 50 cubic feet? A. A ton is 2,000 or 2,240 pounds, according to the terms of agreement. 9. I observe you spell this tun with a u. Do you mean a tun weight or bulk? A. See Webster's Dictionary.

S.—For compass bearings of the sun and meridian altitude, see almanac.

J. S. M. asks: 1. Please tell me if an air pump will lift water 5 feet, forming a good vacuum? A. You can readily lift the water this distance. 2. Would not the old fashioned pump, with a valve in the plunger, lift water at 260° Fah.? A. A piston pump would do better. 3. Does the use of a blower help to make clinkers in the boiler furnace? A. Generally it does. 4. Can there be any greater vacuum than the pressure of the atmosphere, 14 7/8 or 15 lbs.? No.

H. & M. says: We had a new cylinder, 16 x 36, put on an old engine bed plate; it has been working badly. On taking off the steam chest plate and comparing the valve with the ports and exhaust, we found that, when the port was 1-32 of an inch open, the exhaust on the opposite end (or port) was open full 1/2 of an inch. We put pieces in the valve to close the exhaust, which left the exhaust open 1/4 of an inch, when the opposite port was open 1-32 of an inch. The engine had been running 80 revolutions per minute, and we put her down to 70 revolutions. Will you please tell us if we did right in closing the exhaust, and also what motive the makers could possibly have in making the valve to work in that way? A. We think the change effected an improvement. An examination of the valves of steam engines often shows quite as faulty construction as is indicated in the present instance. These cases can best be accounted for by supposing that the manufacturers were careless or ignorant.

N. J. asks: 1. Is ground bone used for hardening purposes? If so, what is principally hardened by it? A. It is sometimes used for case hardening iron, etc. 2. Is there any substitute for it? A. Leather horns, hoofs, may be used instead.

J. P. says: To dissolve copper by sulphuric acid, it is directed to first oxidize the copper in a reverberatory furnace. Does the addition of nitrate of potassa to the sulphuric acid obviate the necessity of calcination, or previous oxidation? A. Copper can be dissolved in strong sulphuric acid, by the application of heat.

W. H. N. asks: How can oily cotton waste be cleaned for re-use? Can the oil be extracted and purified? A. Bisulphide of carbon is used to extract grease. The volatile bisulphide can afterwards be distilled off and recovered, leaving the grease behind. For practical details, consult some good chemist.

M. H. K. asks: Under the same circumstances, which has the most friction, an eccentric or a crank, with the same frictional surface, stroke, load, etc.? A. The friction would be the same in both cases. For answer to your other question, address the editor of the paper in question.

J. R. H. says: In a work by Mr. R. A. Proctor, entitled "Light Science for Leisure Hours," it is said that: "A distinguished French astronomer, author of one of the most fascinating works on popular astronomy that has hitherto appeared, remarks that a man would be looked upon as a maniac who should speak of the influence of Jupiter's moons upon the cotton trade. Yet, as he proceeds to show, there is an easily traced connection between the ideas which appear at first sight so incongruous. The link is found in the determination of celestial longitude." Please explain how this connection between the motion of Jupiter's moons and the cotton trade may be traced. A. The relative position of Jupiter's moons, when correctly determined, might enable the mariner to determine his longitude, and this again, by diminishing the risks of ocean navigation, would influence the price of articles transported across the sea.

G. F. V. asks: Will plaster of Paris and althea root (marshmallow), mixed with water, stand much heat after setting? A. It ought to stand a temperature 45° higher than the boiling point of water without injury.

W. H. asks: What shade of blue glass will show best at night, at 1,000 feet distance? Common blue glass does not show blue at that distance. A. Try cobalt blue glass.

N. H. says: I have heard that a certain part of the full grown interior of a cow, or even of a hog or a horse, can be used for the purpose of curdling milk for cheese making. Can you tell me what part of which animal can be best used for this purpose? A. There are various substances which, when added to milk, cause it to coagulate or form a curd. Such are the vegetable and mineral acids, and neutral, earthy, and metallic salts. Rennet, or the stomach of the calf, however, seems to be almost exclusively used and preferred by dairy farmers, but the stomach of all other sucking quadrupeds possesses the same properties. We have little doubt that the application of practical chemistry in cheese making would give the farmer a much more reliable and cheaper substitute. To prepare rennet, the stomach of the calf should be freed from the outer skin, fat, and useless membrane, washed, treated with brine or dry salt for a few hours, and then hung up to dry. When well prepared, the dried "vells" somewhat resemble parchment in appearance. For use a piece of the requisite size is cut off, and soaked for some hours in whey or water, and the whole added to the milk. Two square inches from the bottom of a good "vell" are said to be sufficient for a cheese of 60 lbs. We are inclined to think that your imported rennets have not been properly prepared, or have become spoiled by long keeping.

E. S. Y. asks: Can I get a patent in Canada for an invention patented in the United States in 1867? A. In Canada, patents are not granted for devices that have been patented in another country for more than one year. For prices of copies of patents, see our advertisement on another page.

W. F. K. asks: How can I produce a current of cold air to pass through a tube 3 feet in diameter and 12 feet long, laying in a horizontal position, the current to move at the rate of 10 miles per hour? A. By the use of a fan or rotary blower.

J. J. R. says: I claim that, in shooting game on the wing, if the gun is held directly on the game and moved with a uniform motion, the shot and game will meet every time. My opponent claims that if you do not shoot ahead of the game far enough to have the game meet it, you will surely miss. A. Your opponent is right. In the act of firing, if the muzzle of the gun requires to be moved at the rate of one foot per second in order to follow the game, and the game is moving at ten feet per second, it is obvious that the shot will not reach the game. The gun must therefore be aimed in advance of the game.

B. J. T. asks: What is the best transparent solution for fixing paper upon glass? A. Try a solution of the best isinglass in glacial acetic acid.

A. W. D. asks: 1. How can I make the best balloon gas? A. The best balloon gas is hydrogen, which is made by dissolving zinc in oil of vitriol diluted with five times its bulk of water. 2. What is its lifting power per cubic foot? A. A cubic foot of hydrogen weighs about 3,698 grains, a cubic foot of air weighs 53,222 grains, and the lifting power is proportional to the difference. 3. Is it explosive? A. When pure it is not explosive, but when mixed with air, it is.

J. B. V. asks: How can I remove the so-called conferva, the green stuff, from my brown stone stoop? A. Try soda lye. Low orders of vegetable growth frequently select cool and shaded localities. The dust is full of plant germs, which no sooner effect a lodgment than they begin to grow under favorable circumstances of temperature and moisture.

E. T. D. asks: 1. How can I make a bichromate battery, using a carbon cell? A. Take gas carbon (from old gas retorts) and cleave it into suitable plates with an ax. It destroys the teeth of saws. 2. How can I make carbon cells? A. Dissolve bichromate of potash in water and add oil of vitriol until the solution is strongly acid. Put the carbon plate and this solution into a cup of porous earthenware. Stand this cup in a jar containing a strip of zinc and dilute oil of vitriol. Connect the zinc and carbon with copper wire.

M. B. S. asks: Is there any transparent cement or varnish that diluted sulphuric acid will not affect? A. Try a solution of 75 parts of india rubber in 6 parts of chloroform, to which, after the india rubber has been dissolved, 15 parts of mastic have been added.

O. A. F. asks: How can I put a perforated metal plate into the steam dome of my boiler to break the foam? A. Try wire gauze, arranging some clamps to hold it.

J. E. M. asks: 1. What is the best method of extracting the strength from powdered nut galls? A. The best mode is to loosely stop a funnel with a piece of cotton wool, and fill it half or two thirds full of powdered galls. Then cover over the funnel, but not quite airtight. Ether is poured upon the powder, and after some time a liquid runs through into a receiver placed below. It consists of two distinct strata: the lower, which is almost colorless, is a very strong solution of nearly pure tannic acid in water; the upper consists of ether holding in solution gallic acid, coloring matter, and other impurities. The carefully separated heavy liquid is placed to evaporate over a surface of oil of vitriol in the vacuum of the air pump, and yields the tannin. The water comes from the ether, which usually contains a small liquid. 2. Is there a liquid antimony? A. There is no liquid antimony, but there is a compound of chlorine with antimony, the bichloride of antimony, which becomes liquid when slightly heated, and is called butter of antimony. It may be formed by dissolving antimony in hot muriatic acid, or by dissolving sulphide of antimony in hot strong muriatic acid and distilling the product. 3. Could I press a bale of hay with compressed air, and what size of piston head would it require to get power enough, having a jack at each end of press? A. You could not use air, because air is compressible; and by so much as you increased the pressure on the piston, the volume of the air would be diminished.

S. P. asks: 1. Are there any Bessemer steel castings made in this country? A. Yes. 2. Can they be forged, worked hot, punched, and tempered? A. Yes.

E. P. F. asks: How can I make imitation coral? A. Color prepared chalk with sesquioxide of iron or rose pink, pass through a sieve, and make into a paste with white wax.

C. M. L., H. D. M., and many others ask: How can rubber boots be mended? A. Cut a patch out of rubber, and rub the patch and the boot with sand paper. Dissolve a little pure rubber in turpentine to the thickness of molasses; smear the patch and boot five times with this, letting dry each time; then smear once more and press together.

W. H. D. asks: 1. Is the quantity of rain and snow fall constant in every year, or is there as much again in some years as in others? About how many feet altogether fall in a year? A. The average quantity for any locality is about the same, varying greatly in different places. For instance, the average annual rain fall in London is 20.655 inches, and at St. Domingo, 130 inches. For answer to your other questions, address a manufacturer.

D. R. T. asks: What part of the rim of a flywheel goes the fastest? A. The outside part. Your other questions are not sufficiently explicit to enable us to answer them.

C. H. M. says: Given a strong glass tube, filled with water and hermetically sealed, in which are introduced two electrodes, connected to a battery strong enough to decompose water. The battery is set to work. There being no room for the resultant gases, will the decomposition cease, will the two gases under the pressure reunite and form water again, or will the tube burst? A. Not only tubes of strong glass, but balls and cylinders of thick iron may be burst by the accumulated pressure of the liberated hydrogen and oxygen, which neither recombine to form water under this great pressure nor are condensed to a liquid state. 2. Draper says, in his "Textbook of Chemistry," p. 342: By placing a piece of platinum in nitric acid of a specific gravity of 1.34, and then bringing an iron wire in contact with it, and withdrawing the platinum, the iron assumes a passive or allotropic state. It now exhibits no tendency to unite with oxygen, cannot precipitate copper from its solutions, and simulates the properties of platinum and gold. This seems to me an interesting fact, but it is very brief. What induces this change and what is the rule governing it? How much platinum would it require to allotropize a pound of iron? A. There are various modes of producing this passive condition of iron in an acid of a moderate degree of concentration; some of these seem to indicate an intimate connection with its voltaic relations, as, for example, the experiments which you quote. The production of the passive state does not depend upon the relative quantities of platinum and iron, but upon the strength of the acid in which they are immersed and the circumstances under which they are brought into contact. Iron which has been ignited, and is therefore covered with black oxide, likewise is passive, although, on account of the greater thickness of the coating, the passive state is more complete. This would make it highly probable that the explanation is still simpler than that of some voltaic relation, and that the passive condition is due to the formation of a thin film of anhydrous sesquioxide on the surface of the iron. Your other question is too large to be discussed in these columns.

J. J. K. says: A neighbor took out a patent in 1859, and soon afterwards died. His widow has never done anything with the patent, which is now 15 years old. A. Patents granted in 1859 expired 14 years from date, unless renewed before expiration, and cannot be renewed after expiration except by special act of Congress.

A. B. C. should apply to dealers in photographic materials for the book of instruction in the art.

C. F. W. asks: Can you inform me by what means felt hats can be made flexible, so as to admit of being pressed into a different form? A. Try moistening them.

O. S. asks: If lime be added to fuel, will it intensify the heat of the fire? A. No.

G. R. E. asks: How is an interrupter, which closes and opens the battery circuits as often as the fork vibrates, about 500 times per second, constructed? A. An interrupter or circuit breaker generally consists of a spring, one end of which is attached to one of the poles of an electromagnet, and the other end armed with a piece of soft iron, and kept by the spring a short distance from the pole, but free to be attracted by it when a current passes through the magnet. Sometimes a toothed wheel is used, in contact with a metal spring in connection with the battery.

H. J. D. asks: Do you know of any work that treats on grout walls, the manner of mixing, building, etc.? A. There have been several works of the kind published; one of the latest is a "Treatise on Concrete," by Henry Reid, C. E. 2. What are the proportions of lime and gravel or gravel and sand? A. See answer to J. L. C., p. 138 of this volume. 3. What would be the proper thickness of walls for a two story house? A. For an ordinary dwelling house, 12 inches would be sufficient. 4. Are the walls considered strong? A. As strong as brick or stone when good cement and sharp sand are used. 5. To what extent are they fireproof, as compared with brick or stone walls? A. They are quite as much fireproof as brick or stone.

W. J. R. says: I am running a 5 inch circular saw, which is a little concave on side next the timber. It has what is called the chisel tooth, square in front and on back, but it has to be filed in a way which makes all other saws run out of the timber. It runs too much to the timber when filed square. Does the concave next the timber make it run in? How can I remedy it? Should it be convex next the timber? A. It is almost impossible to make two saws that will hang just alike on the same mandrel, or make the same saw hang alike on any two mandrels. The slightest difference in turning up the collars of the mandrel, or in the finish of the saw near the mandrel hole, will cause a very perceptible difference in the hanging, so that it is often necessary to adjust the saw by packing between the collars with writing paper. In hanging a new saw, it is best to fit it on, screw it up between the collars, and then examine it carefully on the front or log side, and see if the face of the saw is flat. If it is found to be rounding on the log side, cut a ring of writing paper, about half an inch wide, the size of the collar on the outside, oil it, and stick it on the face of the fast collar around the outer edge. Then cut another ring of paper of the same width, making the outside of the ring the size of the hole in the loose collar; put this small ring between the loose collar and the saw, and screw up the collars. If the two rings are not enough, put in more until the saw comes right. If the saw hangs dishing on the log side, reverse the rings of paper, that is, put the small ring between the saw and the fast collar, and the large ring on the loose collar. Should a saw run a little out of true on the rim, it may be made to run true by packing with writing paper between the saw and fast collar. A saw concave on the side next to the log is sure to cause it to run into the timber. It should be perfectly flat on the log side and convex on the board side. For a book of information as to how to run circular saws, send to Emerson, Ford & Co., Beaver Falls, Pa. It will be furnished free.—J. E. K., of Pa.

V. T. asks: What chemical compound will take fire at about 150° to 200° Fahrenheit, without danger of violent explosion? A. Phosphorus.

J. B. says: 1. Frequently small patches of quicksilver are found removed from the backs of looking glass plates; with what material can these patches be covered almost instantaneously, so as to answer the purposes of commerce, and how is it applied? Tin foil has been suggested. A. Clean the damaged spot by very careful rubbing with fine cotton until there is no trace of grease or dust; then with the point of a knife cut the size of the required piece off the silvering of another glass; a small globule of mercury (the size of a pin's head for a surface the size of the finger nail) is dropped upon the cut piece. The mercury penetrates as far as the cut, and allows the piece to be removed. It is then gently pressed on the spot with a piece of cotton. 2. How can cast and sheet iron stoves be best preserved from rust, on being put away for winter's use? A. By packing in well burned, perfectly dry, coarsely powdered quicklime, or by coating with black lead, or by boxing up as nearly airtight as possible along with quick lime, in a dry place. Your other queries relate to trade matters.

G. A. J. asks: Is air the heaviest during a rainy, damp time, or when it is clear and cold? A. It is the heavier in a cold, clear day.

P. asks: 1. Is there an invisible ink for writing on postal cards? A. A dilute solution of chloride of cobalt; on gently heating, the writing is developed. 2. Is there any invisible ink that will become visible by the application of water? A. We believe not.

J. W. H. asks: 1. How can I change the color of brass to copper? A. It cannot be done directly. The object, however, can be effected by a very thin coating of electroplated copper. 2. How can I give brass or copper a bright color, after it comes from the foundry? A. By exposing for a short time to dilute aqua fortis.

P. says: In making a hydrogen lamp, I poured the (commercial) acid and water (1 to 4) into the jar, when bubbles began to appear upon the zinc; but after a couple of minutes, the acid ceased to work. I then procured some "chemically pure" sulphuric acid and put that into the jar with the same proportion of water, but it had no effect upon the zinc. The zinc was common sheet zinc, melted into a roll. What was, probably, the cause of the failure? A. Our own experience is that commercial sheet zinc dissolves in oil of vitriol and water (1 to 4) with great rapidity. Try altering the proportions you employed until you hit the point of greatest action. There is no advantage in substituting pure for commercial sulphuric acid.

C. M. asks: How should paint be mixed to be applied to a mixture of glue and glycerin? A. Try grinding up oil paints with a thick hot solution of common soap.

E. A. F. T. asks: Can elm, pecan, and white oak trees, from 12 to 30 inches diameter, be sawn up for wheelwright's use with a 24 inch circular saw driven by a 6 horse power engine? How much timber, board measure, can be sawn with such a saw and power in a day? A. A 24 inch saw would be rather too small for timber 30 inches in diameter. A 36 inch saw would do better, and a 6 horse power engine would drive it well enough; such a saw, well managed, would cut from 4,000 to 6,000 feet board measure in each 10 hours.—J. E. K., of Pa.

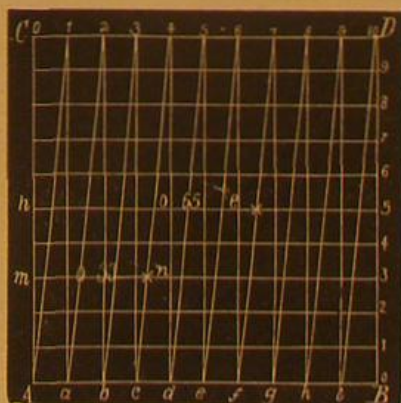
W. E. asks: Does it take as much to support a man of 160 lbs. weight in the water as it would to support the same weight of iron or other heavy substance? A. No. 2. Do any of the ocean steamships carry life rafts? If so, what kind are they? A. Some of them do. We believe both the Monitor and Nonpareil rafts are used. In answer to your other question, consult a lawyer.

C. P. asks: How can I bend a piece of rosewood 1/2 inch thick, 3 1/2 inches wide, and 4 inches long, in a circle without breaking it, to lap 8 inches? A. Try steaming it.

C. C. E. says: I am building a church spire to the height of 165 feet from the ground. It is surmounted by a cross 6 feet high, overlaid with gold leaf. Do I need a lightning rod? If so, what is the best kind? A. Yes. The spire should be furnished with a lightning rod. See hints recently given to another correspondent on the subject.

J. W. asks: How can old shoes be put to use? A. One of the uses is for the case hardening of iron.

M. J. K. asks: Please explain the use and construction of the diagonal scale. Can the relative proportions of a drawing be obtained from it without working them out fractionally? A. If A B represents



one unit of measure, as one foot, on any required scale each of the divisions A a, a b, b c, etc., represents 0.1. Divide A C into 10 equal parts, and draw lines through each division parallel to A B. Draw also diagonals, A 1, a 2, b 3, etc. Then the distances, from A C, to the points of intersection of the diagonals with the horizontal lines, represent hundredths. For instance, 0.45 is the distance a, at the intersection of the horizontal line k 5, and the diagonal f 7—0.33 is the distance m n, and so on.

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

- R. T. S.—Stones are so altered by exposure to fire that it would be necessary to see the mineral before fusion in order to pronounce what it is. We know of no separate treatise on charcoal burning.
- H. S.—Your specimens are iron pyrites.
- R. H. W. A.—Iron pyrites. For directions for silvering mirrors, see p. 280, vol. 24.
- W. W.—It is metallic iron.

C. H. M. asks: Is there any means by which I can filter the heat out of sunlight, and converge the light rays into a focus afterwards, without having any heat in the focus?—B. F. K. asks: What metals are used to make Yankee brass, and what are the proportions of each?—F. S. asks: How can I stick india rubber on rough and polished brass, so that kerosene oil will not loosen it?—C. M. asks: How can I soften a meerschmum pipe, which has become hardened by too rapid smoking and will not color? What will remove the incrustation from the inside?—W. H. D. asks: If the foundation of the centennial tower gave way 1/2 of an inch on one side, how much would it throw it out of perpendicular at top?—T. A. H. says: In polishing a wooden knob, I laid a piece of worn sand paper on the palm of my left hand, held the knob in my right hand, and moved it rapidly on the paper in a circle of about two inches, from right to left. The paper began immediately to rotate with a regular motion from left to right. The movement of the paper was much slower than that of the knob, though well defined and continuous while the friction lasted. Can any of your readers explain this?—A. S. asks: How is stamping done on goods for embroidery or braiding?—J. P. W. asks: How can I make a good imitation meerschmum pipe?—P. J. Q. asks: What cement will make a tight joint between iron and wood?—L. C. B. asks: What can I do to keep hens from eating their eggs?—L. L. R. says: A seal skin cap became greasy and I removed the grease with ammonia and alcohol, but it left the fur without gloss. How can I restore the gloss and remove the kinks in the fur?—J. W. M. asks: How can I join gun barrels in making a double barreled gun? How can I cut the grooves of a rifle?—J. E. McG. asks: Can any one give me a good recipe for root beer?—W. P. S. P. asks: How many square miles of the earth's surface can be seen from the top of a steep 400 feet high, supposing the earth to be perfectly spherical and 7,920 miles in diameter?—J. N. W. forwards us for inspection a piece of plank, on one side of which is an excrescence as large as a hen's egg. All over the lump, as over the flat portion of the surface, the saw marks are visible, and the next plank in the log had not the least depression to account for the phenomenon. Our correspondent bored a hole through the lump to see if there were a soft place in it, which would account for the growth by the swelling of the wood, but it is solid throughout. Can any of our readers account for it?—V. T. asks: What is a good composition with which to impregnate a fuse that will burn at about 100 or 200 feet a minute?

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 Epicycloid. By M. M.
- On Three Challenges to the Students of Nature. By D. L. S.
- On Psychic Force. By J. T. C.
- On Proving a Theory. By G. E. W.
- On Magic Squares. By T. C. S.
- On Electricity in Therapeutics. By S. T. W.
- On Trades Unions. By N. W. K.
- On Landing a Line from a Vessel. By W. H. D.

Also enquiries from the following:

- W. W. C.—E. S.—C. R.—S. A. S.—E. S.—C. J.—S. A. M.—F. J.—L. P. C.

Correspondents in different parts of the country ask: Who makes brass and copper tubes, drawn without joints? Who makes sap evaporators? Where can gutta serena be obtained? Where can the meniscus and eyepieces for the cheap telescope, described on p. 7, vol. 30, be obtained? Who sells tools used by sculptors in modelling? Who sells German leaf gold? Who makes water and gas pipes? Who sells portable frame dwelling houses? Who makes rock-drilling machines and cement drain pipe machines? Who sells peanut-roasting machines? Where can glasses for looking down into water be obtained? Who sells machines for crushing seed without stones? Who sells whalebone for whips? Who makes small steel castings? Who makes lozenge cutting machines, to work by hand? Who sells box-wood for engravers' use? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

February 24, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Air to air chambers, supplying, T. Shaw.....	147,870
Alarm, electric, F. L. Pope.....	147,975
Animals, nasal yoke for, R. S. Shepherd.....	147,873
Bag fastening, M. Schwerin.....	147,866
Bale tie, cotton, E. J. Beard.....	147,811
Bale tie, cotton, R. Fell, Jr.....	147,797
Bale tie, cotton, E. W. Whitman.....	147,883
Bale ties, guard for wire, W. S. Davis.....	147,911
Bands, making endless, T. Piper.....	147,974
Bed bottom, Mathias & Van Derzee.....	147,775
Bedstead, folding, A. Whittemore.....	148,012
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Belt punch, E. G. Pullis.....	147,792
Bench, carpenter's, E. H. Lancaster.....	147,848
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Boiler feeder, C. Wright.....	147,886
Boiler, sectional steam, D. Russell, Jr.....	147,785
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Boot and shoe, A. Lawyer.....	147,776
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Table listing various patents and their numbers, including items like 'Bridge, iron, J. and Z. Wall', 'Locomotive, D. Fraser', 'Meat chopper, C. H. Ellis', etc.

Table listing various patents and their numbers, including items like 'Polishing glass, etc., A. Broighton', 'Paper bag machine, B. E. Pettet', 'Extensions granted', 'Designs patented', 'Trade marks registered', 'Canadian patents', 'Schedule of patent fees', and 'Applications for extensions'.

5,156.—C. N. Goss, Claremont, Sullivan county, N. H., U. S. Improvements on horse hay rakes, called "Granite State Horse Hay Rakes." March 3, 1874.

PATENTS

The publishers of the SCIENTIFIC AMERICAN have acted as solicitors of patents in the United States and foreign countries for more than three quarters of a century.

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[NEW SERIES.]

NEW YORK, APRIL 4, 1874.

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FIRE EXTINGUISHING APPARATUS FOR BUILDINGS.

Illustrated in the annexed engravings will be found a novel and, it is believed to be, a most efficient device for protecting buildings of every description from fire. The invention consists essentially in a peculiar form of tank roof, which may be entirely submerged through its connection with a system of water pipes running through the edifice, as illustrated in our engraving. By means also below described, the outer walls may be kept constantly wet by a thin stream of water pouring down their faces. Perforated pipes are laid through the building, in order to afford a supply of water to the different stories; and finally, by suitable hose connections on the roof, streams of water may be thrown upon adjoining structures.

The roof arrangement is shown in Fig. 2, and consists of a flat sheet metal water-tight covering, having around it a flange, A, within which is a partition, B, the two portions forming the eaves. The flange, A, supports a cornice, the lower edge of which stands out from the wall for a distance of about an eighth of an inch. Perforations are made in the outer flange, so that, whenever the water in the gutter rises above the orifices, it will escape and flow down the walls.

A suitable waste pipe, C, Fig. 1, connects with the gutter, and ordinarily carries off the water to the sewer; but when it is desired to cause an overflow through the perforations, as above noted, the shutting off of a cock, at D, accomplishes the object.

Under the lower door, and inside the walls of the building, it is designed to place four distributing mains, one of which is shown at E, Fig. 1. From each corner, formed by their junction, rises a stand pipe, F, to and through the roof, terminating in a hose coupling, Fig. 2. Under the roof horizontal pipes, G, connect the stand pipes together, and these, as are also the mains, E, are provided with suitable stop-cocks, by means of which water may be delivered at any one or more of the stand pipes upon the roofs, or without pressure through all the pipes. One stand pipe terminates at the plane of the roof, and serves to conduct water therefrom except when flooding is desired, when a stopcock at the lower part of the tube is closed. At the planes of the joists of the several floors, the stand pipes are tapped with couplings with which to connect perforated pipes extending across the building, for the purpose of throwing spray between the floors and ceilings to extinguish fires occurring therein. These spray tubes are provided with stop valves at each end, so that no water need be used unless required.

In the center of the roof is a pipe, H, extending through the same and having hose couplings at both ends. The upper extremity may be connected by a hose with one of the stand pipes; and, by hose attached to its lower portion, water may be delivered at any point within the upper story. The stand pipes are provided with external couplings at the several floors, which project through the outer walls to receive lines of hose from fire engines, as shown in Fig. 1.

The inventor suggests that the device will prove a valuable safeguard in theaters and other buildings liable to sudden conflagration. He proposes to make the sides of proscenium boxes, and also the railing of each balcony, of galvanized metal with perforated surfaces, so that a flow of water may be instantly secured, which will flood the auditorium.

Patented January 20, 1874. For further particulars re-

garding sale of rights address the inventor, Mr. John C. Schweizer, with Kramer Brothers, 264 and 266 Madison street, Chicago, Ill., or Francis Probst, 51 Liberty street, New York city.

Carnivorous Plants.

In a recent number of the *American Naturalist*, Mrs. Mary Treat gives an interesting account of her observations of the habits of the plant known as sundew (*drosera filiformis*), which she found in July last, in Atlantic county, N. J. These

death of the larger insects, they fall around the roots of the plants as if to fertilize them, but the smaller flies remain sticking to the leaves.

Careful and repeated experiments during several days revealed the fact that on some days the plants work much better than on others. Whether it was the electrical condition or amount of moisture in the atmosphere is yet to be ascertained.

I experimented with three species of these plants—*d. filiformis*, *d. longifolia*, and *d. rotundifolia*.

July 11, 10 o'clock, A. M., I pinned some living flies half an inch from the leaves, near the apex, of *d. filiformis*. In forty minutes the leaves had bent perceptibly toward the flies. At twelve o'clock the leaves had reached the flies, and their legs were entangled among the bristles and held fast. I then removed the flies three quarters of an inch further from the leaves. The leaves still remained bent away from the direction of the light toward the flies, but did not reach them at this distance. Whether the action of the flies' wings may have created sufficient force to bring the leaves near enough to entangle the flies, is a question I have not yet satisfactorily settled in my own mind, for dead flies did not seem to have the same power as living ones.

Fifteen minutes past ten of the same day, I placed bits of raw beef on some of the most vigorous leaves of *d. longifolia*. Ten minutes past twelve, two of the leaves had folded around the beef, hiding it from sight. Half past eleven of the same day I placed living flies on the leaves of *d. longifolia*. At twelve o'clock and forty-eight minutes, one of the leaves had folded entirely around its victim, and the other leaves had partially folded and the flies had ceased to struggle. By half past two, four leaves had each folded around a fly. The leaf folds from the apex to the petiole, after the manner of its venation. I tried mineral substances, bits of dry chalk, magnesia, and pebbles. In twenty-four hours neither the leaves nor the bristles had made any move like clasping these articles. I wet a piece of chalk in water, and in less than an hour the bristles were curving about it, but soon unfolded again, leaving the chalk free on the blade of the leaf.

The bristles around the edge of the leaf of *d. rotundifolia* are longer than on those of *d. longifolia*, but the leaf of the former does not fold around a fly as it does in the latter—simply the bristles curve around the object, the glands on the ends of the bristles touching the substance, like so many mouths receiving nourishment.

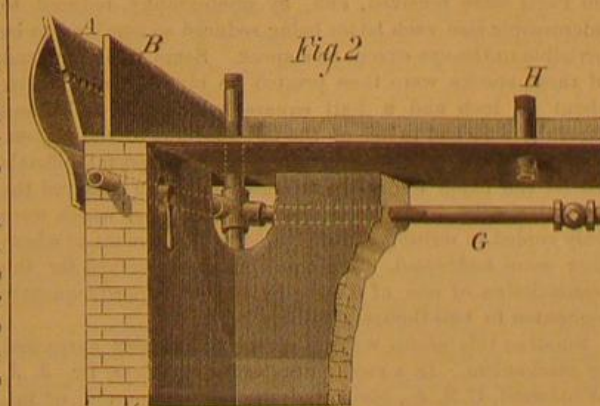
Half past 10, A. M., I placed raw beef on some leaves of *d. rotundifolia*; by 1 o'clock the inner bristles were curving about it, and the longer bristles, on the outer edge of the leaf, were slowly curving upward. By 9 o'clock, in the evening, all the bristles of three of the most vigorous leaves were clasping the beef, almost hiding it from sight, while an equally vigorous leaf made no move like clasping a bit of dry chalk. At 10 o'clock in the morning I placed bits of raw apple on some of the leaves of the last named species; by 9 o'clock in the evening part of the bristles were clasping it, but not so closely as the beef. By 10 o'clock next day, twenty-four hours, nearly all the bristles were curved toward it, but not many of the glands were touching it. So it would seem that these plants are really carnivorous, that they prefer and absorb animal substances through their leaves. And Mr. Darwin says that by pricking a point in the leaf of *drosera*, he can paralyze half of it, and this indicates nerves!



FIRE EXTINGUISHING APPARATUS FOR BUILDINGS.

plants appear to be most remarkably endowed. To all the usual functions of plants, certain animal instincts and propensities are added, such as the power to seize, kill, and suck the blood of insects, and to grasp and eat raw meat, etc.

Our author says of the plant: It was in full bloom and growing as thick as it could well stand, on either side of an extensive cranberry plantation. This charming plant, with its pretty pink blossoms, together with the dew-like substance exuding from the glands (the glands surmount the bristles or hairs which cover the long thread-like leaves), was one of the most beautiful sights I ever beheld. From



former observations I had supposed this plant caught only small insects, but now found I was mistaken; great asilus flies were held firm prisoners, innumerable moths and butterflies, many of them two inches across, were alike held captive till they died—the bright flowers and brilliant, glistening dew luring them on to sure death. But what is the use of this wholesale destruction of insect life? Can the plants use them? Upon examination I find that, after the

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NEW YORK, SATURDAY, APRIL 4, 1874.

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THE SCIENTIFIC AMERICAN AS A PREVENTIVE OF BOILER EXPLOSIONS.—VALUE OF ITS CORRESPONDENCE.

Our readers, in their kind letters of commendation of the SCIENTIFIC AMERICAN, very frequently tell us that the information they derive from its columns is of the greatest value to them in their several callings, and every day we are told that a single hint put in practice is often the means of making or saving considerable sums of money.

Mr. S. E. Worrell, of Worrell, Hannibal county, Mo., writes that he has read the SCIENTIFIC AMERICAN for fourteen years, and that he has learned more from its pages than during the period he attended school. In perusing a recent number, he goes on to state, his attention was attracted by the report of boiler inspections by the Hartford Boiler Insurance Company.

We congratulate our correspondent on his narrow escape from a probable casualty. We commend him for his careful attention to what he reads. If every mechanic, on receiving a number of the SCIENTIFIC AMERICAN, would thoroughly consider its suggestions, and seek to apply them to his individual case, there is no doubt but many of the disasters occurring in the use of machinery would be avoided.

We would suggest that this feature of the paper may be made still more useful and interesting, if every subscriber will take the trouble to communicate some new fact or discovery he has made, whether by accident or experiment.

A few lines of such information from the workshop are frequently of more practical value than a volume of essays on some abstract science by the most learned author.

THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS.

Those of our readers who are familiar with the course of events during the strike of railroad engineers, which occurred, principally on western lines, some two months since, will remember that the demonstration elicited a strong letter of disapproval from Mr. Charles Wilson, Grand Chief Engineer of the Brotherhood of Locomotive Engineers.

The locomotive engineers of this country are as a rule an able and thoroughly reliable body of men. To their hands are entrusted immense responsibilities, and from them are required the exercise of an amount of skill, cool judgment, and, at times, absolute heroism which raise them far above the average mechanic.

Mr. Wilson, we understand, proposes to appeal to the Brotherhood as a whole, against the action of their delegates, and invites such members as do not acquiesce in the course of the latter, to join him in forming a new society on the old basis, as expressed in the letter referred to in the beginning.

THE MARVELS OF MECHANICS.

During the last siege of Paris, the inhabitants from time to time effected communication with their friends beyond the German investing lines by means of carrier pigeons. In fact, a regular pigeon post was organized, having one of its receiving stations in London.

Small as this photo writing seems, it has been surpassed by mechanism. In a recent number of the Lens, Dr. J. J. Woodward, U. S. A., gives an enlarged photograph of microscopic writing done by machinery on glass, by means of a diamond, executed by Mr. William Webb, of London.

copy a space of about two inches long by one and a half inches broad. All the words are brought legibly out on the photograph, the total number of letters being 227; and such is the exceeding fineness of the original writing that 29,431,458 letters written in the same way would only cover one square inch of glass surface.

The Webb machine, however, does not equal, in the fineness of its writing or perfection, the prior instrument of Mr. N. Peters, a wealthy banker of London, who, as long ago as 1855, was able to write nearly three times finer than Webb.

METROLOGICAL SCIENCE.

The American Metrological Society, the first session of which was held during December last in this city, forwards us a copy of its constitution and by-laws, in which the objects of the association are fully set forth.

President Barnard, of Columbia College, has been elected President, and the names of several well-known scientific gentlemen, including Professors Hilgard, Newton, Cooke, Elliot, and Thurston are among the officers and council.

The second memorial refers to the legal weights of our gold coinage, and asks that the pure gold contained in the dollars shall be exactly one gramme and a half.

The gramme of pure gold would thus become the world's unit of money, and the problem of an international coinage thus quickly and easily settled.

THE DETROIT RIVER TUNNEL.

An interesting history of the attempted construction of the tunnel under the Detroit river, between Detroit and Windsor, on the Canada shore, is given in a paper read by Mr. E. S. Chesborough, C. E., at the last annual convention, and published in the Transactions, of the American Society of Civil Engineers.

On the Detroit side, other difficulties were being encountered. At 1,180 feet from the shaft, the ventilating apparatus proved inadequate and two of the workmen were killed.

influx of water became so great as to require more powerful pumping engines, and then the contractors, discouraged, sought and received permission to relinquish the work.

Then the directors attempted to continue on the Windsor end by means of two parallel trial drifts, and to begin a second one at the shore shaft, at a level 10 feet above the grade of the drainage tunnel, leaving the latter to be used as a sand holder in case of further irruption, the idea being that, in either one or the other drift, some progress might be made. Experience, it seems, had shown that a stream of sand and water flowing into the tunnel at one point would never be accompanied by a troublesome one flowing in at another. It is unnecessary to enter into the details of the last effort. The actual advance in new ground during the last two months was only 64 feet, and the cost about \$7,500, or more than 6½ times the contract price, and the directors, in turn discouraged, abandoned the enterprise.

Mr. Chesborough answers various criticisms on the mode of carrying on the work, and states reasons why the orifices through which the irruptions occurred could not be stopped. A shield, he remarks, could not be used to advantage, nor could success have been assured by the pneumatic process. The causes of the irruption were springs and water courses, having their source 150 feet higher than the tunnel, and much above the level of tide water. Mr. McAlpine notes a similar case in the building of the dry docks at Brooklyn, N. Y., where fresh water came in with a head of 50 feet higher than that of the salt water. The water entering at Detroit was sulphur water, and without doubt owed its origin to Sulphur Springs at Sandwich, below Detroit, where the level rises from 30 to 40 feet above that of the river.

A HILL OF SULPHUR.

One of the most remarkable deposits of native sulphur, as yet discovered, is a great hill composed of the almost pure article, found some two years ago at a distance of thirty miles south of the Union Pacific Railway and nine hundred miles west of Omaha. This marvelous deposit is found to consist almost wholly of sulphur, containing only 15 per cent of impurities. The best deposits heretofore available are those found in Sicily. The principal supplies for the manufacture of sulphuric acid come from there; the deposits contain 35 per cent of impurities and 65 per cent of sulphur. Our western sulphur hill, therefore, is much the most valuable, and promises to become ere long of great importance to the country.

THE LAUNCH OF THE CITY OF PEKING.

The country has good cause for self-congratulation in the efforts which our prominent shipbuilders and capitalists are putting forth to regain the commerce which, during the war, passed from under our flag. Another great vessel has been launched, one of the largest ships ever constructed, save the Great Eastern, which is to form part of the Pacific Mail steamship line; a second vessel of similar proportions is on the stocks, and the same builders, we learn, are maturing plans for a line of European steamers. The City of Peking, which was recently successfully launched at Chester, Pa., was constructed by the Delaware River Iron Shipbuilding and Engine Works, of which Mr. John Roach is President, and is without doubt one of the most magnificent vessels, in construction, form, and fittings, ever built. Her length is 420 feet, beam 47 feet 4 inches, and tonnage 6,000 tons. She has compound engines of 4,500 horse power, and a Hirsch four bladed screw 20 feet 3 inches in diameter. There are four decks, with accommodations for 2,000 passengers, fitted up in almost palatial style. No improvement in interior conveniences has been omitted; the machinery, soon to be inserted, is said to be a masterpiece of workmanship.

The ship is entirely of iron, five million pounds of the metal being used in her hull. She has four masts, three of which are of iron and are used as ventilators, and she spreads 33,000 square feet of canvas. Her estimated consumption of coal under her ten boilers is estimated at between fifty and sixty tons per twenty four hours, and her speed will be about fifteen and a half knots.

The ceremony of launching was made the occasion of a holiday in Chester, and the town was thronged with visitors from New York, Philadelphia, and Washington. Large numbers of prominent men were present, including senators, representatives, chiefs of bureaus and other government officials. The ship, as the last shore was removed, glided into the water in splendid style, and was duly christened by the daughter of the builder, breaking the traditional bottle of wine over the bows. Speeches were afterwards made by Senators Cameron and Bogy, and by Mr. Roach, the latter gentleman detailing the operations of the company since its formation two years ago. The City of Peking will be commanded by Captain Jefferson Maury, and will shortly be brought to this city to receive her machinery at the Morgan Iron Works.

THE CHARACTER OF METALS AS EXHIBITED BY THEIR FRACTURE.

BY PROFESSOR R. H. THURSTON.

In an article published in the SCIENTIFIC AMERICAN of January 17*, a series of finely executed engravings illustrated the value of an inspection of the fractured surfaces of test pieces of metals broken by torsion as a means of judging of their character.

During the research there referred to, of which the results are given at length in a paper now in course of publication by the American Society of Civil Engineers, in the "Transactions" of that society†, the effect of various changes of

condition, in production of alteration in the characteristics of fracture, has been found to present an interesting and useful study.

Referring to that article, the reader will observe the marked difference between numbers 16 and 23 as exhibiting the effect of a difference in thoroughness of working, the former being a good iron badly worked, and the latter being the most perfectly worked piece of iron which has ever come under the observation of the writer. Nos. 23 and 30 show the difference between a cast iron highly charged with carbon and a specimen containing a minimum percentage, while still other illustrations exhibit the low steels 58, 68, 71, containing only iron and a low portion of carbon, and the malleable cast irons, 33, 35, which are steels which retain the impurities of cast iron, and are somewhat irregular in structure.

The effect of cold upon the properties of iron has been but little understood. One party of experimenters claim to have proven an increase, others a decrease, of strength with decrease of temperature. In a paper, originally prepared for the *Iron Age**, and since republished by several other periodicals,† the writer collated such information, as then existed, from both scientific and engineering authorities, which showed that the general effect of low temperature seemed to be a decrease in power of resisting blows and an increase in power of resisting a steady strain, these seemingly contradictory effects being the consequence of increased tenacity accompanied by a simultaneous and yet greater decrease of ductility. Subsequent experiments by the writer, with the autographic testing machine designed by him for the Stevens Institute of Technology, in which errors of observation are avoided by so arranging the apparatus that the specimen tested shall write legibly its own story, have to some extent confirmed those deductions, but have revealed some reversals of the rule and have indicated that good materials are better in both respects at temperatures not far removed from zero.

The paper referred to was called forth by the request of the editor of the paper in which it first appeared, to whom Mr. Oliver Williams had forwarded a specimen of metal which had been broken at one point at a temperature of 75° Fah., and at another place when at a temperature of 20°. This specimen was afterwards placed in the cabinet of metals and minerals, in the lecture room of the writer, at the Stevens Institute of Technology. The method of fracture is stated to have been precisely the same in each case. The difference in appearance is very remarkable. The fracture at 70° is a strikingly perfect illustration of the fibrous, as that at 20° is of the granular, fracture.

Judging from general experience, I should be inclined to consider this iron far less reliable in cold than in warm weather. Careful experiment, however, is daily convincing engineers that the distinction, here so well shown, is a far less reliable indication of the strength and ductility of iron than was formerly supposed.

A kind of fracture which is probably always indicative of brittleness is generally, and possibly correctly, termed crystalline. It is supposed to be produced by a long continued succession of shocks, which, straining the metal to the elastic limit, permit the crystalline grouping of molecules to take place. Dr. Percy, the leading metallurgical authority of the world, seems to have been fully convinced of the possibility of the formation, in this way, of true crystals; but direct experiment is still desirable to fully determine it. A singular instance of this peculiar molecular action recently occurred at the Morgan Iron Works, New York. While a powerful steam hammer was at work upon the red hot end of a very large shaft, originally designed for the engines of a large naval steamer, a piece of the opposite end, which was cold, and which was supposed to be strong enough to transmit several thousand horse power, dropped off. This was an extraordinary event, but not unprecedented. In all such instances, the fracture seems to follow a plane passing through a comparatively sharp angle at the side of a collar or at the end of a journal.

The effect of cold is not always observable, particularly with ductile iron, of which two specimens were tested, one, at 10° Fah., and the other at 70° Fah. The metal was a cheap grade of wrought iron, quite cold-short, and very irregular. Two specimens from the same bar of good tool steel, were also tested, one having been broken at 18° Fah., and the other at 70°.

The purest irons and low steels, and even the shear steels, do not usually show a change in form of fracture with change of temperature. At all temperatures likely to be experienced in this latitude, at least, they are equally reliable.

Two specimens of copper were also tested. The first was cast in dry sand and broken at 10° Fah., the second was cast in green sand and broken at 70°. The beautiful crystalline structure of the former is apparently due, principally, to low temperature. The unsmooth structure of the latter is the consequence of using a damp mold, and exhibits the advisability of using dry sand whenever possible. The two are very characteristic specimens. Copper is strongest at low temperatures and seems to lose none of its ductility. Forged specimens of copper, in all but color, resemble, when fractured, the toughest and most ductile kinds of iron.

The wonderful difference in properties of steel, under different methods of treatment, is shown by two specimens from the same bar of fine cast steel. The first has been carefully annealed, the second as thoroughly hardened. The close resemblance of the former to the low steels, shown in

the former communication, was at once noticed. It does not appear like a true steel, not having even the faintest resemblance to the hardened specimen, which presents the uneven fracture and fine grain characteristic of the best tool steels.

Still another illustration of a peculiar modification of iron produced by special methods of treatment is seen in a piece of iron which had been subjected to the process of cold rolling. The effect of this action is to produce a marked increase of strength and of elasticity. In precisely what way this effect was produced was long a disputed point. No change of density had been detected, and some of the most talented and distinguished scientific men and engineers who had occasion to examine this singular material, as members of the International Jury at the Vienna Exhibition, found it exceedingly difficult to credit the claims made for it, although sustained by reports of experiments made upon it by well known authorities at home and abroad.

It has lately been shown by the writer that the effect of cold rolling is to render the iron more perfectly homogeneous and to produce such a disposition of internal strains as to greatly increase its elastic resistance.*

The thready appearance of the side of the broken specimens, and the toughness and compactness, of which good evidence is seen by an inspection of the end of the test piece, are the peculiar characteristics of this material. Those of the readers of the SCIENTIFIC AMERICAN who have occasion to adopt the method of testing metals, described in the issue of January 17, will be interested in learning the effect of varying the proportions of copper, tin, and zinc, in bronze, brass, and other compositions.

An alloy of ten parts copper to one part tin has two thirds the strength of iron and about one half its ductility. Such a metal is very valuable wherever strength and toughness are required in a cast metal. An increased proportion of tin produces increased hardness and a loss of ductility. Sixty-nine parts copper to thirty-one parts tin is an alloy which is very hard and as brittle as glass. Increasing the proportion of copper gives greater ductility at the expense of strength, and castings become liable to unsoundness.

Zinc is a brittle metal of crystalline structure, and vastly different from tin. Yet an alloy of zinc and copper may be made of considerable strength and of great ductility, as is the case with wire brass where the proportions are about two of copper to one of zinc, and with an unusually beautiful special grade of brass made at the Stevens Institute. This specimen exhibits characteristics common to all the more ductile alloys as well as of the metal tin. The curious, irregularly wavy appearance of the exterior, and the half fibrous, half granular fracture, are seen in gun metal, soft brass, oroid, phosphor bronze, and many other alloys which have been tested. Metal workers often make a free working and fine looking alloy by uniting copper, tin, and zinc. For some purposes such a mixture is well adapted, but it often happens that, without suspecting it, the workman seriously injures his material by adding, for appearance sake, zinc to a bronze in proportions seemingly too small to effect its mechanical properties.

The writer has found the addition of but a fraction over one per cent of lead, to a good brass, to reduce its strength nearly a half, and to cause a corresponding loss of ductility, thus making it but about one fourth as valuable in resisting blows as the clean alloy.

A good bronze, containing about ten of copper to one of tin, to which less than three per cent of zinc was added, was also tested in comparison with a brass in which lead was thus a component. The former is a metal of fine looking exterior, works well and takes a good polish. Its strength is slightly increased by the addition of the zinc, but its ductility is hardly a sixth that of the pure copper and tin alloy. The fracture shows this change to the eye with unmistakable clearness. Instead of the toughness and extensibility shown so plainly in the specimen with lead in it, is exhibited a ragged, dull, irregular break like cast iron.

Such experiments as these are exceedingly instructive; and every worker in metals, every iron and brass founder, would find himself well repaid for time expended in such researches by the discovery of the mixtures best fitted for his work; and if each were to make public the results of his work, whenever evidently important, he would benefit the world without loss to himself.

Dr. Arnott.

The decease is announced of the celebrated Dr. Nell Arnott, at the advanced age of eighty-five years. He was not only a physician of eminence, but an author, a scientist, and an inventor. His "Elements of Physics," published in 1827, was largely circulated, and greatly promoted the study of the sciences. His researches upon warming and ventilation, and his inventions of stoves and ventilators, have greatly added to human comfort, and have led the way to various other important discoveries. Dr. Arnott was the recipient of many honors, and no one more justly deserved them. His life was a most useful one.

TO NEW SUBSCRIBERS.

It has been our custom to commence at the beginning of the year, all subscriptions received previous to the first of April, and to send the back numbers from the first of January. Hereafter the paper will be sent from the date of receipt of subscription; but to those who wish them, the back numbers from the commencement of the volume will be furnished, and the subscription dated from the first of the year.

*Testing the quality of iron, steel, and other metals without special apparatus.

† March 1874, et seq.

* *Iron Age*, June, 1873.

† *Van Nostrand's Engineering Magazine* July 1873; *Journal of the Franklin Institute*, September, October, 1873; *London Iron*, January 1874, etc.

* *Trans. Am. Soc. C. E.*, March, 1874.

THE PALÆOTHERIUM MAGNUM.

The palaeontological collection of the French Museum of Natural History has recently been enriched with a new fossil of the highest scientific interest. It is an entire skeleton of the palæotherium magnum, found incrustated in the quarries of Vitry-sur-Seine. Our engraving is reproduced from a photograph taken in the galleries of the excavations by means of the electric light.

The animal was first described by Cuvier, and was a mammifer, now entirely extinct and indeed without any actual representative among existing creatures. At one period its species was extremely abundant. Modern geologists classify it with the rhinoceros, the tapir and the horse; but their views have heretofore been based only on the detached bones, which have become common objects in almost every collection. The examination of the complete skeleton, now for the first time discovered entire, shows that even Cuvier was wrong in ascribing to the animal the proportions and conformation of the tapir. So far from being massive and heavy in build, as has been supposed, the palæotherium was a light, graceful animal, with a neck longer than that of the horse and closely resembling in external form that of the llama. Three toes are counted on each foot, and there is a snout or rudiment of a trunk. The femur has a third trochanter. The dentary system is composed of six incisors, four canines and fourteen molars, the last being analogous to the similar teeth of the rhinoceros. The height of the animal was a little less than that of the medium horse. It was herbivorous, and existed in vast herds during the middle of the eocene period, as its remains are found in gypsum and equivalent rocks formed during that stage of the world's history.

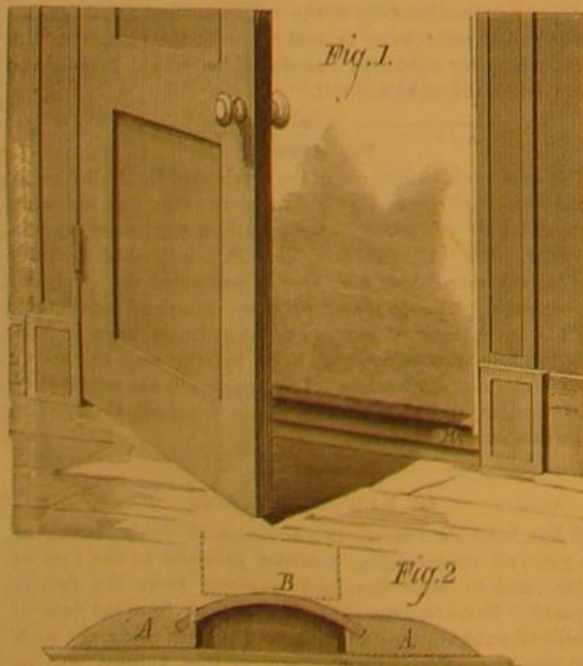
Galvanic Electricity.

Put a rod of amalgamated zinc in a glass cell filled with dilute acid, and it will be seen that the apparent action is limited to the gradual production of a few bubbles of gas. On placing this copper wire in the cell beside the zinc, there is no change until I allow the two metals to touch, when you see torrents of bubbles are evolved from the surface of the copper wire. On substituting platinum or silver for the copper we get a similar effect, and that whether we join the metals within the liquid or at a point exterior to it. Thus, if I join the copper wire to this galvanometer, and connect the other end of the coil with the zinc rod, you see that the magnetic needle is deflected as long as contact continues; but immediately on breaking the circuit, the action on the needle and the evolution of bubbles cease instantly. Such an arrangement of two metals, in a liquid capable of acting on one of them, is called a galvanic battery, and by means of it, in connection with a very delicate galvanometer on the other side of the Atlantic, we are able to send telegraphic signals across the ocean.

From the fact that the bubbles of gas are given off from the surface of the copper, we might suppose that it was that metal which was acted on; but if we were to weigh them, we should find that it was the zinc which had lost weight, while the copper remained quite unacted on. The dissolved metal is known as the positive, and the unacted metal as the negative; in fact, there is less tendency to solution on the part of the copper when connected with the zinc than in the absence of the latter metal, which, on the other hand, is far more rapidly dissolved than it would be alone.—Lecture by A. H. Allen, F.C.S.

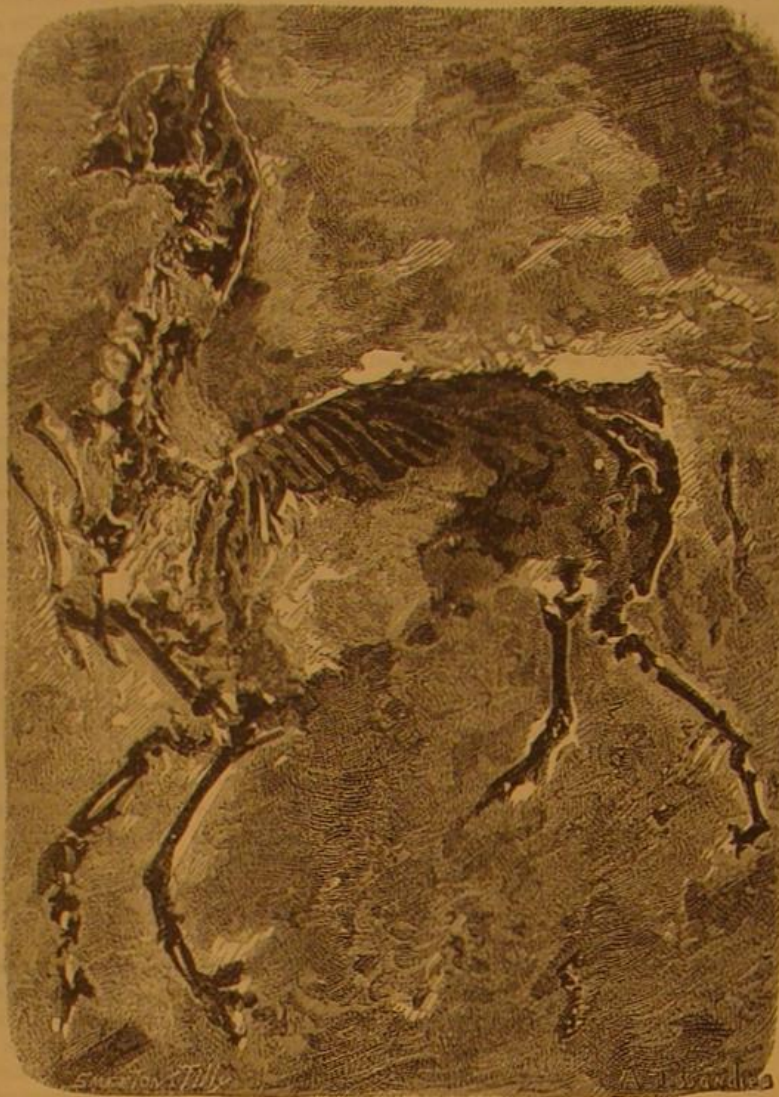
IMPROVED ADJUSTABLE THRESHOLD.

Prolific causes of cold feet, consequent colds, and soiled carpets, are cracks under doors, between the bottom and the



threshold. As a remedy for this trouble, a very simple device has been suggested, and has, as we are informed by the manufacturers, been in use for some four years past in Chicago, with perfect success. It consists, simply, of a strip of

heavy rubber, B, let into hard wood pieces, A, and securely fastened, thus forming an arch in the center, as will be seen from the sectional view, Fig. 2. When the threshold is in place, the rubber arch presses gently on the bottom of the door (dotted lines, Fig. 2); when closed, across the whole width, entirely excluding, it is claimed, rain, cold, dust, etc.



THE PALÆOTHERIUM MAGNUM.

The device is said to be very durable, and to outwear wooden thresholds. It cannot get out of order and is easily swept over.

We learn that it is now being introduced in other sections of the country for the first time, and is meeting with ready application. Further particulars regarding sale of rights (State or county) can be obtained by addressing Wilson, Peirce, & Co., 182 Clark street, Chicago, Ill.

Tooth-edged Cutting Scissors.

Dr. B. W. Richardson says: I have recently had constructed for my use a pair of tooth-edged cutting scissors, on the



plan shown in the diagram. The scissors are of the ordinary construction, in all respects, except in the cutting edge. The cutting edge of each blade, instead of being even and sharp, is divided into finely pointed teeth, each tooth being directed with a slight inclination towards the handle of the scissors. When the blades meet, the teeth cross each other; and as they pierce any structure that may lie between them, they crush also, between their surfaces.

If a piece of moderately firm substance be placed between the blades—a piece of paper or thin card, for example—the scissors perforate it in a series of perforations resembling what is seen in the postage stamp; that is to say, they do not cut clean through the substance, so as to leave it in two distinct parts at once. A little lateral or half-rotating movement of the closed blades is, however, sufficient to tear through the still connected lines of substance and to complete the separation. The same occurs if the substance placed between the blades be a portion of soft animal structure, only that more force is required in the lateral or rotating movement to cause complete separation. The parts punctured are crushed between the teeth, and are separated by the twist or torsion.

I find these scissors useful in dividing, directly and quickly, structures in which there are many minute blood vessels, and which, when divided by the knife, bleed freely. These toothed scissors, as they can be made at one and the same time to pierce, crush, and twist, control bleeding remarkably.

I have put the scissors to a good test in a case of epulis. The tumor was increasing rapidly, and three teeth were involved in it. It was very vascular, had a broad base, and might, at first sight, have been taken for a malignant rather than for a fibrous tumor. The three teeth being extracted, I found I could get a deep grasp of the tumor between the blades of the scissors. I carried the teeth of the scissors well through the base of the tumor, crushing some portion of bone in the way, and gently and easily twisted the mass off, and lifted it away upon the blades without the loss of any blood whatever. The healing in this case was rapid and good.—Medical Times and Gazette.

Iron Columns.

At a recent meeting of the members of the London Architectural Association, Mr. Richard Moreland, C.E., read an important paper on "Iron Construction," in which he said that, with regard to cast iron pillars in long columns, the transverse section had two duties to perform, namely, to support the load and to resist flexure, so that only one half of the strength of the pillar could be considered available for the resistance to crushing, and the other half for the resistance to flexure. In other words, one half was in compression and the other half in tension; and this was precisely the condition in which a girder was in; or it might be taken as a question of leverage, the length of one end being the diameter of the pillar, and the other half length of the column; but in the case where the pillar was large in comparison to its length, then the whole of the material must be taken to resist the compression of a considerable portion of its crushing strength. The working load on pillars should not exceed one tenth to one sixth of their breaking, and, under ordinary circumstances, should not exceed 25 diameters. Special care should be taken when the pillar was subject to transverse strains, where heavy goods of unstable form were piled against them, as a considerable strain might be produced from this cause; and also in the event of blows from rolling goods or other causes. Pillars in juxtaposition to brick walls took the whole load when they were strong enough to bear it; but masonry served to stiffen the pillar if secured to it; and if the wall was built in cement, and of considerable thickness in comparison to the iron pillars, they then possibly might assist each other. In cases where the brickwork was liable to be compressed, and the pillar unequal to its load, then obviously nearly the whole weight must be discharged on the pillar; but care must be taken, as possibly intense compression might take place at the base of the pillar. The basis should be as level as possible. Short columns under crushing force were deformed by pyramid wedges forming at the ends and forcing out wedges at the sides; this was also seen in the crushing of stone and other solid materials. For various forms and sections of pillars, and also of different lengths, the strength of the material would vary considerably under the diverse conditions in which it was placed. For small proportions of length to diameter, cast iron was the strongest material, but its strength diminished, as the proportion of length to diameter increased, faster than wrought iron; and, in comparison of solid square or wrought iron pillars with solid round cast iron pillars beyond twenty-six and a half diameters, wrought iron was stronger. For ordinary work no cast iron columns should exceed twenty-seven diameters. The elasticity of cast iron was twice as great as that of wrought iron. The strength of girders to resist resilience was proportional to the weight of the beam, irrespective of the length, so that a beam twice the weight or twice the length would take twice the load to produce the same deflection. Rolled girders were only economical up to a given size and weight.

PATENT BOTTLE.

Mr. Benjamin C. Odell, of Kingston, N. Y., is the inventor of the novel style of bottle represented in the annexed illustration. The object is to separate, within the same bottle, two kinds of liquid, which can be separately removed, and this is effected by arranging a partition to form two compartments, each of which has its own discharge or spout. It is a handy device for invalids traveling, as medicine might be carried in the smaller division and water in the larger, while a cup, similar to the kind generally accompanying "pocket pistols," might be fitted over the bottom. Any number of partitions may be placed in the bottle, with a corresponding number of spouts. Thus arranged, it might prove valu-



able to physicians, by affording them the means of carrying quantities of several remedies in a single pocket receptacle.

THE maximum cost of transporting railway freight, last year, between New York and Chicago, was 7 mills per ton per mile. The total cost of moving freight by canal (horse power being used for towage) is 5 mills per ton per mile.

IMPROVED ADJUSTABLE SCAFFOLD.

Painters and other mechanics, who have frequent occasion to use scaffolding in performing their work are, in the invention represented in the annexed engraving, provided with an adjustable extension truss which, according to the inventor, may be applied with equal facility to various purposes. It serves as a truss for scaffolding, a common ladder, platform, and step ladder, and, from its simple construction, may be built quite cheaply. It may be compactly folded, and thus readily moved from place to place.

The two parts, A and B, of the extension truss are hinged together near the top by means of side plates, cross rod, C, and nut, as shown, so as to fold together or to be detachable from each other. The tops of parts A and B are united by lateral boards, D, one of which is hinged so as to fit, when necessary, over the recess which holds the vertical cross piece, E, and which is lined with metal plates. Both parts may be extended to and adjusted at different heights, the front portion by sliding pieces, F, guided by suitable plates, I, one set secured to A, and embracing F, and the other arranged in the opposite manner. Holes in the sliding pieces and pins serve to lock the former in any desired position. The top slide plates limit the upward motion of the sliding pieces, F, the lower ends of which project beyond the parts, A, and are provided with metallic sockets, produced with the angles of inclination of the truss to the ground. Both portions are connected by rounds in such a manner that they offer, in any position, a double support to the foot.

The rear part, B, is extended by means of slides, G, which move in guide recesses. Lateral pieces stiffen the fixed portion, while steps or rods serve the same purpose for the slides. The connection of the two parts, B and G, is made by holes in both washer plates at the outer sides of part, B, and cross rods, H, with screw ends and heads, by which the whole is firmly retained in any position corresponding to that of the part, A. The slides, G, also terminate underneath in suitable shoes or sockets.

The platform may be constructed as represented in our illustration, or the cross pieces, E, may be removed and longitudinal timbers laid between the opposite trusses under the lateral boards, D, and above those marked I. Heavy bolts passing through all secure the beams in place.

The inventor states that, when the device is folded up, the boards connecting the trusses may be secured between the steps of the front part, A, serving thereby as a support for paint pots and other implements. In similar manner either half may be used as a suspended platform for painters in painting the outside of houses, while the detached front part may be applied as an extension ladder.

We are informed that a 4 feet 10 inch truss, as shown in the engraving, makes a scaffold that will reach to a ceiling of 14 feet 6 inches in height. It also forms a step ladder of from 4 feet 10 inches to 8 feet, and of five distinct sizes.

The device may be used upon stairs as easily as on a level floor, by extending the front part two steps, or a sufficient distance to accommodate the rise. It has no braces, is self-bracing on top, and can never, it is claimed, spread or give way.

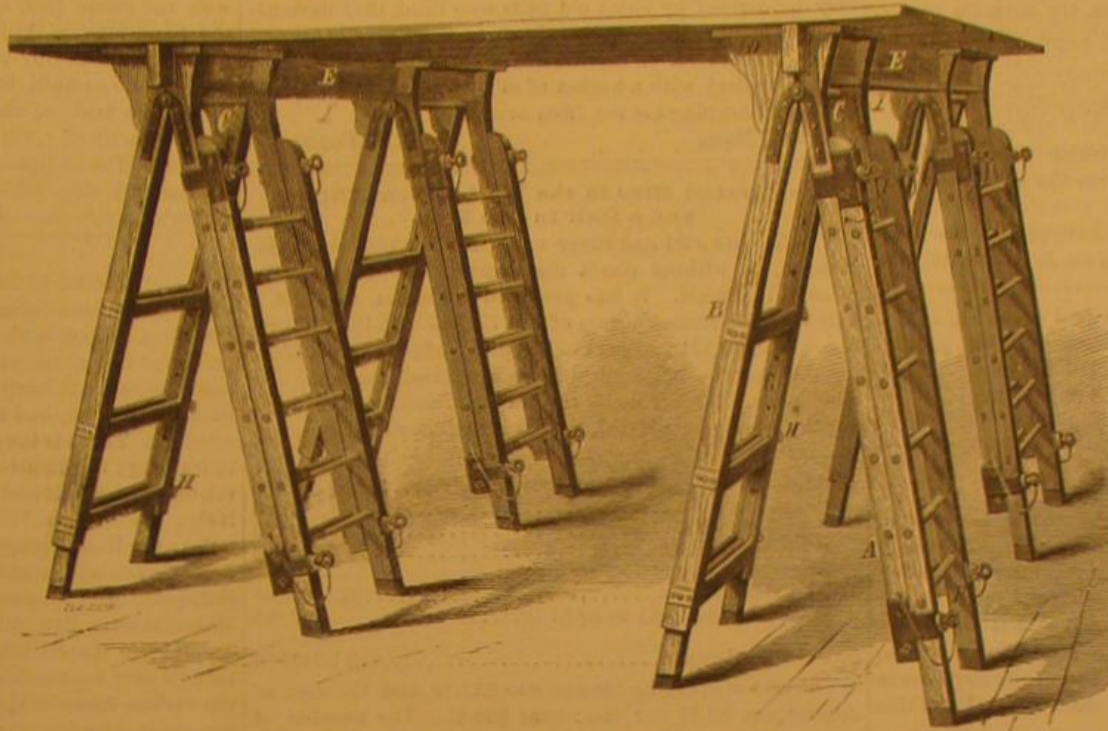
Patented through the Scientific American Patent Agency, November 4, 1873. For further particulars regarding sale of State rights, etc., address the inventor, Mr. John Dillon, 405 Fourth avenue, N^Y York city.

A NEW MAGNETO-ELECTRICAL INSTRUMENT.

A novel form of magneto-electric battery, adapted for use as an exploder, is represented in the annexed engraving, which we extract from the pages of *La Nature*. It consists simply of a horseshoe magnet, around the arms of which are wound coils of insulated wire. To the poles is applied an armature of soft iron. The apparatus is a reproduction of a similar device used by Faraday in his experiments to show that, when the armature was suddenly removed from the poles, a current is almost instantly established in the coils, while, on replacing the iron, another current was engendered similar to the first, but in the contrary direction.

In order to use the current thus obtained, in place of that of an ordinary battery for exploding charges, a high tension is necessary, and this is obtained by a simple and ingenious attachment. The key which moves the armature carries a small spring (shown on the left in the engraving) which touches a screw. When the armature is removed from the magnet this contact is broken, but not instantaneously, as

the parts touch until two thirds of the motion is completed. One of the conducting wires is connected with the lever of the armature, the other with the screw; consequently the current caused by the sudden break is kept within the apparatus during two thirds of the time of its production. This arrangement, which, at first sight, would appear designed to cause the loss of the effect of the greater portion of the current, really increases the tension, because the current which is delivered by the machine is no longer the magneto-electric induced current, but the extra current of the latter—in other words, a second induced current, which is produced at the moment of the rupture of the local circuit of the magneto-electric current. In round numbers, the attachment augments the current in the proportion of 1 to 5, and gives a



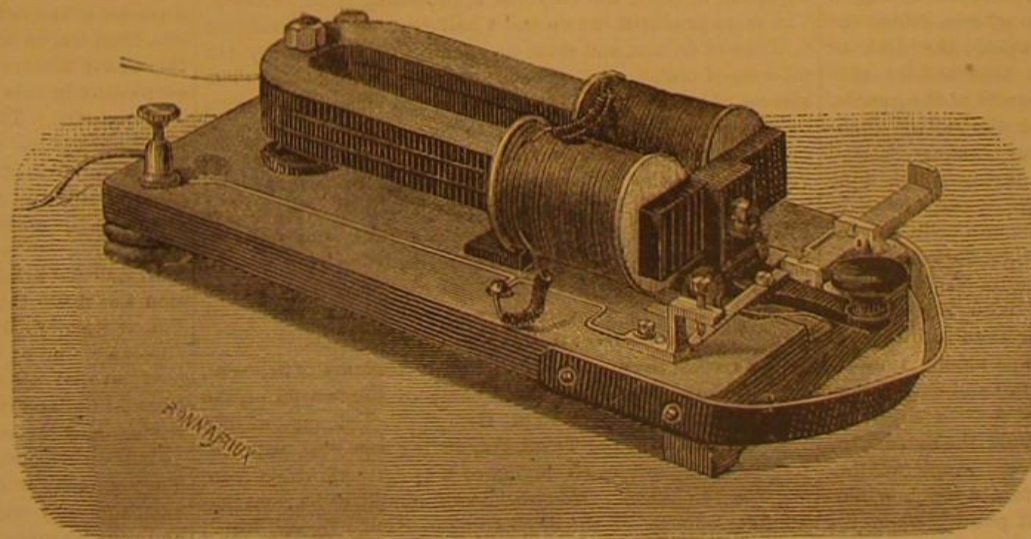
DILLON'S ADJUSTABLE SCAFFOLD.

spark which will explode ordinary hunting powder placed loosely between metal points.

This device is undoubtedly one of the simplest yet devised, for its purpose, as well as one of the easiest constructed. Its energy may be increased by using more powerful magnets, the Jamin, for example.

We should imagine that it might be advantageously substituted for the battery in short telegraph circuits; and in fact, it has been used for that purpose in the Vienna Exposition. The key of the instrument was manipulated exactly as that of the ordinary Morse machine, producing a series of currents alternately positive and negative, which operated a Morse receiver having a polarized armature.

For military telegraphs, the device would be very useful on



A NEW MAGNETO-ELECTRICAL INSTRUMENT.

account of its light weight, simplicity, and absence of battery. Another application which suggests itself is for counting either the revolutions of an engine or of a wheel in a vehicle, and transmitting knowledge of the same to any desired point. An eccentric might be arranged on the shaft the revolutions of which it is desired to know, so that at each turn the contact of the armature with the poles might be ruptured, and a current sent to a suitable receiver or counting apparatus, easily devised. Many other problems, it appears, may be solved by this machine, and inventors will find in its further applications an excellent field for the exercise of their ingenuity.

C. G. V. P. says: "The reason we have so many false theories about ventilation is this: We have heard or read that carbonic acid is heavier than the pure air, and consequently must sink to the bottom, and should be discharged at the floor; but we forget that carbonic acid coming from our lungs has a much higher temperature than the surrounding atmosphere, consequently it rises. Make the discharge, therefore, in the ceiling or the chimney, and you are rid of it."

The Propagating House.

Our readers will perhaps say: "This subject has no interest for us, inasmuch as we do not possess such a luxury, and indeed consider such a structure entirely out of our reach." In this instance, however, if such have been your thoughts, readers, you have prejudged the case, for we intend showing how a splendid propagating house may be had at no additional cost to those who possess a small stove or vinery. We have seen this plan adopted in the gardens of a peer of the realm, and found that it answered admirably, and is worthy the notice of all who delight in their gardens, and have a love of plants, for by its use a good supply of young plants may be maintained for the decoration of the dwelling rooms and the dinner table, while no end of plants can be struck in spring for flower garden purposes. In the first place, then, readers, we will imagine you have a small vinery heated with hot water; that you have now, or will soon, start the vines, and will, therefore, have a nice gentle heat at command. Now our system does not consist in bringing in any large frames or hand lights to take up the limited space, because, if you are economical and practical, you will have brought in a considerable number of strawberry plants to produce some luscious early fruit, one or two pot vines to help out the crop from the roof, a few pot roses, some spireas, lilacs, and other fragrant shrubs to delight the olfactory nerves; but it is simply to have some small narrow frames made to fit the troughs on the pipes, these narrow frames to be fitted with a glass top; the troughs in question, being kept filled with water, produce a splendid moist bottom heat, which is one of the great desiderata in the propagation of most stove plants and all soft-wooded things; the frames need only to be a few inches high; they should have some drainage material placed in the bottom, and the remainder may be sand only, or what

we prefer for striking the majority of cuttings in, namely, the refuse from cocoa nut fiber. In this material, and in such situations, cuttings of verbenas, coleus, geraniums, heliotropes, fuchsias, and any such kind of plants, may be rooted in a few days, while, as a matter of course, harder wooded plants will take a little longer. This is not a theory, readers, but has been reduced successfully to practice for many years, and those who would do more in the embellishment of their gardens, but for the want of a propagation house, may, with a few such little frames, produce any amount of plants in the spring months for summer use, and we cannot too strongly urge them to give it a trial.—*Land and Water.*

Floats for Ships' Boats.

The Marine Department of the London Board of Trade have been making experiments with the boats of coasters, and find that any old boat can be converted into an efficient lifeboat by using air casings outside. The Marine Department have, for this purpose, used air cylinders, which they have specially designed, fastened outside the boat by a netting; so that the boat can be used for an ordinary boat as long as wanted, and converted into a lifeboat when occasion requires it. The material used for these cylinders, and approved by the Marine Department, is a combination known as Clarkson's. It consists of a layer of cork about a quarter of an inch thick between two layers of strong canvas. One cubic foot of air space in these cylinders will support about 60 lbs. The cylinders of this material are the cheapest, most efficient, and most durable means yet invented for converting an old boat into a lifeboat. Mr. Clarkson has made the experimental cylinders on models furnished to him by the Marine Department, and is, we believe, prepared to supply any number demanded. Air cases to place inside lifeboats, also made of this material, have been supplied to some of the mail steamers, and are much preferred by the Marine Department to cases of copper, iron, zinc, or wood, as they are practically indestructible, are not affected by heat, and are very light.—*Nautical Magazine.*

NOTHING can convey a more impressive idea of the power of water as a general agent than the wonderful cañons of Mexico, Texas, and the Rocky Mountains, where the torrents may be seen rushing along, through the incision it has cut for itself in the hard rock, at a depth of several thousand feet between perpendicular walls. The greatest of these cañons, that of Colorado, is 298 miles in length, and its sides rise perpendicularly to a height of 5,000 or 6,000 feet.

DR. M. WYMAN, who made the autopsy of Professor Agassiz, states that the latter's brain weighed 83.4 ounces.

Correspondence.

Harmony of the Planetary System.

To the Editor of the Scientific American:

Allow me to remark that the so-called new harmonic law existing between the planetary distances and motions, published "to the world" in your issue of March 21, 1874, page 181, by Mr. Alfred Luther, as superior to Kepler's third law, is only a deduction from the same, as is easily proved by expressing it in a formula.

The rule given by Mr. A. Luther is this: "The square root of the quotient arising from dividing the distance of any exterior planet by the distance of any interior planet, multiplied by the velocity of the exterior planet, shall equal the velocity of the interior planet." Calling the distances D and d and the velocities V and v, then the formula corresponding to the rule is this: $\sqrt{\frac{D}{d}} \times V = v$. From this we deduce successively

$\frac{D}{d} = \frac{v^2}{V^2}$, or, by squaring, $\frac{D}{d} = \frac{v^2}{V^2}$,

giving the proportion $D:d::v^2:V^2$, which means that the distances are inversely proportional to the squares of the velocities.

According to Kepler's third law we have (calling the times of revolution R and r) $R^2:r^2::D^3:d^3$, or, by extracting the square root, $R:r::\sqrt{D^3}:\sqrt{d^3}$ (1).

As the time of revolution is, for equal velocities, in the ratio of the distances, and for equal distances in the inverse ratio of the velocities, we have $R:r::D:V::d:v$ (2)

By combining the proportions (1) and (2), we obtain $D \div V : d \div v :: \sqrt{D^3} : \sqrt{d^3}$. Multiply with

$V:v::V:v$; we obtain $D:d::\sqrt{V^3D^3}:\sqrt{v^3d^3}$, or $D:d::\sqrt{V^2D^3}:\sqrt{v^2d^3}$.

Squaring this equation, to eliminate the root sign, we have: $D^2:d^2::V^2D^3:v^2d^3$, a deduction from Kepler's third law, in which velocity is substituted for time of revolution. Dividing this proportion by $D^2:d^2::D^2:d^2$, we have $1:1::V^2D:v^2d$. Hence $V^2D=v^2d$, or $D:d::v^2:V^2$, showing that the statement that the distances are inversely proportional to the squares of the velocities is nothing but one of the disguises in which it is possible to clothe Kepler's third law. From this proportion, it follows directly that:

$V^2 = \frac{D \times v^2}{d}$ and $V = \sqrt{\frac{D}{d}} \times v$,

which is the identical formula expressing the rule given by Mr. A. Luther. P. H. VANDER WEYDE, M.D. New York city.

Calming the Sea by Means of Oil.

To the Editor of the Scientific American:

I have a suggestion to make which may be of much importance to navigation in steamers. Although I have never tried my plan on so large a scale as is now proposed, I have tried it successfully on a small scale. It is simply to use oil in subduing or mitigating the force of the breaking wave. Some seventeen years ago, I fitted out a small iron steamer to go to the La Plata. She was of light construction and shallow draft of water, and was temporarily rigged as a three masted schooner. Her paddle wheels, minus one half the buckets, were shipped and lashed; the deck or covering of the guards was omitted, so that nothing save the iron arms of the wheels and the supports of the guards, also of iron, remained to interfere with the sailing qualities of the vessel. She left Boston about January 12, and arrived in the La Plata in sixty days, during which time the floats were occasionally shipped in full to carry her over calm spots. She had a keel put on with tap bolts, so contrived as to be taken off on arrival without docking, if required. Considering the stormy season of the year, and ignoring the fact that her officers and crew might more reasonably expect to be hanged rather than drowned, I made every provision for her safety; and among these, I lashed a half barrel of oil on the taffrail and one on each side, and ordered the captain to allow a little to escape from the first in scudding, and a little from the one on the weather side in laying to. She had some rough weather on the coast and in the Gulf, and this afforded ample opportunity to test the calming effect of oil poured upon the waters. It answered the purpose admirably, no sea ever breaking on board.

Now let me suppose a large cask of oil, stowed securely some ten feet, more or less, above the water line, on deck or under deck in an ocean steamer; attach to this a suitable hose of vulcanized rubber, with a small orifice, perhaps half an inch, and let this be fitted to rig out by means of a spar something like the bowsprit of a cutter; have it fitted with guys and topping lift, and shove it out ahead thirty to fifty feet; to the hose attach a cock, to be under command of the officer of the deck, and let him discharge oil on the water whenever he sees a wave coming. Steamers going head to a heavy sea, as is well understood, must reduce their speed materially and thus consume much time, or run the risk of getting heavy seas on board. Keen competition and the demand for rapid runs cause the risk to be frequently incurred, and we hear of serious disasters every day. While I do not imagine that pouring oil on the troubled waters would keep absolutely dry the forecabin of a powerful steamer going head to a gale, I do religiously believe that it would do much to keep down the crest of a breaking wave, and that it would enable steamers to go directly against the sea, when, without the oil, they might be compelled to take the sea "on the shoulder." No one

ever heard of a whaler with blubber about decks being boarded by a sea.

It would be certainly effective when the steamer is obliged to slow down to three or four knots, and also when laying to for repairs or cooling off bearings.

For light ships riding in exposed places, such as Nantucket South Shoal, Sandy Hook, and many other localities, the oil would be very satisfactory.

The only question in my mind is whether at high speed (for a gale and large sea), say nine or ten knots, the oil could be dropped far enough ahead to have the desired effect. The experiment can be tried very easily and at no great cost, by squirting out oil by a force pump, and if it should prove successful a more economical plan can be adopted. The idea will, by some who have never thrown grease over in scudding off the Cape, be deemed somewhat Quixotic, and it may be derided by some old salts who think they have nothing to learn. Let these go down to the Jersey coast and run a lifeboat off or on through a sharp surf, and they, being supplied with a bucket of oil, can be convinced of its efficacy in keeping the sea from breaking.

Milton, Mass. R. B. FORBES.

The Greatest Mine in the World--Ten Millions and a Half in One Year.

The Belcher gold and silver mine in the Comstock lode, Nevada, is without doubt the greatest bullion-producing mine in the world. It has produced in the last two and a half years the immense sum of \$16,772,965. In 1873 it produced \$10,779,171 and paid out as dividends \$6,700,000 during the year, a large surplus being carried forward. By adding the dividends under the old organization and deducting the assessments levied, we have the following results up to March, 1874:

Table with 2 columns: Dividends, June 1864 to May 1865 inclusive; to 1872; 1873; in Jan. and Feb. 1874. Values range from \$421,200 to \$2,184,000.

Table with 2 columns: Total dividends; Assessments Dec. 1865 to April 1871. Values are \$10,405,200 and 660,400.

Table with 2 columns: Stockholders' profits. Value is \$9,744,800.

The cost of crushing the ore was \$12.10, and the cost of mining was \$8.51 per ton; total \$20.61. The number of tons worked in 1873 was 154,664; the total receipts of bullion in 1873 were \$10,779,171.07; the average yield per ton in 1873 was \$69.69.

The bullion statement is as follows, from the stamped value of bullion as per assay certificates: Value in gold, \$5,725,247.50; value in silver, \$5,009,520.51; assay grains, \$44,403.06; total, \$10,779,171.07. Number of ounces of refined bullion, 4,173,535.74-100. Average fineness of gold, 66 1/2 thousandths; average fineness in silver, 0.929 thousandths. Value per ounce in gold, \$1.37 19-100; value per ounce in silver, \$1.20 2-100. Value of bullion per ounce, \$2.57 21-100; average value per ton in gold, \$37.16; average value in silver, \$32.53; total value per ton, 69.69. This statement will appear strange to those who suppose the Comstock lode produces nothing but silver, as it shows that in this, the greatest producing line on the lode, the gold predominated.

This mine has no parallel in the world, the Crown Point, adjoining it, being the only one approaching it in richness. The mine produced in two and a half years nearly seventeen millions of dollars, and since its opening has paid nearly ten millions of dollars as dividends above all assessments. The success of this and the Crown Point has encouraged mine owners on the whole Comstock to pursue developments at greater depths. The circumstances connected with the development of the Belcher into a first class mine furnish an example for other mines in similar circumstances. After their ore gave out, they worked systematically and uninterruptedly until they developed the largest ledge ever opened in any mine in the world.—Scientific and Mining Press.

Pacific Ocean Deep Sea Soundings.

At a recent meeting of the California Academy of Sciences, Professor Davidson announced some of the results of the soundings made by Captain George T. Belknap, of the United States steamer Tuscarora, during last year, with reference to the projected laying of a telegraphic cable from this coast to Japan. This work had accomplished a remarkable development of the depths of the Pacific Ocean, which had no parallel in the plateaus of the Atlantic. The Tuscarora first started in her line of soundings from the entrance to the Straits of Fuca, across that portion of the North Pacific designated as the Gulf of Alaska, toward the Asiatic coast. After leaving the entrance to the straits, the bottom slopes gradually to a depth of 100 fathoms, and then a sudden descent occurs, which reaches a depth of 1,400 fathoms, at a distance of 150 miles from the coast. The temperature of the water at the greatest depth on this line of survey was 34 degrees.

Commander Belknap then returned, prosecuting off and on soundings all along the coast to the entrance of San Francisco Bay. This work determined the fact that the sudden descent at the bottom of the Pacific to a great depth is continuous down the entire coast, varying from twenty to seventy miles out. In the latitude of San Francisco Bay, the great bench is reached a short distance off the Farallones, where the bottom suddenly descends to a depth of two miles. Off Cape Foulweather, the bottom descends precipitately from 400 fathoms to a depth of 1,500 fathoms, and then the plateau continues westward for hundreds of miles, and comparatively as level as a billiard table. Off Cape Mendocino, where shoals have been erroneously supposed to exist, from the seaward jutting of the mountains, a depth of 2,200 fathoms

is reached eighty miles from the shore. Thirty miles off the Golden Gate, the bottom is reached at 100 fathoms; at 55 miles, it has descended to 1,700 fathoms; and 100 miles out, the enormous depth of 2,548 fathoms has been measured without reaching bottom.

Improved Shifting Engine.

A new improvement on the shifting engines on the Pennsylvania Railroad has been introduced, which is in great favor with those running them, and fully meets the expectations of the company, at whose shops in Altoona they were constructed. The ordinary tankless "dinkey" has to be supplied three times a day with coal and water, while enough fuel can be stored in the tank of the improved engine to last three days, and water enough to supply the necessary steam for a day and a half. The engine is also supplied with the steam bell, an invention perfected at the shops of the Pennsylvania Railroad Company. By pulling an apparatus in the cab by the engineer, the bell rings and continues to do so until he pushes it back to its natural position. The tank of the tender connected with the engine has a capacity of 1,200 gallons of water and about three tons of coal. The engineer is also enabled from his position to see the brakeman while coupling, which has a tendency to diminish accidents.—American Railroad Journal.

Tunnels.

The completion of the Hoosac tunnel and the rapid progress of the Sutro have caused the miners both in the East and in the West to look with interest upon what has been and is projected in connection with tunnel driving. It is in Germany, says the Mining Journal, that the great tunnels have been constructed, and these have been made exclusively for mining. There is the great tunnel at Freiberg, twenty-four miles long; the Ernst-August and the Georg at Clausthal, thirteen and a half and ten and three quarters miles respectively; the Joseph II. at Schemnitz, nine and a quarter miles; the Rotschönberg at Freiberg, eight miles; the Mont Cenis, seven and a half miles, which about completes the European list. In the United States we have the Hoosac, in Massachusetts, five miles long; the Sutro, in Nevada, for opening up the celebrated Comstock lode: this tunnel, although only four miles long, will, with its ramifications to the various mines of the district, prove one of the most important in America: the Sierra Madre tunnel at Black Hawk, commenced during the present year, and which will be twelve miles long, as well as San Carlos and Union Pacific tunnels, which are under two and a half miles. The Ernst-August tunnel was driven at the rate of a mile per annum, and it will be interesting to notice how long it will take the Americans, with all the approved appliances at present at command, to complete the nearly similar Sierra Madre tunnel.

The New Geyser Basin.

That a new and most important geyser basin has been discovered in Eastern Montana, seems now unquestionable. It was visited last fall by the well known mountaineers Jack Baronett, John Dunn and John Allen. It is represented as much more extensive than any of the already explored basins, and to contain geysers of much greater force and volume than any yet described by tourists. One of these newly discovered geysers is estimated to throw a volume of water forty feet in diameter over five hundred feet high, and to continue in eruption from ten to fifteen minutes. It is also reported that in this newly discovered basin there are "mud volcanoes" far surpassing in volume and eruptive force those on the Upper Yellowstone. This unexplored spot of the most wonderful of all our natural wonders is about twenty-five miles southeast of the summit of Mount Washburn, from which point the greater geysers, when in action, when the air is clear, are visible to the naked eye.—Avant Courier.

In a recent article upon "Swindling Patent Sellers," allusion was made to a concern styled the Western Michigan Patent Agency, formerly of Albion, Mich. Messrs. G. L. Jocelyn & Co., of Grand Rapids, proprietors of an establishment at that place entitled "Western Michigan Patent and General Collection Agency," write to us, requesting that our readers may not confound their enterprise with any of the swindling concerns intended to be exposed by our article. The similarity in name, they fear, may lead to misapprehension, and they wish it understood that theirs is an honest and reliable concern, in proof of which they send us certificates from leading citizens of Grand Rapids. These documents speak well of the personal and business merits of the Messrs. Jocelyn, and indicate that they are engaged in a useful line of operations. Individuals who can so fully command the confidence of their fellow citizens as do these gentlemen have, we think, little reason to fear that the public will couple them with the professional cheats against whom our former article was especially directed.

OBJECT FOR THE POLARISCOPE.—REV. WILLIAM LAW informs the English Mechanic that the following are two of the finest subjects for the polariscope which animal tissues can supply: Thin slices of the upper part of a pig's claw, cut transversely, and of the paw of the polar bear. Both are indescribably beautiful. They are, when cut, dropped into strong spirits of turpentine and mounted in Canada balsam. The bristles of the hedgehog also form very beautiful objects for the polariscope.

THE OPTIC NERVE.—By a microscope examination of the retina and optic nerve and the brain, M. Bauer found them to consist of globules of 1/800 to 1/1000 of an inch in diameter, united by a transparent viscid and coagulable gelatinous fluid.—E. Lovell.

Loiseau's Artificial Fuel Manufacture.

Mr. Emile T. Loiseau, of Mauch Chunk, Pa., the inventor of a very complete and, we believe, efficient process for the manufacture of artificial fuel out of coal waste (which, it will be remembered, was not long ago illustrated and described in these columns), has recently obtained five patents through this office which cover the essential points of his improved machinery and system.

Mr. Loiseau, we also notice, has lately delivered an excellent and able lecture on the subject of "Artificial Fuel" before the Franklin Institute in Philadelphia, which has been printed in the Journal of that association. The subject has created considerable interest among those practical coal miners and owners of mines who realize the important problem of utilizing the immense quantities of coal dust which now cumber the ground in the vicinity of our mines.

The first of the patents above referred to relates to the entire process of manipulating coal waste to convert it into a convenient fuel form by first mixing it with clay, then molding into blocks, drying, and finally applying a waterproof coating. Mixing and molding separately is the subject of a second patent, which covers machinery used to combine the coal dust with clay and lime water in suitable proportions, introducing it into a pug mill in a plastic state, and then delivering it to compressing cylinders in a broad sheet. Within the cylinders, it is divided and pressed into blocks or lumps convenient for use and passed to an apron to be dried and further prepared for use. The mixing apparatus, consisting of a tub in which are a number of arms and shafts constituting a movable spider in combination with a stationary one, is made the subject of a third patent. The various arms in this machine are so arranged that they revolve without interfering with each other, while every portion of the material is submitted to their action. The fourth patent refers to the drying oven in which are a number of belts arranged one above the other, and connected by a system of gearing to carry the material back and forth and finally deliver it near the bottom. The belts are strengthened by ropes which carry a series of metal balls which engage in recesses in drums, serving as cogs to propel the belts.

The last patent covers the waterproofing device, by means of which the fuel is coated with a material which renders it impervious to moisture. The machine has an endless belt which dips in a tank, and is guided therein by balls entering suitably inclined grooves. The lumps delivered on the apron are carried through the liquid and are thus covered with a waterproof covering which dries upon exposure to the air.

Mr. Loiseau has also obtained foreign patents on his inventions, and parties interested in mines at home or abroad are invited by the inventor to examine into his system of utilizing what is now a waste substance.

The experimental trials, conducted some time ago to test the heating powers of the product, indicated a very fair rate of power, and considerable cohesion. These qualities were fully tested at the exhibition of the American Institute, and with very favorable results. As to the important question of cost, the inventor states that the article can be manufactured for about one dollar per ton.

The Early Education of Children.

In a lecture, Professor Walter H. Smith, of Boston, Mass., said that the want of accuracy in children should be no source of sorrow. He considered it more desirable that they should be dull and stupid at first, that their process of education might be more gradual and thorough. A rapid development should be checked rather than encouraged. One plan of instruction which was followed with success was a course of study of lines and forms, requiring the pupils to draw from description and dictation. Simple forms and objects should be selected first; and when the pupils are sufficiently advanced, more difficult and complex forms could be substituted, each step being so gradual that no perceptible improvement is shown at the time, but which, when looked upon afterward, will denote rapid progress. This plan, he said, insured perfect attention on the part of the pupil, and developed an absorbing interest in the work.

New Process for Iron Making.

F. W. Gerhard has completed a new process which is attracting considerable notice. The invention consists in the manufacture of puddled iron direct from the ore, the use of the blast furnace being dispensed with. Instead of using pig iron, Gerhard uses a compound which he calls "iron coke," and which consists of a mixture of ore (or any substance containing iron), the necessary fluxes, and the equivalent of carbon. A lump of this compound is put into the furnace, and by the single process known to the puddler as "balling," a "heat" may be obtained in considerably less time and with considerably less labor than under the old method; the process of "melting" and "boiling" being entirely dispensed with. The most important feature of the invention is the great saving which it effects in fuel. Bell estimates that $5\frac{1}{2}$ tons of coal are required to produce a single ton of bar iron, but Bennett Aitkins puts the amount at six tons seven hundredweight. Taking the average at six tons, it may be reckoned that two tons are consumed in the blast furnace, and the remaining four tons in the finished iron works. The protoxide of iron containing 77.78 per cent requires 21.43 of carbon. The magnetic oxide containing 72.41 per cent requires 32.17 of carbon. Admitting that the three descriptions of iron ores were employed in the making of cast iron, by the new process, then 30 lbs. of carbon would suffice to produce 100 lbs. of cast iron; or a ton of iron, weighing 2,000 lbs., would require 750 lbs. carbon, a

saving of 3,760 lbs. carbon as compared with the ordinary method. It is obvious that when heavy pieces of solid pig iron are placed in a puddling furnace to be melted, the greater portion of heat is wasted, and after it is liquefied a much longer time is required to eliminate the carbon which it contains and other extraneous elements of which it is composed, with a continuation of an immense waste of fuel. On the contrary, when the "iron coke" is thrown into the heated furnace, the carbon which it contains immediately acts upon the oxygen contained in the ore. Even the Barrow hematite—one of the most refractory of ores—is ready for "balling" with a much less expenditure, of time, labor, and fuel, than by the old process. These statements have been abundantly verified by experiments made in the presence of practical ironmasters and ironworkers, who speak very highly of the merits and importance of the invention.

Launch of the Cable Ship Faraday.

The new cable steamship Faraday, which has been built by Messrs. C. Mitchell & Co., Newcastle, England, for the Messrs. Siemens Brothers, for the purpose of laying their Atlantic cable, was launched on the 17th of February last.

The vessel has been built to the order of Messrs. Siemens Brothers, London, for the purpose of laying their Atlantic cables, and in every requisite the ship is certainly one of the most perfect of its kind. The steamer is 360 feet long, 52 feet beam and 36 feet deep. Her gross register tonnage is about 5,000, and her dead carrying weight about 6,000 tons. The iron hull, built under the inspection of Lloyds' agents, will be accorded the highest certificate of classification. From her peculiar structure, the vessel receives enormous strength, in addition to the usual requirements of Lloyds' rules. Supporting the sides of the vessel are three enormous cable tanks, constructed of plate iron, and forming a series of double arches. These are united together, and attached to the general fabric of the vessel by five iron decks. For the comfort and convenience of those on board, the upper and main decks are supplemented by the usual decks of wood. The Faraday is double bottomed, and in the space below the two bottoms is a net work of iron girders for carrying the cable tanks, and these give also a longitudinal strength to that portion of the hull. Water ballast is also carried in this space, by which the ship may be trimmed as the paying out of the cable is carried on. This arrangement has likewise the advantage of dispensing with cargo or other dead weight beyond fuel. For the purpose of filling and emptying single compartments of the double bottom, or for flooding any one of the cable tanks, a complete and well devised system of valves, cocks, pipes, and auxiliary engine power has been introduced; and the system, which is worked from the engine room, is under the control of the engineer. The bow and stern of the vessel are of the same form, and in this respect she is unlike other vessels in outward appearance. Rudders are provided at each end, and she can thus be navigated ahead or astern, as may be desired when paying out or picking up a cable. Each rudder, to provide against accident, is supplied with strong screw steering gear, worked in the usual manner by manual power, and the steering is accomplished by means of a steam engine placed amidships. Harfield's steam windlass works the anchors and cable chains, and steam apparatus, placed in various positions along the deck, performs all the heavy labor about the vessel. The rigging is after the most approved manner of ocean steamers, and accommodation is provided of the most complete nature, for the large staff of officers, electricians and crew, numbering about 150 persons. In addition to the multifarious appliances of a cable ship, the vessel will be fitted up with all the cabins and appliances of a large passenger steamer, and will be propelled by machinery of the compound, surface-condensing principle, which has been constructed by Messrs. T. Clark & Co., of Newcastle. To obtain increased steering or manœuvring power—an important condition in cable laying—the steamer will be provided with two propellers, commonly termed "twin screws," which will be worked by two separate sets of engines, placed vertically over the shaft, each with two cylinders, one at high and the other at low pressure. By this means great regularity of motion will be obtained, and by a high degree of expansion, in working the system, fuel will be greatly economized, to an extent that would have been considered impracticable a few years ago. The deck machinery for the paying out of the cable is being manufactured by the Vulcan Foundry Company, who are experienced in this branch of work. It is needless to say that the Faraday has been called after the great English chemist and natural philosopher of that name.

English and American Railways.

The London *Railway News* has some interesting comparisons of English and American railway returns, and in the matter of rolling stock and train earnings is surprised to find the American roads more economically run than the English. Taking four roads in each country, aggregating about 4,000 miles, it is found that the American road has only 0.33 of a locomotive and 6.72 freight cars per mile, while the English has 0.93 of a locomotive and 28.83 cars. The New York Central, with a heavier traffic than the London and Northwestern, has half the locomotive per mile. The English refuse to believe that the superior size and strength of American locomotives account fully for this difference. The earnings, for instance, of an American locomotive are 70 per cent more than those of an English, and the entire rolling stock, which in England barely pays for itself in a year, in this country pays for itself and 65 per cent more. The *News* also discovers that, while passenger fares are 30 per cent lower than in England, the earnings per train here are 4 per cent more, and on freight trains 15 per cent more, than on the English roads.

Pipe Way Transportation.

Pipe way transportation is coming into favor in the oil regions of Pennsylvania, to carry petroleum from the wells to stations on the railway. The longest pipe way is 15 miles, overcoming 400 feet of elevation by steam pressure at the entrance to the tube. This system of transportation is so independent of weather and bad roads, and so preventive of leakage, and gives such thorough satisfaction without any drawbacks, that public attention is directed to many other practical applications of the same system.

Twenty-five years ago, on the national road between Cumberland and the bituminous coal field beyond, we saw a small rivulet turned to similar account in the cheap transportation of coal. A zigzag, $\frac{1}{2}$ inch board flume followed the tortuous course of the petty stream and carried 6 inches depth of water and 12 inches surface. A dam collected water enough to make two runs of coal a day. Each run bore in its current 30 tons of coal, fed from a chute with a rake. The distance is under 5 miles; the fall was at least 20 feet to the mile. The coal floated along with ease, carrying with it chunks of slate and conglomerate rock. There were chutes for its reception on the turnpike. These had screens, over which the coal passed, being perfectly cleansed and polished before entering. All day long wagons were self-loading under these chutes. The cost of transportation over the water way was merely nominal. It was an easy step for invention to suggest pipe ways for similar transportation of fluids, and for mails and packages, by pressure of condensed air, as now used in London.

It is not generally known that, in France, the pipe way system has been used for ten years past in transporting beet juice from the field to the sugaries. The sugaries at Cambria work up annually 246,000 tons of beets; they are supplied with beet juice through 62 miles of pipe, now being extended to 100 miles, in many ramifications.

At points central to cultivation, works are erected for rasping beets and expressing juice. Milk of lime is immediately added to prevent decomposition; and after inspection and measurement, the saccharine stream is turned into the pipe way and delivered at the terminal sugaries, the long contact with lime and the thorough agitation purifying the juice more perfectly than usual. It is estimated that, during 1874, there will be a total length of such pipe ways of 560 miles, doing service between the scattered beet fields and the condensed sugar works of France.

The pipes are placed two feet eight inches below the surface, and steam engines compress the air as desired. All degrees of elevation are thus surmounted. The juice has a gravity of one degree Baumé on entering, and the same when discharged.

This pipe way system so economizes sugar-making that it wonderfully multiplies the sugaries. No investment exceeds that concerned in this production. Farmers find it far better than other crops. Pipe way stocks are in high favor, and sugaries pay best of all.

If new industries are needful to the future progress of California, here is one that should be considered. It offers a wide field for expansion, without risk of oversupplies; and if the right soil be selected, the crop is sure, and the profits of sugar-making are more than usually reliable.—*Mining and Scientific Press.*

Norwegian Antiquities.

At a recent meeting of the California Academy of Sciences, R. E. C. Stearns read an interesting translation from the reports of the Society for the Preservation of the Norwegian Antiquities. It described the excavation of an ancient vessel, of the Viking period, found in the parish of Tane, Norway. It was the custom of the Vikings to convert one of their vessels into a sarcophagus, on the death of a great warrior. The vessel was conveyed inland, the remains of the hero deposited in the hull, with his armor, weapons, the bones of his war chargers, and the whole covered with earth. These tumuli have been discovered and excavated in various parts of Norway, and the peculiarities of ancient marine architecture exposed for inspection.

Good Work in Canada.

Mr. A. Davis, of Belleville station, on the Grand Trunk Railway of Canada, forwards us a list of twenty-one subscribers, obtained among the 132 workmen under his charge. This is an excellent showing both for our correspondent and his men, as it indicates on his part a desire to benefit those in his employ, by placing within their reach information of practical value in their callings, while the workmen themselves exhibit good sense and intelligence in availing themselves of the advantages offered.

Mr. Davis tells us that more names are yet to come, and adds: "I take much pains in having my men first class." We think, from the fact of his obtaining so many subscribers out of the comparatively small number of men under him, that Mr. Davis supports his claim for the good qualities of his men.

PRESERVATION OF WOODEN LABELS.—The following method of preserving wooden labels that are to be used on trees or in exposed places is recommended: Thoroughly soak the pieces of wood in a strong solution of sulphate of iron; then lay them, after they are dry, in lime water. This causes the formation of sulphate of lime, a very insoluble salt, in the wood. The rapid destruction of the labels by the weather is thus prevented. Bast, mats, twine, and other substances used in tying or covering up trees and plants when treated in the same manner, are similarly preserved. At a recent meeting of a horticultural society in Berlin wooden labels, thus treated, were shown, which had been constantly exposed to the weather during two years without being affected thereby.

IMPROVED STOVE FOR SMOKE HOUSES.

The invention represented in the annexed engravings is a stove or furnace in which it is proposed to generate smoke by burning twigs or other suitable fuel. The device is to be used in the ordinary smoke house for curing meats, and is so constructed as to produce a large volume of smoke, regulate its production, and insure safety, against fire.

The body, which may be made of any suitable material, is provided with perforations on top and also at the sides. Within is the grate, A, shown through the broken-away portion of Fig. 1, and in the sectional view, Fig. 2, which is formed with inclined sides and a horizontal middle portion provided with apertures closed by the damper, B, Fig. 2. By this arrangement, it is claimed, the admission of air to the fuel, and the combustion thereof, can be regulated with great exactness, to suit dry or green wood, or any other cause of variation in the smoke-producing circumstances.

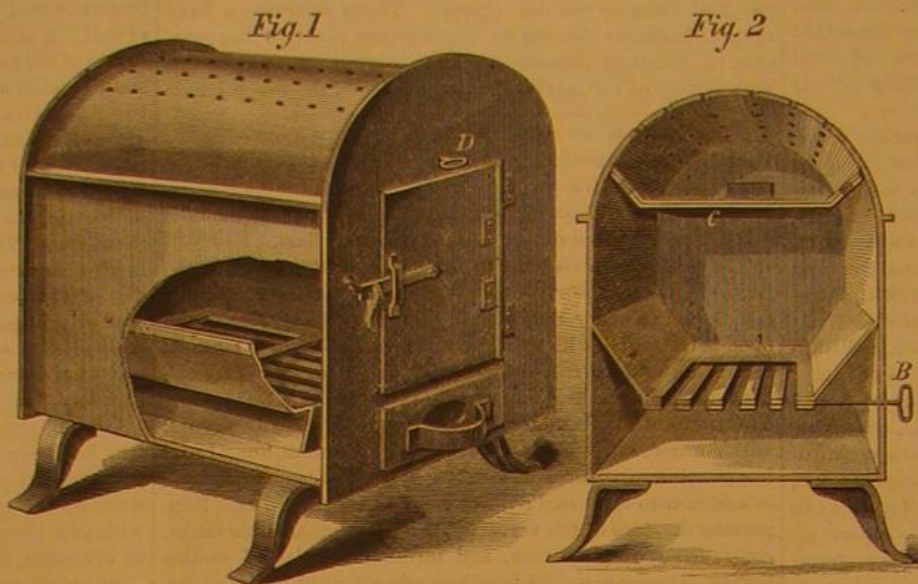
In the upper part of the chamber is placed a partition, C, also having inclined sides through which are a number of perforations. These apertures are governed by suitable dampers, the handle of which is shown at D, Fig. 1, and which regulate somewhat the combustion in the grate below, according to the condition of the wood or the draft.

The device is quite simple and is said to be very efficient in operation. It is covered by two patents, dated October 15, 1872, and December 2, 1873.

Further particulars may be obtained by addressing the inventor, Mr. Isaac N. Deardorff, Canal Dover, Tuscarawas county, Ohio.

for the application of a governor. The device is also claimed to be free from danger of injury or obstruction from anything that can come into the guides. The chutes also cannot interfere with the gate and prevent its operation. The invention is said to be applicable to any and all of the class of wheels called vertical, whether they discharge the water downward, centrally, or outward.

The use of the internal circular gate also, it is believed, permits of the constructing of a cheap wheel of wood, by setting the guide chutes of blocks of that material between the floor of the flume and the upper curb of plank, and gri-



DEARDORFF'S STOVE FOR SMOKE HOUSES.

IMPROVED TURBINE WHEEL.

The invention herewith illustrated is an improvement in the gates and chutes of a turbine, in order that an unbroken sheet of water may be admitted to strike the wheel without becoming expanded or interrupted, and this whether the gate be fully or partially open. The issues or guide chutes are opened from their inner ends, and the water brought at once in contact with the buckets of the wheel. By this means, it is claimed, the greatest possible percentage of power with a partially drawn gate is obtained, and it is said that there is no decrease of power when the gates are partially closed. The inventor asserts that, if there be any loss, it must be when the issues are fully open.

Fig. 1 shows the device in perspective, and Figs. 2 and 3 are respectively vertical and horizontal sections. A, in the latter illustrations, is a rotating gate placed between the top and bottom plates, and resting on the top of the tail water tube, as represented in Fig. 2. In this are made openings, B, which correspond to the buckets of the wheel and form thwarts for admission of the water. To one side of each aperture are keyed the adjustable wings, C, which guide the water, in connection with the curved chutes, D. The latter extend, in part, along the circumference of the wheel and then turn outwardly. On the inner periphery of the gate, A, is a rack, in which a pinion on the vertical rod, E, engages, by which mechanism the gate is rotated so as to open the orifices, B, more or less, as desired. The wings are guided by pins, F, when the ring, A, is turned, and thereby the equal flow of water for the different positions of the latter is secured, it is claimed, without break or interruption.

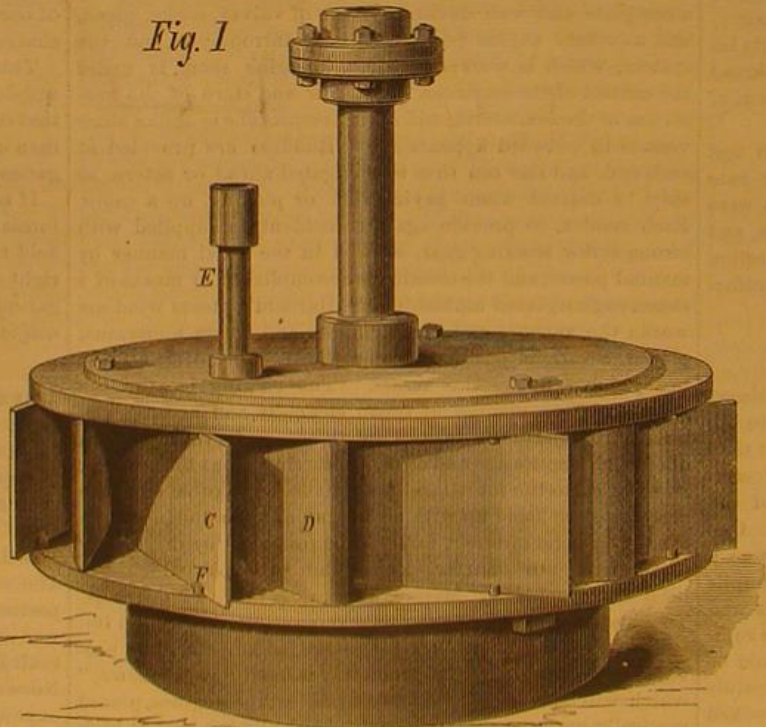
This construction, it will be noted, is quite simple, and obviates the use of considerable mechanism. The whole curb, it is stated, by suitably reversing it when down, can be applied to either a right or a left hand wheel. The two sets of patterns ordinarily required for casting either description of wheel are consequently not needed, thus adding to the economy of the apparatus. The gate will open under high heads about as readily as under low ones, as the only force to be overcome is the mere weight of the ring which supports the pressure. The appliance, being thus balanced under all heads, is well fitted

ping with scantling frame. The ring may be made of square bar iron rolled in circular form, and plates of boiler iron cut to required width and length, and fastened to the circle by rivets. In time of drought, the quantity of water used may be regulated by attaching strips of plank upon the faces of the guide chutes.

Patented through the Scientific American Patent Agency, September 9, 1873. For further particulars address the in-

vention with sudden and decided steps, which are thus registered by the hands of the clock. There is such a peculiarity in the construction of the pallets that no probable force can push forward the hands beyond the fixed stops, and no power less than the weight of the gravity arm will drive the wheel work backwards.

The difference between this system and that which works electric clocks hitherto in use is that the passing currents of electricity are employed merely to maintain motion in the pendulum, which is effected by a very weak battery; and from the great momentum, these currents may be intermitted or the wire cut for even two minutes at a time without destroying the coincidence of time shown by the sympathetic clock, which is dependent on the motion of its own pendulum, and not in any way upon the power of the battery. This allows the opportunity of causing several clocks attached to the same wire circuit to report their accuracy by making each clock at a certain second to cut the wire connection during that second, and thus the flow of the current is prevented. By means of a galvanometer placed in the wire these dropped seconds are observed, and the correctness of the respective clocks guaranteed. Whatever the number of clocks placed on the same wire circuit, all of them will, of course, act in unison with the beat of the normal or master clock.—*The Engineer.*



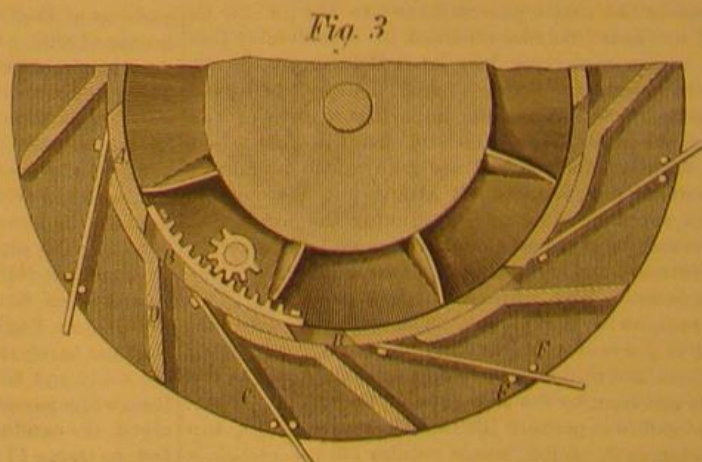
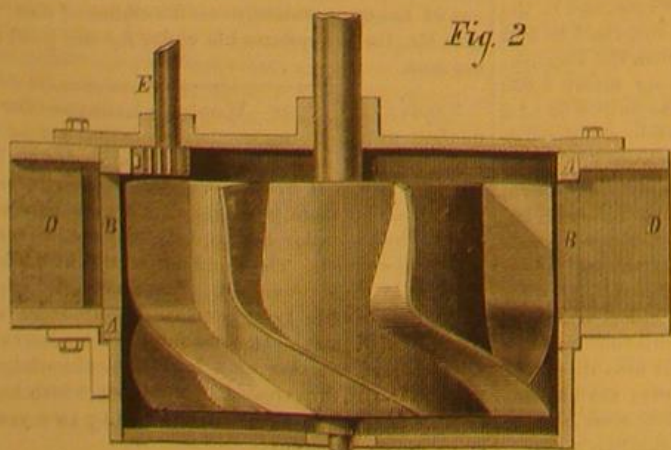
HERRIMAN'S IMPROVED TURBINE WHEEL.

ventor, Mr. Angus A. Herriman, Owen Sound, Ontario, Canada.

TO IMPROVE THE ADHESION OF GUM ARABIC.—It is a well known fact that gum arabic will not cause some kinds of blotting paper to adhere. This may be remedied by adding, to eight ounces of the concentrated solution, 16 grains of aluminum sulphate. Alum answers also, but not so well.

Coffee and Milk as an Aliment.

The stimulating and tonic effect of coffee alone is well known, and also the value of milk alone as an aliment, and of them both when taken alone at long intervals. Abbé Moigno states, however, that when mixed they form a compound absolutely indigestible and unassimilable. He attributes this to the fact that coffee is rich in tannin, and that its mixture with milk transforms the albumen and casein into a sort of indigestible and imputrescible substance, as is formed in the tan vat when animal tissue is placed in it.



A NEW BIRD OF PARADISE.

Three species of birds of Paradise, hitherto unknown to ornithologists, have recently been discovered in the islands of the Malayan archipelago, the aboriginal home of all the tribe. We illustrate herewith one of the thin billed kind, named (after the eminent naturalist Elliott) the *epimachus Elliotti*.

Before presenting this interesting novelty to our readers, we may glance for a moment at the other members of the family to which it belongs. It is but of late years that birds of Paradise have reached us in a perfect state, although for more than a century the natives of the Molucca Islands seem to have been aware of their value, and to have employed them as articles of commerce. The British Museum, in common with other collections, still contains examples of Paradise birds with mutilated wings and without feet; and this was so generally their condition that two skins of *Paradisea papuana*, in that national collection, were thought to be splendid examples in their day, since they actually possessed the latter.

The specimen we herewith illustrate forms a second species of the genus *epimachus*, the only representative of which was *e. speciosus*, from New Guinea, a bird which, if remarkable for its plumage, was at least one of the oldest and best known of the birds of Paradise. It is therefore of great interest to procure a second and thoroughly distinct species after the lapse of so many years. It is easily distinguished from its ally by its violet or purple tail, in addition to its small size: and, regarding its plumage, we quote (says the London Field, from which we take the illustration) the following remarks from Mr. Elliott's work:

The *epimachus Elliotti* is only about two thirds the size of its large relative (*e. speciosus*); but it is possessed of far more brilliant colors in its plumage, and in the sunlight must present a beautiful appearance indeed, as its rich velvety feathers show off their changeable hues of purple and green, with the metallic colors of the tips of the side plumes flashing on the eye as the bird raises them tremblingly over its wings. The broad tail feathers, with their amethyst dyes, look not unlike watered silk, and are of a velvety softness, as is indeed the entire plumage of the body.

Essential Oils.

Essential oils are volatile, and may be distilled without decomposition; they are the product of flowers, plants, fruits, or the juice of certain odoriferous woods. Essential oils differ from the fixed oils obtained from fatty substances; for while the latter are compounds of glycerin and fatty acids, the former are generally hydrocarbons, but sometimes contain also oxygen and sulphur. The fixed oils combine with alkalies to form soaps, but the essential oils do not. All essential oils have powerful odors, and many of them have a hot, aromatic taste. The odor is sometimes agreeable, and at other times repulsive. The most fragrant are oil of rose, jessamine, tuberose, orange flowers, heliotrope, violet, bergamot, and lavender. Paper is rendered permanently transparent by an application of fixed oils; but only temporarily so by the use of volatile preparations. Essential oils are soluble in alcohol and ether; but only partially so when immersed in water. Many of them are found ready formed in plants, and give the peculiar odor to the leaves, flowers, and fruits which make the acquaintance of our olfactories.

The volatile oils are, in many instances, isomeric, that is, composed of the same elements and the same proportions, but with different properties. Chemical science, however, has not yet been able to convert the one into the other, most probably on account of the different groupings of the same number of elements.

Oil of lemon and oil of orange peel are obtained by placing the rinds in a linen cloth and subjecting them to a powerful

pressure between iron plates. The vessel in which the pressure is applied should have a discharge pipe at the bottom. The oils thus obtained are impure, but extraneous matter is separated by careful filtration. Orange flowers, or neroli, has the same chemical composition as the above, but is possessed of more fragrance. In obtaining the last named, more care is necessary, and the petals are subjected to distillation with the vapor of water. Oil of orange flowers, when fresh from the still, is almost colorless; but by age and exposure it soon acquires a red color. It is easily rendered soluble in alcohol, and is extensively used in the manufacture of cologne water. Oil of rose is the most expensive as well as the most fragrant of all the essential oils. There are two varieties of this article, one of which is obtained from the East Indies, and is the product of the *rosa moschata*; the other comes from the Levant, and is obtained from *rosa sempervirens*. In the east, the petals of the rose and other flowers are collected, immersed in spring water, and afterward exposed to the direct rays of the sun. In the course of a few days yellow

There are said to be over one hundred varieties of essential oils, very similar in chemical properties, but differing greatly in taste and smell. The oil is hidden away in little cells which require to be broken before the flower exudes its real fragrance. Violet, heliotrope, and several other delicate perfumes are subjected to infusion and absorption in melted tallow or lard, and in this manner their oil is secured.

Jessamine, tuberose, and other flowers that are injured by heat are subjected to absorption alone. This process is extensively used in several parts of France, and is termed *enfleurage*. Oil of camphor is obtained from the wood or gum by distillation with water; it is subsequently purified by repeated sublimation. The wood, however, is the most generally used for this purpose. It is insoluble in water, but easily soluble in alcohol, ether, and the fixed oils. Oil of turpentine is obtained by distilling the crude juice alone or in water, and is made pure by repeated rectification with water. It is a colorless liquid with a strong aromatic but disagreeable odor. It is of great value in the arts, and for medicinal purposes. Oil of juniper has a different composition, but is obtained from fresh berries after being pounded thoroughly and macerated several hours in water. The subsequent process of distillation is much the same as in respect to turpentine. Oils of saffron and hemlock are obtained in a manner similar to the distillation of most woods and barks, but require very careful preparation, as well as application of the required means to obtain satisfactory and profitable results. — *New York Mercantile Journal*.

Dry Plate Photography.

Mr. H. Houlgrave gives the following formula: He mixed thirty grains of crystallized bromide of cadmium and fifteen grains of pyroxylin with one ounce of ether and one ounce of alcohol, cotton giving a powdery colodion, not succeeding like one that gave a tough film. In a level stereo-developing glass dish, he poured one ounce of the above, and, after leaving it for about two hours to set, he filled up the dish with his bath solution of silver, of about seventy grains strength. After a time he raised the film with a silver fruit knife to allow the solution to flow underneath, and left it to soak a little longer. After pouring off the bath solution he poured on his first washing water, which, from constant use, contained about five grains of silver to the ounce. This was left on the film about half an hour, and then saved for future use. The dish was then filled up with rain water, leaving it two or three hours, and washing again until all milkiness had disappeared. After well draining, the film was hung up to dry by artificial heat, as it took too long to dry otherwise. The pellicle was then of a very horny nature, and could be cut and kept till wanted; of course the washing had to be conducted in the dark room. With one



A NEW BIRD OF PARADISE.

drops of oil collect on top, and are taken up by a bunch of cotton tied to the end of a stick. When sufficient is gathered in this way, the oil is pressed out of the cotton. In some sections the whole flower is subjected to distillation, the calyx remaining entire as it is plucked from the stem. In Egypt the petals of flowers, and especially roses, are subjected to distillation with water in copper stills. Some manufacturers of essential oils place alternate layers of rose leaves and sesame seeds in a vessel, where they are allowed to remain about a fortnight, when fresh layers of roses are added, and this operation is repeated several times, or until the seeds have absorbed sufficient oil, when they are subjected to pressure, the rose oil collecting on top, and the oil of the sesame seeds separating and settling to the bottom. Oil of rose is a thick yellow liquid, which solidifies at a low temperature, and becomes a viscid mass. When concentrated, its odor is so strong as to cause headache, and it is only when diluted that its fragrance can be best appreciated. Its sweetness is not injured by the action of sulphuric acid.

ounce of the pellicle, he made two ounces of emulsion by adding equal quantities of ether and alcohol, and to that quantity he added forty minims of a sixty-grain tannin solution. When the pellicle dissolved—which took some time unless constantly shaken up—he coated his plates, placing them at once in his drying box without any further washing, using no substratum. He preferred an edging of india rubber solution before pouring on the emulsion. In development he first moistened his plates with pure alcohol, washed with water, and then developed with a three grain solution of pyrogallie acid, adding one drop of a twenty-grain solution of bromide of potassium and one drop of a sixty-grain solution of bicarbonate of ammonia.

DURING the past ten years, the screw has entirely replaced the paddle in transatlantic navigation, the weight of marine engines has diminished one half, the steam pressure has quadrupled, and the consumption of coal has decreased two thirds.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for April, 1874.

Mercury.

This planet, which was so beautiful in the evening twilight in March, rises in April before the sun, and should be looked for in the morning. Its declination is so much farther south than in March that it cannot be so well seen.

On the 1st of April, Mercury rises about 5 A. M., and sets at 4h. 31m. P. M. On the 30th, Mercury rises at 4h. 19m. A. M., and sets at 4h. 47m. P. M.

Venus.

On the 1st of April, Venus rises at 6h. 14m. A. M., and sets at 7h. 6m. P. M. On the 30th, Venus rises at 5h. 49m. A. M., and sets at 8h. 19m. P. M.

Venus should be seen after sunset, almost directly in the sun's path on the first half of the month; after that date it will be further north than the sun and can be seen for some time after sunset. Venus and the moon will be in conjunction on the 17th.

Mars.

Mars will at present scarcely repay the observer who attempts to study its phenomena, even with the aid of a good telescope.

On the 1st, Mars rises at 6h. 51m. A. M., and sets at 8h. 35m. P. M. On the 30th, Mars rises at 5h. 54m. A. M., and sets at 8h. 30m. P. M.

Jupiter.

On April 1, Jupiter rises at 4h. 50m. P. M., and sets at 5h. 14m. A. M. On the 30th, it rises at 2h. 43m. P. M., and sets at 3h. 15m. the next morning.

Jupiter is the great beauty of our evening skies all through the month. It should be observed between 9 P. M. and midnight, when it is not far from meridian. Its motion among the stars is retrograde, or toward the west, and it is so great that from night to night its change of place can be detected.

The phenomena resulting from the motions of the satellites on the 7th and 15th of the month are very interesting, and some of them can be seen with a small telescope. On the 7th the fourth satellite will disappear by eclipse—it will pass into the shadow of Jupiter, and before it comes out the first satellite will disappear by transit—that is, it will be projected on the face of Jupiter and will be lost in the light of the planet.

On the evening of the 15th, the fourth and second satellites of Jupiter make transits across the face of the planet nearly at the same time; with a powerful telescope both will be seen projected on the disk, but they cannot be detected by a telescope of low power; they will be lost in the light of Jupiter, and the planet will seem to have but two moons.

Saturn.

Saturn is very unfavorably situated, as it is far south, rises in the early morning and sets on the 1st a little after 1 P. M. and on the 30th before noon.

Uranus.

Uranus is well situated for observation, but requires a pretty good telescope to render it interesting. It rises on April 1 at 0h. 42m. P. M., and sets at 3h. 7m. the next morning. On the 30th, Uranus rises at 10h. 49m. A. M., having set at 1h. 18m. on the morning of that day.

Neptune.

It is useless to attempt observations on Neptune at present. It comes to the meridian nearly at the same time with the sun, and makes nearly the same diurnal path.

Meteors.

But few meteors have been seen during February and the first half of March. The only one reported of any considerable size was seen on February 28, south of Sirius, at 8h. 30m. P. M. The moon was nearly full, yet it appeared brighter than Jupiter. Several meteors were seen between 8 and 9 P. M. of the 15th of March.

Barometer and Thermometer.

The meteorological journal from February 14 to March 14 gives the highest barometer, February 25, 30.51; the lowest barometer, March 10, 29.46; the highest thermometer, March 4, at 2 P. M., 53°; the lowest thermometer, February 18, at 7 A. M., 11°.

Amount of Rain.

The rain which fell during the night of February 20 amounted to 0.21 inches.

The rain which fell between the afternoon of February 22 and the morning of February 23 amounted to 0.28 inches.

The rain which fell during the night of March 3 and the morning of March 4 amounted to 0.16 inches.

A Street Fire.

In this city, recently, a one horse truck laden with twenty-seven cases of naphtha was being driven up Third avenue by an employee of the Gas Meter's Saving Company. When near 14th street, the driver struck a match and threw the end of it among the cans. In an instant the whole contents were in a blaze. The driver sprang out and left the vehicle to its fate. The horse, a fine young animal, reared and plunged with fright, but the traces and harness confined him to the burning pile. Superintendent Hartfield, of Mr. Bergh's society, riding up on a car, sprang off at the spot, and, under a scorching fire, unhitched the animal and saved it from a horrible death. In ten minutes the wagon was a small heap of charred fragments. The flames reached the top story of

the house at the corner of 13th street and Third avenue. An alarm of fire was sounded by telegraph, and the hook and ladder apparatus was quickly on the spot and assisted to put out the flames.

The Basking Shark.

An interesting ichthyological discovery has lately been made by Professor Steenstrup, of Copenhagen. He finds that certain comblike bodies, which have been supposed to be appendages of the skin of certain sharks, are really shifting organs appended to the interior of the gill apertures of the basking shark; and he infers that this fish, the largest shark of the northern regions, which attains a length of thirty-five feet or more, lives, like the still more gigantic whales, upon the bodies of small marine animals strained from the water by these peculiar fringes. The very fine rays composing the fringes are five or six inches long, and were some years ago shown by Professor Hanover to consist of dentine, so that each of them may be regarded as, to a certain extent, the analogue of a tooth. It is remarkable that Bishop Gunnerus, who originally described the basking shark (*Selachus maximus*) and regarded it as the fish that swallowed the prophet Jonah, noticed the existence of these branchial sieves more than a century ago.—Science Gossip.

PRIZE FOR AN ALCOHOLOMETER.—M. Léon Say has proposed to one of the commissions of the French Assembly that a prize of 200 francs should be offered for the discovery of a process by which it may be possible to determine immediately and practically the amount of alcohol in any mixture, no matter how composed. The commission voted unanimously in favor of the proposal, and M. Dampierre was charged to draw up a report on the subject.

A REDDISH BROWN PAINT FOR WOOD.—The wood is first washed with a solution of 1 lb. cupric sulphate in 1 gallon of water, and then with $\frac{1}{4}$ lb. potassium ferrocyanide dissolved in 1 gallon of water. The resulting brown cupric ferrocyanide withstands the weather, and is not attacked by insects. It may be covered, if desired, with a coat of linseed oil varnish.

Mr. W. R. Norris, the inventor of the diagonal planer illustrated on page 198 of our last issue, desires us to state that the capacity for work of his machine is fifty doors, each 2 feet 6 inches by 6 feet 6 inches, per hour, and not per day, as stated in the description.

IMPORTANCE OF ADVERTISING.

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

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

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

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

Inventions Patented in England by Americans.

- (Compiled from the Commissioners of Patents' Journal.)
From February 21 to March 2, 1874, inclusive.
CARTRIDGE MACHINERY.—C. H. Webb, Brookly, N. Y.
CORUGATING MACHINE.—H. W. Lafferty et al., Gloucester, N. J.
EMERY GRINDING.—C. Heaton (of New York city), London, England.
FEED WATER HEATER, ETC.—J. P. Magoon, St. Johnsbury, Vt.
FLOOR COVERING.—J. L. Kendall, Foxboro', Mass.
JOURNAL BOX.—J. N. Smith, Jersey city, N. J.
LOOK HARNES, ETC.—J. Sladdin, Lawrence, Mass.
PRESERVING EGGS.—D. Miles, Boston, Mass.
SEWING MACHINE.—L. M. Singer (of New York city), Pailinton, England.
TWISTING FRINGE.—W. Brooks, Remington, Vt.

DECISIONS OF THE COURTS.

Supreme Court—District of Columbia.

CONKLIN AND STAFFORD.—PATENT STRADDLING CULTIVATOR. [Application for reissue.—Appeal from the Commissioner of Patents.—Decision March 2, 1874.]

Opinion of the court delivered by MacArthur, Judge: The appeal in this case is from a decision of the Commissioner of Patents refusing to grant a reissue of a patent to the representatives of a deceased inventor. The refusal to allow the reissue is placed by the Commissioner on the ground that the claims for which the reissue is denied have been abandoned to the public use, and are, therefore, not patentable. The facts of the case are as follows: Daniel S. Stafford made application for letters patent August 30, 1860, for a new and useful improvement in corn cultivators, which he described in his specification as that kind of cultivator that can be raised or lowered, or turned to the right or left, by the operator from his seat on the machine, so as to adapt the machine for passing over or turning to one side of an obstruction, or to cause it to follow the crooks in the rows of plants. And this is followed by an elaborate description of the invention in all its details. The original patent was issued to him January 15, 1861, embracing three claims: First, the combination which enabled the driver to guide the machine so as to follow the crooks in the rows of plants; second, the combination of the seat and the bent axle; and third, the long bent share blades or cutters for the purpose of throwing the loose soil toward the plants. In 1866 Daniel S. Stafford died, and on the 13th September, 1870, his assignee and widow, who has since married and is now Mrs. Conklin, filed an application for a reissue, embracing seven claims, five of which were allowed, and two of them were rejected for the reason already mentioned, that Stafford had abandoned the subject matter of such claims previous to the issuing of the original patent. These claims are in the following language: The combination, in a straddle row cultivator, of two wheels, B, an axle, C, frame, A, and series of plows, G, arranged in two gangs, so as to till or cultivate the soil on both sides of a single row of plants simultaneously as set forth. Also the combination, in a straddle row cultivator, of two wheels, B, an axle, C, frame, A, series of plows, G, arranged in two gangs, and a seat, E, for the driver, for the purposes set forth. The application for the reissue was necessarily made under the fifty-third section of the revised patent law of 1870, which seems to be the only provision in the statute authorizing the Commissioner to issue a new patent for

the same invention. This section declares that whenever any patent is operative or invalid, by reason of a defective or insufficient specification, or by reason of the patented claim being as his own invention, discovery more than he had a right to claim as new, if the error has arisen by inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, the Commissioner is authorized, on the surrender of such patent, to cause a new one to be issued, with corrected specifications.

It will be seen by the terms of the statute that in order to entitle a party to the reissue of a patent it is incumbent upon him to show that it is inoperative or invalid by reason of a defective or insufficient specification, or that the patentee had claimed more than he invented, and that the error has arisen by inadvertence, accident, or mistake, and without any fraudulent or deceptive intention. Unless these circumstances exist in an application of this character, I can find no authority by which the Commissioner can reissue a patent; and he is restricted to the particular cases mentioned in the statute. I refer to these requirements of law, because if the original patent is never inoperative or invalid, and if no error has been occasioned by accident or mistake, there must be a presumption of law and fact that the patentee has abandoned to the use of the public everything which he may have invented, but which he did not include in his claims and specifications. The law presumes that every one who applies for a patent will embody his invention in specifications sufficiently definite to preserve as much of it as he desires to protect by a patent. If, therefore, he has overlooked anything within the scope of his invention, he may amend his specifications. The party asking this relief must be denied it unless he brings himself within the statute. When he knows all the facts relating to his own case, but, through culpable negligence or misconduct, has failed to claim all of his discovery, the law will not extend its aid to him, but will leave him to enjoy only such limited advantage as he has actually secured. The law reserves its remedies for the careful and diligent; no one may have been misled from any of the causes mentioned in the statute.

Courts of equity very often grant relief in cases of mistake when a meritorious case is established by the pleadings and proofs; but the remedy is regulated by well-established rules of law, and undoubtedly Congress had the same rules in view when it extended this remedy to similar cases under the patent law which they enacted.

It is conceded that the Supreme Court has decided in several cases that the granting of a reissued patent closes all inquiry into the existence of inadvertence, accident, or mistake. A presumption then arises that the proofs have been regularly made, and that they were satisfactory. "No other tribunal is at liberty to re-examine or controvert the sufficiency of such proofs if laid before him when the law has made such the proper judge of their sufficiency and competency." (Hallway vs. Stimpson, 14 Peters, 439. Seymour vs. Osborne, 11 Wall., 542.)

In the case at bar no such presumption arises, for the patent has not issued, and the proofs are before us to be examined and weighed, and we are called upon, as preliminary to the granting of the patent, to judge of the sufficiency and competency of the proofs to sustain the application in conformity to the essential requisites of the statute. The decisions referred to can have no application to an appeal of this kind.

In this case Stafford during his lifetime never pretended to any one that his patent was inoperative, or that the specifications were defective in any respect, or that he had omitted or added accidentally or by mistake. On the contrary he always claimed for it the highest merit and practical utility. The evidence in the case of Sayles vs. Hapgood, used by consent on this application, establishes beyond any doubt that it was a valuable invention, and one of the witnesses expresses it as a strong, durable, and efficient farm implement. It appears that more than 15,000 of these machines had been manufactured under the patent up to the time of his death in 1866, and sold to the public. Another circumstance of much significance is not to be overlooked in this connection, and it is that, after the original patent had been obtained, Stafford made further improvements upon the same cultivator, and for one of these he procured a distinct and independent patent. About three weeks before he died he gave his brother a description of a model for another improvement, which was patented after his death; and during all the time he was employed in making models of new improvements upon his invention there is not a particle of evidence tending to show that he claimed there was anything wanting in the specifications which he had filed in the Patent Office when he obtained the original patent in 1861.

It seems quite clear, upon this state of the case, that Stafford never intended to patent more than he had carefully and definitely described in his original application; and that everything else which he might have invented up to that period was abandoned to the public. This intention is clearly indicated by his acts, and is as fully proved as it is possible to prove the purposes of one now dead.

It is noticeable that the application for the reissue states none of the causes mentioned in the statute for which a new patent might be issued, and careful examinations of the proofs disclose the fact that not a particle of evidence has been taken to sustain these prerequisites of the law. No presumption can prevail here that the proofs have been made, as would be the case if a patent had issued, and the only rational belief that can arise upon the case as it now stands is that Stafford abandoned what he did not include in his specifications.

We are aware that the Commissioner has presumed abandonment from what he deems proof of the public use of the invention for several years previous to the issuing of the original patent. While we may not be satisfied that a public use is shown of such a character as to establish abandonment, yet the testimony on this subject, taken in connection with the facts I have already mentioned, adds considerable force to the presumption that Stafford never intended to patent what is now claimed.

He made his first machine in 1852, and it comprehended in a rude form all the elements of the combination for which in 1861 he obtained a patent. It was a two wheeled straddle row cultivator, with plows on each side, so as to cultivate a whole row at a time, with a seat for the driver, drawn by two mules, and did as good work as a single plow. To explain the delay which took place from his first machine, in 1852, until he obtained his patent, eighteen years afterward, in 1861, the appellants claimed to have proved by the testimony of several witnesses that during all that time Stafford was in poor health, and was greatly embarrassed in his circumstances; that he was employed from time to time in improving his invention, and constantly declared his intention to obtain a patent as soon as he could procure the means. Whether this was the real cause of delay or not, such a protracted period of reflection and experiment afforded him extraordinary opportunities to ascertain and describe his claim with precision and accuracy.

There is no proof that he was not entirely satisfied with what he did. The application for the reissue is not made until 1871, a period of nearly five years after his death, and thirty years after he had reduced his invention to a practical form. In the meantime at least one hundred distinct patents have been issued for cultivators, and the numerous manufacturers in the west and northwest are respectively manufacturing on a patent of their own. The art has probably received many valuable additions from the efforts of so many persons; but if the claims of the appellants be allowed they would have a monopoly of every form of cultivator with wheels, axles, plows, and a seat for the driver.

It would, indeed, be a patent for a cultivator generally. Such a claim should not be assented to unless it can be shown with reasonable certainty that, if patentable at all, it has never been deserted and abandoned by the inventor.

We are of the opinion that the decision of the Commissioner should be affirmed. Some discussion occurred during the argument concerning the jurisdiction of this court on an appeal from a decision of the Commissioner of Patents. The forty-eighth section of the act provides for the appeal, and the next section directs that the appellant shall file in the Patent Office his reasons of appeal in writing, and the fiftieth section enacts that the court shall revise the decision appealed from, and that such revision shall be confined to the point set forth in the reasons of appeal. A majority of the court are of opinion that by a true interpretation of these sections we can only examine into the reasons of appeal, and the record and proceedings, so far as they apply thereto, for the purpose of ascertaining whether the Commissioner has made an erroneous decision; and that we cannot revise the decision on any other ground than that upon which the application was rejected. In the case now under consideration the reissue was denied for the reason that the inventor had abandoned to public use the subject matter of his claims, and the appellants assigned the reasons for matter of his two claims, and the appellants assigned the reasons for appealing to be that the Commissioner erred in refusing the claim on the ground of abandonment. The issue is thus clearly defined in the mode designated by the law, and we are forbidden to set the decision aside on any other ground. Nor can we go into the record at large for the general purpose of seeing whether the decision is right on some other ground, not passed upon by the Commissioner nor stated in the reasons of appeal.

It has been suggested that a case may occur in which the true grounds of error are not set forth in the reasons of appeal, and yet the decision be sustainable on some other ground. It is, however, a sufficient answer to this view that it is not our duty to put a forced construction on statutes to remedy supposed evils. Besides, if the party wishes to test his general right to a patent, he can do so under the fifty-second section, which declares that he may have a bill in a court of equity if he has been refused one by the Commissioner. We have deemed it proper to dispose of this point in the present case for the purpose of settling the practice on a disputed point in this class of cases.

On the question of jurisdiction, Judge Olin dissented.

The Commissioner, he says, as near as I understand the reason assigned by him for his refusal to reissue this patent with the improved specifications proposed, holds that where a patentee has been experimenting by way of improving his machine for a period of about twenty years, and then applies for a patent for his improvements, and a patent is granted for all he asks as his invention, and after the lapse of some eight or ten years, during which this machine has been manufactured and scattered broadcast over the country, the patentee shall be deemed to have abandoned to public use all such inventions or devices in the original patent for which he did not ask protection in his application for the original patent granted him.

I think the reasoning of the Commissioner by which he arrived at that conclusion is sound; and still I think he might well have placed his decision upon the ground that, by law, the facts of this case did not authorize the reissue of the Stafford patent.

No new matter, the statute says, shall be introduced into the specifications, nor, in case of a machine patent, shall the model or drawings be amended except each by the other.

What is here meant by the statute, which says that upon the reissue of a patent "no new matter shall be introduced into the specification," etc. I understand it to mean this, and this only, that upon the reissue of a patent, the patentee is allowed to surrender his specifications in such a way as to render valid and operative the patent originally granted, but that no new matter shall be introduced into the reissued patent which was not claimed in the original application and specifications. By new matter is here obviously meant setting up a new claim for some new and valuable invention which was not claimed in the original patent. My conclusion is, therefore, that this case, all the facts appearing before us, did not authorize the Commissioner of Patents to grant a reissue of the patent in this case.

From the claims, as set forth in this application for a reissue of the Stafford patent, it will be clearly seen that an attempt is made to straddle over every possible invention and improvement known in this kind of machine, and to render them all subject to the payment of a royalty to the assignee of Stafford, and to his widow, Mrs. Conklin.

*Well, we think the Commissioner might have paused before granting such an extraordinary claim. E. L. Stanton and A. MacCollum, counsel for appellants. Marcus S. Hopkins, for the Commissioner of Patents.

Recent American and Foreign Patents.

Improved Spring Bottom Cot.

Francis E. Lord and Herman K. Blanchard, Cambridgeport, Mass.—The frame consists of two side bars connected at their ends by two cross strips and near their ends by two cross bars. The legs are pivoted to the side bars, and the lower parts of each pair are connected by a cross strip. In the ends of the cross strips are formed slots, the inner parts of which are made sufficiently large to receive the heads of the braces, and their outer parts are made narrow to fit upon the necks of said braces. The latter are pivoted to the side bars in such a position that their heads, when the legs are extended, may pass through the larger parts of the slots in the cross strips. The braces are then slipped close up to the legs, which brings their necks into the narrow parts of the slots in the cross strips, and securely fastens the said legs in place. This construction enables the legs and braces to be turned up along the inner sides of the side bars, so as to be entirely out of the way, and adapt the cot for use as a bed bottom, or enable it to be compactly packed for transportation or storage.

Improved Sawing Machine.

Harvey Morey and Samuel H. Bellah, Cameron, Tex.—A frame, mounted on a low truck, has horizontal ways for a saw frame to slide forward and backward in, the saw projecting at one side of the frame. The frame is also provided with vertical ways, into which the saw can be shifted when it is desired to saw felled trees into blocks. This saw frame has a forked pitman rod attached to each end, one of which is connected directly to the crank of a driving shaft, and the other is connected to a rock lever, which is connected to another crank on said shaft, the two cranks being arranged at opposite sides of the axis. The saw frame has a feed screw, so arranged that it can feed the frame forward and back, while said frame reciprocates to work the saw.

Improved Device for Emptying Carboys.

Hugh R. F. Koehling, New York city.—This is an improved device for removing acids and other liquids from carboys and other vessels by atmospheric pressure, and without agitating said liquids or disturbing any sediment that may be in said vessels. By suitable construction, when the piston of an air pump is drawn upward, an upper valve is closed by the pressure of the air within the bottle, preventing the escape of the air from the latter. A lower valve is then raised by the pressure of the outer air, allowing said outer air to enter the barrel of the air pump. As the piston is forced downward, the pressure of the air forced out of the barrel closes the lower valve, and, opening the upper valve, passes into the bottle, where its pressure will force the liquid contained in said bottle out through a siphon-shaped tube into the receiver.

Improved Cultivator and Plow.

James B. Lucas, Pellsville, Ill.—The axle is bent four times to form a middle bow. The tongue is secured to the hounds, and the rear part of the latter to the axle, near its outer ends. Braces are attached to the axle and to the hounds. To the forward end of the plow beam are secured the ends of two bars, which are pivoted to couplings, by which they are connected with the axle. Another brace bar is pivoted to a coupling, by which it is connected to the axle, and is placed upon the mold board side of the beam, its rear end being bent to lie along the side of the said beam, and to pass through the loop of the coupling attached to the plow beam. This construction allows the plow to have enough lateral movement to pass around stones and other obstructions, and to enable it to be raised and swung beneath the framework of the machine. By operating a lever, the forward end of the plow beam may be raised from the ground, allowing the plow to run upon its foot or heel.

Improved Packing Box.

William D. Woodruff, Louisville, Ky.—The bottom has cleats fastened upon the upper side along the edges, and projecting at the ends. The top of the box has similar cleats on the under side. The side pieces extend beyond the ends of the top and bottom boards as far as cleats do, and they also have a cleat extending across the inside at each end. The end boards have a cleat at the lower end, extending across the inside. To set up the box, the bottom is laid at the ends on the cleats of the end pieces, which are set upright; the side pieces are then laid at their lower edges on the bottom, between the edges of the end pieces and cleats. Then, after filling the box, the top is laid on between the upper projecting end of the end boards, with its cleats outside of and confining the upper edges of the side boards; then binding cleats are put on between the upper ends of the end pieces and the upper side of the top, and fastened by screws screwed obliquely into the end pieces. To take it apart after unpacking it, the screws are taken out, after which all the parts can be readily separated and packed away in a small pile.

Improved Flour and Middlings Purifier.

George W. Brown, Metropolis, Ill.—The general idea of this invention is to enable the attendant to force any amount of air that may be required into the chest or inside the reel, or both, and withdraw it, as may be required for the different kinds, qualities, and conditions of grain, suitable valves being employed to regulate and control the currents. By long trunks along the top of the chest communicating with two air chambers, air may be blown into the reel space with the pressure fan, or sucked out to draw out impurities with the other. By trunks along the sides of the reel above the fall boards, air is to be forced in below the reel to clean the fall boards and facilitate the descent of the flour to the conveyer below, also to act on the under side of the reel. A perforated tube on the shaft facilitates the separation of the material bolted by the jets of air it lets in from the pressure chamber. Coarse wire wings on the perforated tube separate the material falling on them. A smooth ring, fitted in the enlarged portion of the reel at the mouth of the funnel, carries the remaining unbolted material quickly under or beyond the mouth of the funnel to the coarse tail screen beyond, or to be passed out at the tail end to a receiver below. The funnel is for drawing the impurities out of that portion of the reel through which the fine matters are bolted, while preventing the escape of the coarser particles from the tail portion. The material collecting in the suction chamber is removed from time to time through a suitable aperture therefor in the case, having a gate for closing it.

Improved Cane Harvester.

Felix L. Cervantes, Cardenas, Cuba.—This invention consists of a harvester cutter adapted for cutting a single row of cane, with an endless bottom carrier and two or more side carriers between two high sides of a supporting case. The cane is held vertically, and carried against a series of horizontal saws on a vertical shaft, which cut the cane into short sections for convenience in handling. The tops are also cut off and delivered into a receptacle for fodder, while the cane is passed into a wagon to be conveyed to the sugar mill.

Improved Knit Legging.

Samuel Baron, New York city.—This invention consists of knit leggings for ladies and children, having an extension above the knee with an elastic in the top, and also having a contracted portion immediately below the knee, formed by shortening the stitches, in which elastics may or may not be used. The object is to provide leggings which will cover the knee and a portion of the leg above, and retain their position.

Improved Oil Stone Holder.

Ezra C. W. Hull, Hoosick Falls, N. Y.—This invention consists in an oil stone holder made to revolve on pivots, and having three faces, with adjustable clamps and screws for securing the oil stones. By making the cylinder to hold two or more stones, which may be of different degrees of fineness, it is a great convenience in sharpening tools.

Improved Steel for Sharpening Knives.

Owen W. Taft, Brooklyn, N. Y.—This invention relates to a knife-sharpening steel possessing peculiarities of construction calculated to render it much more efficient and for a longer period than other steels. It consists in a series of blades set radially around a rod or stock, which is attached to a handle of suitable form. These blades are employed for the benefit of the angles of their outer edges for knife-sharpening purposes which are more efficient than can be formed on a steel rod by the concave flutes or grooves, or the file surfaces with which steels are armed.

Their form is better adapted for action on the knife edge; and it is such that the edges do not become dulled by wear, but are adapted to be self-sharpening, or if necessary they can be filed or ground sharp. A patent for this device has also been applied for in England.

Improved Fruit Masher and Sifter.

Charles S. Bucklin, Red Bank, N. J.—This invention is an improved machine for rubbing tomatoes and straining out the seeds in making catsup. The tomatoes are introduced through a hopper, and fall into a semi-cylindrical wire cloth screen, through which they are rubbed by a cam on a longitudinal shaft. They then pass to a lower screen which may be suitably inclined, which is sufficiently fine to prevent the passage of the seeds.

Improved Press.

John W. Fields, Sherman, Texas.—The press case is arranged horizontally, and contains a follower which has guide pulleys on its rod. Ropes pass over these pulleys and around a fixed wheel, by rotating which a to-and-fro motion is imparted to the follower.

Improved Electrode Handle for Medical Use.

Jerome Kidder, New York city.—This invention provides, for electro-medical purposes, an improved double electrode for facilitating the adjustment of the amount of surface required, and the convenience of manipulating the current. It consists of a double electrode, so constructed that both poles of the electric current can be brought to it, and still be insulated from each other, so that one pole of the current will be received in the hand that holds the electrode, while the other pole may be applied to other parts of the body, thus using the same with one hand, leaving the other free for other purposes.

Improved Cultivator.

Isaac Cory, Dalton, Ind.—An arched bar is secured to the driver's seat, so that both may be moved forward or back, to adjust the seat so that the weight of the driver may properly balance the machine. Stirrups for the driver's feet are secured to the rear ends of side bars by the clamps that secure the ends of the arched bar, and may be raised or lowered, as the length of the driver's legs may require. The middle parts of the side bars are connected by an arched bar, the ends of which are secured to said bars, and its middle part depressed to bring it into proper position for the rear end of the tongue to be attached to it, the side bends giving space for the plow handles when the plows are raised from the ground. The forward ends of the side bars are connected by another bar, the end parts of which are horizontal, and the middle part arched to allow the plows to be pivoted in front, the handles to rise up, and the implements to be moved laterally or vertically.

Improved Axle Nut Fastening.

Rolla R. Jones, Pillar Point, N. Y.—This invention consists of a circumferential groove, extending about half around the axle near the end, a pawl in a recess in the bore of the nut, adapted to fall into said groove when the nut is fitted on the axle, and a slide bolt in the nut, adapted to slide over the pawl by the action of a spring, after it has fallen into the groove, and lock it fast, obviating screw threads. The nut is fastened more securely than it can be by screwing on.

Improved Razor.

George A. Whitmarsh, Colton, N. Y., assignor to himself and F. E. Miner, New York city.—This invention has for its object to improve the construction of razors, so that they may be more conveniently and safely held in position to be used. It consists in a razor blade made with a short cutting part and a long shank having a thumb rest formed upon it.

Improved Fountain Pen.

David L. Latourette, New York city.—The penholder consists of a tubular base, which screws to the end of a tubular handle, which is the ink fountain. The ink is shut off from the base by a disk and packing, or ground metallic joint, near the upper end of the latter. A feeding tube extends from this disk down through the base, along the back of the pen, to deliver the ink upon it. A capillary feeder of thread is arranged in the orifice of the feeding tube, and in connection with the back of the pen, to cause an even flow. An adjustable cap is screwed on the lower end of the feeding tube to regulate the flow of ink, and a spring of peculiar construction is combined with the base piece for holding pens of different sizes and forms. This invention was illustrated and described on page 178 of our current volume.

Improved Chair Seat.

Thomas W. Moore, New York city, assignor to Fannie N. Moore, Plainfield, N. J.—A series of springs are arranged parallel to each other, and fastened at each end to opposite sides of the frame. These springs are crimped or corrugated to allow for a proper degree of contraction and expansion, and also are bent at intervals to form spaces for the reception of flat transverse pieces. The latter are interlaced with the springs at regular intervals, are parallel to each other, and secured by fastenings, if desired. The flat pieces give a smooth face to the seat or back of a chair but others of a different shape may be employed to prevent the projection of the corrugations from being unpleasant to the sitter.

Stop Mechanism for Spinning and Doubling Machines.

George Krainik, Paterson, N. J., assignor to himself and John Francoeur same place.—The first part of this invention consists of the bolster projecting below the bolster rail, and having the loose pulley of the spindle on it, so that the spindle will be freed from the friction of the pulley when the belt is running on it, and thus will always stop when the belt is thrown off. The second part consists of mechanism such that, when a thread breaks and one of the faller wires falls, it will swing a tongue forward into the path of a projection on a reciprocating bar. The tongue will thus be moved powerfully by the latter, so as to release the trip rod to stop the machine. The third part of the invention consists of a piece of cloth or other substance, and a slide with wedge-like prongs, combined with the bobbin on which the thread winds from the spindle, the friction roller which turns the bobbin, and the falling rod by which the spindle belts are thrown off when a thread breaks, so that, when the rod falls, the cloth and the wedges will be moved forward between the bobbin and the friction roller. The cloth then stops the bobbin, so that it will not continue to draw the thread from the spindles after they are stopped. The wedges go under the journals or pivots of the bobbin to lift it, so that it will not press the cloth on the friction roller during the stoppage, and thus protect it as much as possible from wear by the roller.

Improved Spool Box.

Benjamin F. Carpenter, Roselle, N. J.—A stand is rigidly attached to the bottom of a rotary spool box. The thread from the spools, of which there are a number disposed on pivots on the bottom of the box, is carried up through a disk plate level with the top of the cover. The holes in this disk are numbered on the top to indicate the number of the thread. There is a wheel formed of plates, around the periphery of which is placed a close spiral wire for holding the thread when it is being cut. The thread, as it is carried up from the plate, is passed between two of the convolutions of the spiral, and is compressed sufficiently to hold it for cutting. The cutter is semicircular in form, and is attached to the top of the wheel disk, at its ends, and is covered by a spiral. The thread is carried over the latter and forced down between two of the convolutions on the edge of the cutter, and is thus readily severed. In thus cutting the thread, the fingers of the operator are protected by the spiral.

Improved Check Valve.

Marshall T. Davidson, Brooklyn, N. Y.—This invention consists in the combination of a globe-shaped elbow having a horizontal valve seat, with a screw cup arranged vertically above the seat, with a ring-shaped extension for guiding the valve in a vertical direction. The globe-shaped elbow forms an annular chamber around the cup-shaped seat, through which the steam or water is easily conducted to the exit pipe, their return being checked in an effective manner by their vertical downward pressure exerted on the valve, securing it more tightly in its seat. The valve works thus easily in both directions, and forms, by its position at the elbow joint of the pipes, a convenient and efficient connection.

Improved Dress Protector.

Edward G. Kelley, Brooklyn, N. Y.—This invention consists of a dress protector of spiral wire, bent in such shape as is found most convenient for attachment and protection, and attached either directly to the trail of the dress or to a piece of cloth to be applied to the dress.

Improved Ice-Snow Scraper.

Henry Little, Middletown, N. Y.—This is a machine for scraping the snow from the surface of ice, preparatory to sawing and harvesting it. The two side boards of the machine are of such dimensions as will enable them to contain enough snow for a load. Their rear ends meet at an angle. To the lower part of one of the side boards is attached a bar, the rear end of which projects, and has an eye formed in it to receive the pintle formed upon the rear end of a lever, which is pivoted to the other of the side boards. To the inner side of the rear ends of the side boards are attached two vertical bars, the upper ends of which project above the upper edges of said side boards, and are hinged to each other, so that the lower parts of the said ends may spread apart to discharge collected snow. The forward ends of the side boards are connected and held at the proper distance apart by a rod, and the boards are kept from spreading too far apart by stop bars. There is a platform for the driver to stand upon, the ends of which pass through keepers attached to the upper edges of the side boards, so that the said platform will not interfere with the proper operation of the said side boards. In using the scraper, it is drawn to the place whence the snow is to be scraped; the side boards are then brought into a vertical position; the lever and bar are connected together; and the scraper is drawn to the place where the snow is to be deposited. The lever is then operated to disconnect it from the bar and discharge the collected snow, and the scraper is drawn back for another load.

Improved Binders' Attachment for Harvesters.

Wesley C. Dentler, Palmyra, Neb.—This invention is an improved bundle-carrying attachment for harvesters for receiving the bundles when bound, and enabling them to be dropped together when a sufficient number have been collected. To curved braces are pivoted the carriers, the inner ends of which are bent upward to rest against the edges of the tables, and the outer ends are similarly curved to prevent the bundles placed upon them from slipping off. The carriers are connected with cranks formed upon the ends of a shaft. To the latter is attached an arm, the end of which is bent at right angles to be caught by a spring catch, to hold the carriers in place when raised into position to receive the bundles. The spring catch is so formed that one of the binders, with his foot, can readily detach it, and allow the carriers to be lowered by the weight of the bundles, which bundles then slide off. A curved spring is so arranged with the arm as to raise the carriers into position to receive the bundles, when the arm is caught and held by the spring catch, locking the carriers in position. By this construction the bundles can be dropped in rows, so that they can be readily shocked, and so that the shocks can be more conveniently and quickly loaded upon a wagon. This construction also prevents the waste of grain from scattering, and from its being shelled out by throwing the bundles upon the ground as they are bound.

Improved Cattle Stanchion.

Hoses Willard, Vergennes, Vt.—There is a pivoted revolving frame, consisting of two stanchions connected together by horizontal pieces. One stanchion is movable in a slot, so as to admit the head of the animal, and is longer than the other, so that it may be slipped into slots in the cap to make the frame fast. At other times the frame is allowed to revolve in either direction, according to the position of the animal.

Improved Saw Jointer.

Edwin Gowdy, Pottsville, Ohio.—This invention is an improved machine for dressing and truing the teeth of circular and other saws. It consists of a base piece, with a longitudinal screw for carrying a file holder with files firmly secured by a key and washer. After the teeth of the saw have been swaged, and the shorter teeth raised sufficiently to strike the first file, the file holder is adjusted on the saw so that the same runs steadily between end screws. By turning, then, the saw backward, the first file acts as a gage and files on the circumferential edge of the teeth, dressing them smoothly and evenly. The key is then loosened and taken out with the front file and washer. The file holder is then screwed forward and the side files adjusted to the saw, which is then passed several times along the same until the rough side edge of the teeth is taken off, and a smooth and square edge is produced. The file holder is then carried back, requiring, after being once set, but little adjustment, which is, however, easily obtained by detaching the sliding file holder and adjusting the bottom set screws.

Improved Three Cylinder Engine.

Phillip T. Brownell, Elmira, N. Y.—This invention is an improved bushing for the crank pin of a three-cylinder engine, and an improved oiling device for the same. The sectional bush for the wrist or crank pin of the engine is cut longitudinally into four equal parts, which are arranged around the pin within the eyes of radial sliding rods, and are secured to said eyes, one to each, in such positions as to give the proper bearing upon the pin. The inner surfaces of the eyes are so formed as to permit a free movement over the parts of the bush that are fastened to the other eyes. The shaft has a disk attached to its inner end, and the wrist pin projects therefrom in a plane eccentric, but parallel to said shaft. Thus at each revolution the pin describes a circle, whose center is the axis of the shaft. The oil for lubricating the bushings is held in and supplied from a cup which is attached fixedly to the pin, but is arranged eccentrically thereto, and concentrically with the shaft. When the engine is at rest, the oil remains in the lower portion of the cup. When in motion, the oil is distributed in the cup and carried around by centrifugal force, finding its way to the bearings.

Improved Mud Fender for Equestrians.

Austin P. Speed, Louisville, Ky.—This is a device for protecting the boots and legs of persons riding upon horseback from being splattered with mud. It consists in a steel frame, to which is attached a boot of such size as to receive the foot of the rider, and within which the stirrup hangs free. The boot consists of a sole having an upwardly projecting flange attached to it, except at one side, which is left open, and the upper edge of its closed side is attached to the covered frame.

Improved Ear Cleaner.

Moritz Leiner, New York city.—This invention is an instrument for cleaning the ear, and it consists in a twisted stem of metal, having a swab or bulb of some soft elastic substance at one end, attached by an eye in one end of the stem, and a spoon or scraper at the other end of the stem.

Improved Seed Planter.

Thompson Pressly, Sweet Home, Tex., assignor of one half his right to D. E. Hicks.—The roller, which runs upon the ground and presses the earth on the seed, is supported by curved side bars and struts, which are adjustable on the beam and standard, so as to throw the roller up or down. The friction of the roller on the ground rotates the agitator in the seed box. The plow is attached to the end of the standard, so that it can be raised or lowered, and thereby regulate the depth of furrow.

Improved Neck Tie.

Reginald R. Parker, Indianapolis, Ind.—The object of this invention is to furnish an improved neck tie or bow, the ends of which are stiffened in such a manner that they are prevented from becoming limp, or wrinkled or curled to the outside, protecting, also, the raw edge, and imparting to the whole bow a neater and better shape. The invention consists in a neck tie or bow provided at the under side of the corners with protecting and stiffening facings, of paper or other suitable material.

Improved Sweep for Cultivators and Plows.

Elias Haiman, Columbus, Ga.—The middle part of the sweep has a ridge formed along its central line and extending from the bolt hole in the stem to, or nearly to, the point, while the side edges of the stem are bent to form flanges extending along the upper edges of the wings. These two corrugations, being thus relatively placed, prevent the sheet from being bent in either a vertical or horizontal direction, and allow of the employment of this metal that is more easily worked and makes a cheaper article.

Improved Safety Pin for Thill Couplings.

Joseph G. Dance, Long Green, Md.—This invention relates to a peculiar construction of safety pin by which a thill may be coupled to a vehicle with great facility, and yet so securely that no jolting or ordinary casualty will displace it.

Improved Ship.

A. John Bell, Ashland, Ky.—This invention consists in a ship or vessel having its lower deck made in three parts, the middle one resting upon bulkheads bracing the sides of hull, and easily removable.

Business and Personal.

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

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Circular Saw Table.—See Havens' advertisement, page 220.

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Temples and Oilcans. Draper, Hopedale, Mass.

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

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

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

By touching different buttons on the desk of the manager, he can communicate with any person in the establishment without leaving his seat. The Miniature Electric Telegraph—Splendid for offices, factories, shops, dwellings, etc. Price only \$5, with battery, etc., complete for working. Made by F. C. Beach & Co., 260 Broadway, corner Warren St., New York. The Scientific American establishment, New York, is fitted with these instruments.



G. McK. does not state the materials of which his dried varnish consists.—A. S. will find a recipe for dressing skins in the Indian manner on p. 266, vol. 26.—C. H. B. is informed that iron gas pipe is not 5 per cent of the total iron manufacture.—B. B. S. will find full directions for solder of all kinds on p. 251, vol. 28.—C. L. N. will find the directions on p. 7, vol. 30, for constructing a telescope, trustworthy and correct.—J. D. H. will find instructions for skeletonizing leaves on p. 315, vol. 29. Suggestions for preventing echoes in buildings are given on p. 256, vol. 29.—J. N. F. will find some valuable information on the restoration of burnt iron on p. 51, vol. 30.—E. H. B. The attraction of gravitation is the attraction of all portions of matter for each other.—A. O. W. The prismatic colors are often visible in a halo, or in a fog of any kind. There is no generally accepted theory of the aurora borealis. Meteors are supposed to be small portions of matter floating through space; they are attracted to our center of gravity, and become incandescent by friction with our atmosphere.—A. F. B. will find that a marine glue, made of best glue and caoutchouc, will remain flexible if enough caoutchouc be used.—J. W. B., of Nashville, Tenn., does not send his name.—L. M. should apply to the master mechanic of some railroad for a situation as fireman.—W. C. T. will find directions for building cement walls on this page.—M. H. W. can fasten leather to iron by following the directions on p. 41, vol. 26. Cementing emery to cloth, leather, and wood, is described on p. 265, vol. 26.—W. A. R. can cast rubber by the process detailed on p. 263, vol. 29.—L. B.'s questions are incomprehensible.—F. L. S. can find the proportions of acids for silvering glass by experiment. We have never heard of any successful mode of silvering glass by electro-deposition.—A. B. D. will find directions for mounting and varnishing chromos on p. 154, vol. 27. For picture frame filling, see p. 95, vol. 29.—C. W. H. Jr. can attach cloth to cast iron by the process described on p. 42, vol. 26.—B. E. cannot do harm by having an investigation of his engine.—D. W. G. will find a bar or chisel handy for knocking clinkers from the sides of a stove.—J. A. will find directions for transferring engravings on p. 128, vol. 30. Chinese white or the mineral of an emerald card will do to whiten the surface of the block.—W. K. should read Wilson's "Treatise on the Steam Boiler."—G. F. D. can clean his old files by the process described on p. 263, vol. 29.—G. Mel. can utilize his old rubber by following the directions on p. 349, vol. 26.—B. J. L. should read the instructions on p. 379, vol. 25, for polishing walnut wood.—W. F. will find directions for mending rubber boots on p. 238, vol. 30.

A. A. says: In the SCIENTIFIC AMERICAN of August 16, 1873 (editorial on lightning rods), it is stated that the gas and water pipes ought to be connected with the rod; because if not, there is danger that persons may receive shocks from such pipes by the induced electricity developed in them. Now, as the rod and the pipes all extend into the ground, are they not all substantially connected? If the water and gas pipes of a dwelling communicate with the ground, and through it with the rod, is any further connection necessary in order to prevent injury by induced electricity? A. The connection with the ground is good, but at the wrong end. The upper ends must be connected or the resistance of the pipes etc., themselves will cause the trouble mentioned; and also as regards the induction, this is an action in which the end of the rod nearest the cloud is charged and not the other end in the ground. These are a few points, but one must study the meaning of induction, resistance, tension or "potential," etc., to see the whole thing clearly.

B. B. E. asks: What shape or degree of convexity must a plano-convex lens have to ensure the least spherical aberration? A. The smallest curvature possible, in other words, a long focus lens.

C. R. asks: How much power is saved by the use of sperm oil for lubricating purposes as compared with lard, tallow, or mixed oils? A. There will be from 1 to 5 per cent of difference in the friction with different lubricants, according to Morin's experiments.

T. M. Jr. asks: 1. Do you know of any make of engines with the ordinary eccentric valve cutting off at both ends of the stroke alike? What would be the advantage of such an arrangement? A. It is sometimes done by making the lead different at each end of the stroke. 2. What could I do to prevent danger to surrounding buildings from sparks coming out of the stack of a cupola while casting? A. We cannot recommend any very reliable preventive.

A. P. G. asks: Has any steam frigate, of any sea-going vessel of any class, ever attained a speed of 25 miles an hour, under ordinary conditions? A. We have seen it stated that one of the English blockade runners, during the war, made a speed of 22 miles an hour; but this is not well authenticated.

S. says: Is smoking cigarettes very injurious, on account of the paper in which the tobacco is wrapped? A. The paper is injurious, but not more so than the vile weed it encloses.

F. G. W. asks: How heavy a weight with a fall of 20 feet will it require to run a sewing machine, on ordinary work, for an hour? A. A weight of 3,000 lbs.

H. R. G. says: I would like to mold some rubber blocks. How shall I dissolve my rubber? Would plaster of Paris do for molds? A. Dissolve in bisulphide of carbon. Plaster of Paris will answer for molds.

G. W. F. says, in reply to M., who asks what causes his pump valves to thump: "I set up an engine running at 150 revolutions with a pump which thumped. I put a bolt with a large head up through the air chamber and screwed it down over the valve, not letting the valve lift so high. Then I put a jam nut on top to keep it from turning, putting rubber between nut and air chamber, to make it tight. The head of the bolt, coming close to the valve, keeps it from lifting too high. It has worked all right ever since. [We are much obliged to our correspondent for this letter. Our readers would do good service if they would send us notes of this kind on matters of general interest.—Eds.]

W. B. asks: What effect will frost or rain have on a wall made of water, lime, sand, and clay? How should these ingredients be mixed? How should water, lime, sand, and small limestone be mixed to make a wall? How would water, lime, sand, and soft coal clinders do for a wall? A. To build concrete walls it is not safe to use anything but the best cement, broken stone, gravel, and clean sharp sand. One barrel of the best Portland cement will be sufficient for 13 barrels of the other ingredients, filling the interstices between the particles of stone and gravel and adding nothing to their bulk. The cement should be well incorporated with the other ingredients, and supplied with sufficient water to set well.

F. H. B. asks: What is the advantage of constructing shot guns of laminated steel or twist iron barrels? Two old hunters here claim that a shot gun barrel made of pewter on any other material would throw shot just as well as guns of the best made steel, if they were subjected to the same charges of powder, and say that the material of which they are made makes no difference in the shooting. A. Provided the shape of the barrel is not changed by the discharge, we think the old hunters are right. It is not difficult to see, however, that a much lighter construction can be secured, with the same strength, by making the barrels of tough iron.

E. F. C. asks: 1. In constructing an induction coil, how many thicknesses or layers of wire should there be in the primary coil, and why should it be composed of coarser wire than the secondary? A. From one layer upward, although there is but a slight gain beyond a certain point. It is made of coarser wire in order to afford less resistance to the electric current. 2. How is the secondary coil to be wound? Should it be done by commencing at one end of the wire, and winding it upon the primary coil, as threads wound upon a spool? A. It is best to wind it on flat layers like the coils of a rope, and insulate each layer from the next by a ring of oiled silk or other insulator. 3. How many cups of Daniell's battery, 3 inches high by 6 inches diameter, would be required to run the coil described on p. 315, vol. 29, so as to produce perceptible shocks? A. Six cups of Daniell's battery, with a properly constructed coil, should give sparks several inches in length.

J. H. D. says: 1. I am running an engine of about 75 horse power, an ordinary horizontal with common slide valve. I wish to reverse the motion or speed; how can I best do it, as I cannot very well get access to the valve? An engineer gives me the following rule: "Place the crank in position answering to the end of the stroke, and mark the valve stem with file or chisel close up to the gland of stuffing box; now place the crank on the opposite center, loosen the eccentric and turn it round upon the shaft until the mark on the valve stem comes out to the edge of the gland, and fasten the eccentric." Is this a correct rule, and will it give the same lead as before? It does not seem to me that it would. A. It would not give the same lead; and if you do not know the amount, you may have to equalize it by trial at the cylinder cocks. 2. On p. 331 of your vol. 29, in answer to F. H. D.'s query as to the proper dimensions of steam and exhaust pipes, you give a table taken from W. S. Auchincloss' work on valves and link motion. What I wish to know is how to use the table; I cannot exactly see into it. Will you please make it a little clearer for me and several others? A. The piston speed in feet per minute is twice the number of revolutions per minute multiplied by the length of the crank in feet. For example, an engine having a diameter of 16 inches and a stroke of 2 feet, making 100 revolutions per minute, has a piston speed of 2x100x2=400 feet per minute. The area of the piston is 201 square inches, and from the table it appears that the area of steam pipe should be 201x0.958=192.58 square inches, which corresponds to a diameter of a little more than 8 1/2 inches.

O. C. W. says: I have a pipe 3 inches inside diameter and 20 feet long, standing erect with closed valve at the bottom. It is filled with water. What is the pressure on the valve? A. The weight of the water, if the valve has the same diameter as the pipe. 2. How can I increase the pressure without making the pipe longer or forcing the water in at the top of the pipe? A. By dissolving something in the water, to make it heavier.

L. W. asks: Will a rotary engine of 3 horse power propel a small side wheel boat 30 feet long by 7 1/2 feet beam? It draws 12 inches of water. The boat has a medium flat bottom and is sharp forward. Her engine runs at 300 revolutions per minute, and is geared to wheel shaft in proportion of 4 to 1. What speed ought to be obtained, the diameter of wheel being 5 feet 6 inches, with 8x10 buckets? A. With such an engine, the speed would probably not exceed 2 1/2 miles an hour.

H. G. C. says: Has the twist or rotary motion, given to a rifle ball by the pitch of the rifling, anything to do with its velocity or the distance to which it may be thrown by a given charge of powder? A. The twist diminishes the velocity.

C. Y. says: Please state what is the size of the quantity galvanic battery necessary to heat an iron wire the 1-25th of an inch in diameter to red or white heat? The liquids are to be nitric and sulphuric acids. A. About twenty cells.

N. D. S. asks: Is there a law that will hinder me from putting a steam saw mill on a boat and running it (by steam) to any place? I am not a licensed engineer. Can any inspector force me to have my boiler tested against my will, if I only carry my own property? A. We do not think that your case will fall under the requirements of the steamboat law.

M. W. R. asks: How can I restore the color of a black silk velvet cloak that had lime water on it, turning it to a light brown? A. Further injury may be prevented by rubbing the spot first with dilute acetic acid and then with water, but the coloring matter has been destroyed and can be restored only by dyeing again.

A. S. G. says: A stream of water moves at the rate of 10 miles an hour, with a fall of 1 foot per mile; what is the momentum of the water per square foot? A. The horse power of the water per square foot of cross section is equal to the velocity of the water in feet per second multiplied by 62.4 times the height due to this velocity, and divided by 550. To illustrate: Velocity in feet per second=14.6. Height due to this velocity (14.6)² ÷ 64.4 = 3.3 feet. Horse power of water per square foot of cross section, $\frac{14.6 \times 3.3 \times 62.4}{550} = 5.9$ nearly.

S. C. Z. asks: 1. At what part in a machine is it that the dead point most frequently occurs? A. It is the position of the crank when the piston is at either end of the stroke. 2. Can you tell me of any chemical that will dissolve mica? A. Most varieties are decomposed by sulphuric or hydrochloric acid. The silica can then be dissolved in hydrofluoric acid, or a solution of caustic alkali.

P. says: A neighbor bought a cast steel plow and put it into gravelly soil. After using it half a day, he found the mold board badly creased and furrowed. He then exchanged the steel plow for a cast iron one. It is well known that a steel sledge shoe sticks worse on bare ground than a cast iron shoe. Is steel softer than iron? If not, how do you account for these facts? A. This may be explained on the supposition that the steel was of poor quality and badly tempered, so that it was not homogeneous in texture, and did not have the same degree of hardness throughout.

G. O. A. asks: Will a solid ball of iron weighing 25 lbs. fall a distance of 1,000 feet quicker than a ball of the same description weighing 1 lb.? A. No. 2. Will a cylinder of iron 1 inch in diameter and 12 inches long fall 1,000 feet quicker than a cylinder 1 inch in diameter and 1 inch long, if dropped end foremost? A. No.

S. says: We have a tubular boiler running night and day, using water pumped from the river, without any filtering. We find, after running three or four days, that the water foams in the boiler to such an extent that we are compelled to let the steam go down and draw off part of the water, and refill with fresh. Can you give me through the columns of your paper any method to prevent foaming? Is the use of tallow or any other oily substance injurious to a boiler? We have in use an upright boiler feeder, and until recently have used the exhaust from the pump to assist in heating water for the boiler, the pump piston being lubricated by tallow. The question has arisen whether the tallow used would materially affect the boiler or in any way have a tendency to cause foam by entering into a combination with matter contained in the water. A. The foaming seems to be caused by impurities in the water, which raise the boiling point. Blowing off a portion of the water at intervals may remedy the trouble, but it would be better to use a feed water heater that would extract the impurities. Oil and tallow will do no harm, unless they contain impurities.

J. E. C. asks: I. Will it increase the draft of a portable engine when not in motion to connect a small pipe with the boiler and let it extend into the smoke stack? A. Yes. 2. If so, what sized pipe should I use for a 12 horse power engine, and how far up in the smoke stack should it extend? A. About a quarter of an inch in diameter. Run it up three or four feet.

L. E. I. asks: 1. What are the proper dimensions for the ports of a cylinder 4 1/2 inches, running 250 revolutions at 60 lbs. pressure? A. Make the port area one half that of the piston. 2. What would be the power of such an engine? A. Horse power equals pressure on piston in pounds multiplied by piston speed in feet per minute, divided by 33,000.

M. J. C. asks: How is steel wire tempered for making springs, and how can the temper be taken out of steel wire so that it will not break?

S. L. B. says: In your issue of February 14, M. M. asks: "If I hang a rope over a loose pulley and put my feet in a loop in one end and take the other in my hands to elevate myself, what proportion of my weight do I pull down with my hands?"

J. F. F. asks: What is the difference between a 3 foot wheel with 4 discharges, that will use 300 inches of water under 8 feet head, set in a flume, and one of 4 feet diameter with 8 buckets, with scroll on top of wheel, using same amount of water?

G. B. asks: 1. How many barrels of cement will it take to build a house 60 feet long, 25 feet wide, and 25 feet high, the walls to be as thick as they ought to be in your judgment?

F. O. C. H. asks: How can a patch be put on a boiler with bolts, so as not to leak? We have tried lead, iron, and hemp with white lead, but neither would do.

P. D. F.—1. A siphon can only operate when its discharge orifice is lower than the level of its supply. 2. The lantern for showing paper pictures instead of glass transparencies, is constructed like any magic lantern, but the picture is placed where the light usually stands, and the light is placed at one side, so as to illuminate the picture.

D. G. says: 1. Can the insulators ordinarily used on wires be coated, with lead, tin, or some other material that will protect the insulating material from decay? A. They can be coated with gutta serena.

M. J. C. asks: 1. How is brass wire tempered for making springs? A. By hammering or rolling.

M. J. C. asks: 1. How can cast iron be soldered? A. By first tinning it. 2. How is cast iron hardened so that it cannot be filed? A. By chilling it in the mold.

C. W. K. asks: 1. What are the improvements needed in rotary engines? A. Some means of preventing wear. 2. Is the unequal balance in the revolving cylinder a serious objection? A. This is obviated in some forms.

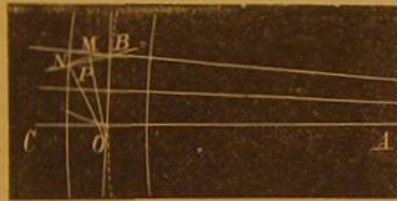
W. W. McK. asks: What is the best to do with cast iron borings? Can I melt them in a cupola? Will not the fan or blast blow them out? How would it do to put a small portion in each ladle of hot iron? Do you think they would melt sufficiently to make a good sound casting? A. Your best plan will be to melt in first in a crucible.

G. P. H. asks: Is there any invention used for the purpose of detecting mineral substances in the earth, as, for instance, silver? A. No.

W. F. W. says: When we speak of the power of the lever, three things are to be understood, the power applied, the resistance, and the fulcrum. Some people believe that a large water wheel is more powerful than a small one for the same reason that a long lever is better than a short one.

S. G. C. says: Your answer to W. F. W., February 28, as to the lever principle applied to the overshot water wheel may be correct if only applied to the turning of the wheel; but when the power of the wheel is applied to the driving of machinery, I assert that there is no lever principle applicable.

F. L. L. asks: How can I draw the curves on teeth of gears? I send you a copy of a drawing from Armstrong's 'Practical Draftsman's Book,' but I do not understand it.



the chord, B N, which passes through the extremities of the curve by a perpendicular, which will cut the tangent, B O, in the point, O. This is the center of the arc, B M N, which very nearly coincides with the epicycloidal curve. The same arc is repeated for each side of all the teeth of the pinion, the radius, B O, being preserved throughout.

H. H. C. says: A friend of mine says that powder can be exploded in an ordinary gun, with an ordinary charge, without report, by oiling the barrel tube and cap. I think not. Which is right? A. It is best to settle so simple a matter by direct experiment.

T. L. asks: How can I set a locomotive eccentric which has slipped? A. It can be done by trial, placing the engine at each end of the stroke, and trying the cylinder cocks.

J. P. asks: How can I season a wooden screw made of green hardwood timber, so that it will not crack in seasoning? A. Your best plan will be to place it in some position so that it will become seasoned very slowly; but even with this precaution, it is doubtful if you can prevent cracking.

P. H. B. asks: 1. How can I make a calcium light for an experiment? A. A cheap modification may be made by forcing a current of air, by means of a blowpipe, into a flame of common illuminating gas, and directing the flame against a piece of chalk.

G. A. asks: 1. In spinning copper, how is the work fastened in the lathe? A. With a clamp. 2. Should metal or wood tools be used? A. Very hard material is necessary for the tool. 3. Which is the best wood for models? A. Mahogany.

A. N. R. asks: Is there any instrument for enlarging or contracting drawings? A. Yes. See engraving and directions for use and manufacture in Scientific Record for 1874.

C. & P. ask: Can you give us a recipe for hardening cast steel mold boards of plows? We harden with prussiate of potash, sal ammoniac, and black oxide of manganese, but these, we find, only harden on the surface. A. You should harden the steel by the ordinary processes of tempering, which have been of late frequently described in our columns.

A. H. D. asks: How many feet board measure are there in a scantling 2 1/2 inches square at one end, and 3 1/2 inches square at the other, and 12 feet in length? A. The ordinary rule of finding the contents, in board measure, of a piece of timber, is to multiply the breadth in inches by the depth in inches, and by the length in feet, and divide the product by 12.

G. W. A. asks: How do you calculate the number of square inches of a safety valve, and how large should the pea be? A. The following formula will enable you to determine any part of a safety valve, if you know the others: Pressure of steam in pounds per square inch x area of the valve in square inches x lever arm of valve = weight of ball x lever arm of ball + weight of lever x lever arm of lever + weight of valve and stem x lever arm of valve

P. T. B. says that an experience of 34 hours will convince C. H. M. that his potato vines would be dead, if arsenic were used instead of Paris green.

R. A. B. says, in reply to E. B. who asked by what means was accurate alignment of the Hoosac tunnel attained: "I can answer this, as I did it myself. In the first place, a line was run over the mountain and tested several times to see that it was exactly straight. Then the working lines of the tunnel diverged northerly



six inches in every one hundred feet from each end. This was to prevent the possibility of passing in the center without meeting."

H. M. P. says that C. S. D., who gives a method for finding the weight of a person's head without cutting it off, must try again, for two reasons: 1. This method assumes that the body, including the head, is of the same specific gravity as water. 2. It assumes that the head is of the same specific gravity as the rest of the body.

J. H. W. says, in reply to many readers, who ask how to make flour paste that will not sour: Take 2 lbs. of flour and 4 pints of water, mix part of the water slowly with the flour, rub up all the lumps, continue to add the remainder of the water till all is added, then strain through a napkin or colander and cook slowly; stir frequently to prevent scorching; when it comes to a boil, take it off. It is sufficiently cold. Then stir in half an ounce of nitro-muriatic acid and put into an earthen vessel to keep.

S. K. W. says, in reply to F. H. M. who asked for the best way to wash flannels: Supposing this inquiry to mean without fulling or turning them yellow, I will give a modus operandi, which I have found satisfactory: Shave a little white soap into a pail, and pour on it water nearly boiling hot to dissolve it, adding, if you choose, a tablespoonful of spirits of ammonia.

B. W. says, in reply to M. S. W.'s three questions as to contraction of the horse's hoof: The contraction of the hoof is brought on by cutting the frog, and by ignorance in setting the shoe, by carrying the seating or bevel of the upper side of the shoe so far back that the heel rests on the slope of the seating, otherwise on two inclined planes; so that every step presses the heel together.

J. W. P. says: 1. I have a quantity of beeswax that has been used for dental purposes; it has become mixed with plaster of Paris, gutta serena, and the dirt from the laboratory. How can I separate the pure wax from the mixture? 2. Can old and brittle gutta serena be made over again, so as to work like new?

J. J. J. asks: Is there a compound that will force the beard to grow faster than it will of itself? E. F. G. asks: Is there any way of photographing a positive picture on glass directly, so as to answer for a magic lantern slide? Is there any way of changing a negative into a positive?—A. E. C. asks: Which can be drawn more easily, a large or small axled wagon? Most farmers claim that a wooden axle in a pipe box can be drawn more easily, on bad or rough roads, than an iron axle, because it is larger.—G. J. asks: Can any one give the formula for the enamel used on engineers' instruments, which is called the bronze finish?—A. B. D. asks: In what manner should a common mouth blowpipe be applied to the flame and work to get the best effect in soldering (hard and soft) and in assaying and experimenting with ores and metals?—C. D. M. asks: Does the rapidity in which the temperature of steel is changed have a tendency to temper it, providing the temperature is not raised above 225° Fah? For illustration, take a razor at a temperature of 10° and plunge it into boiling water. Will this temper it to an injurious extent? Does it injure a razor at all to put it into boiling water? What is the rationale of the tempering of steel? Is it effected by a rearrangement of molecules, or is it a decarbonization?—W. E. S. asks: Can any one start and stop a 30 horse power engine by telegraph? If so, how?—M. J. M. asks: How are clocks finished, and what kind of varnish is used?—C. L. asks: How can I construct a microscope (with two lenses) strong enough to see distinctly the antimalcule in water? 2. Why is a glass can protected from bursting, when being filled with hot fruit, if a knife or spoon is placed upright in the can?—W. E. S. asks: What is the best and most durable whitewash known, for outdoor work?—N. J. F. asks: If a vessel of water is revolved so that the contents will be elevated at the outside, and a series of endless chains, provided with floats, arranged over pulleys in such a manner that they will ascend at the outside and descend near the center of motion, where the water is considerably lower, will the unequal height of the columns in which the chains are immersed impart motion

to the chains, and if not, why is the buoyant effect of the liquid in this case different from what it is when a rest?

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 Ball dropped into the Earth, etc. By J. L. B.
On an Aerial Electric Ship. By C. W. W.
On the Hanging Rope and Pulley. By M. M., by C. B. T., and by N. P. M.
On Large and Small Water Wheels. By G. P.
On a Crooked Stick. By A. A. C.
On a Gasoline Accident. By W. L. W.

Also enquiries from the following: P. A. T.—J. M.—M. P. C.—T. C. H.—G. C. H.—A. H.—J. M. M.—G. B. & P.—H. H.—N. R.—J. T.—H. G. J.—G. & A.

Correspondents in different parts of the country ask: Who sells a plow that will scour as well in black prairie land (Texas) as in a sandy soil? Who makes sawing machines for felling trees? Who makes magnets to order? What is the best protector for wood work exposed to the weather? Who makes cork cutting machinery? Who makes machines for packing coffee, etc., in paper? Who makes furnaces for restoring spent alkalies? Who makes twist drills, of different kinds? Who has a patent plan for building lime kilns? Who makes iron slat blinds, suitable for brick-fronted buildings? Who makes portable paper boats? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL]
Index of Inventions
FOR WHICH
Letters Patent of the United States
WERE GRANTED IN THE WEEK ENDING
March 3, 1874,
AND EACH BEARING THAT DATE.
[Those marked (r) are reissued patents.]

Table listing various inventions and their patent numbers, including items like 'Acid, making acetic, L. Brumlen', 'Addressing machine, L. Bailey', 'Agricultural implements, teeth for, J. King', etc.

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 Equalizer for vehicle springs, E. P. Carter..... 148,033
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 Fence, portable, J. M. Wallis..... 148,156
 Fire escape, H. P. Bell..... 148,173
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 Fish hatching apparatus, N. W. Clark..... 148,053
 Flour chest and bread table, J. M. Jones..... 148,067
 Fog signal, G. C. Pattison..... 148,084
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 Furnace doors, governor for, A. C. Norcross..... 148,132
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APPLICATION FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:
 23,023.—MARKING CLOTH.—H. W. Fuller. May 20.

EXTENSIONS GRANTED.

27,357.—TABLE CUTLERY.—J. W. Gardner.
 27,392.—FOLDING AND PASTING MACHINE.—G. K. Snow.
 27,403.—STEAM AND FIRE REGULATOR.—J. Woodruff.

DESIGNS PATENTED.

7,208 to 7,211.—CARPETS.—T. Barclay, Lowell, Mass.
 7,212.—BURIAL CASE.—F. W. Biele, New York city.
 7,213 to 7,221.—CARPETS.—R. R. Campbell, Lowell, Mass.
 7,222 to 7,224.—CARPETS.—J. Hamer, Lowell, Mass.
 7,225.—CARPET.—C. S. Lilley, Lowell, Mass.
 7,226.—CARPET.—D. McNair, Lowell, Mass.
 7,227 and 7,228.—BIRD CAGE.—G. R. Osborn et al., N.Y. city.
 7,229 and 7,230.—TYPES.—W. H. Page, Norwich, Conn.
 7,231 and 7,232.—RICHES.—E. C. Wooster, New York city.

TRADE MARKS REGISTERED.

1,551.—HARD SOAP.—Buffalo Soap Co., Buffalo, N. Y.
 1,552.—COLORE.—I. Buswell, Solon, Me.
 1,553.—SHIRTS.—H. Christensen, Chicago, Ill.
 1,554.—LUBRICATING OIL.—Loomis & Co., Pittsburgh, Pa.
 1,555.—WELDING COMPOUND.—H. Schlerob, J. City, N.J.
 1,556.—WATCHES.—National Watch Co., Elgin, Ill.
 1,557.—MEDICAL COMPOUND.—H. A. Tilden, New Lebanon, N. Y.
 1,558.—CHEESE.—A. H. Turner, Brooklyn, N. Y.
 1,559.—TOBACCO.—Well & Co., New York city.
 1,560.—ALEX.—A. W. Wickes, N. Y.

SCHEDULE OF PATENT FEES.

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On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA. FEBRUARY 24 TO MARCH 3, 1874.

3,169.—Wm. C. Shepherd, Cleveland, Cayahoga county, O., U. S. Improvements on whitewater stabs, called "Shepherd's Improved Whitewater Stab." March 5, 1874.
 3,170.—Wm. McKee, Toronto, York county, Ont. Improvements in meat cutters, called "McKee's Meat Cutter." March 5, 1874.
 3,171.—J. W. Meaker, Detroit, Wayne county, Mich., U. S. Improvements in self-closing doors for hatchways, called "Meaker's Self-Closing Doors for Hatchways." March 5, 1874.
 3,172.—A. Muhlstein, Ottawa, Putnam county, O., U. S. Improvements on hounds for vehicles, called "Muhlstein's Best Hounds for Wagons, etc." March 5, 1874.
 3,173.—R. C. Margeson, Halifax, Halifax county, N. S. Medicine for cure of the stone, gravel, and other diseases of the urinary organs, called "Calonifuge." March 5, 1874.
 3,174.—J. A. Tupper, Ottawa, Carleton county, Ont. Improvements on washing machines, called "Tupper's Washing Machine." March 5, 1874.
 3,175.—D. Mack, Barnesville, Bourbon county, Kan., U. S. Improvements on garden cultivating implements, called "Mack's Garden Cultivating Implements." March 5, 1874.
 3,176.—G. Casey, Ottawa, Carleton county, Ont. Improvements on a machine for washing clothes, called "Casey's Improved Washer and Wringer." March 5, 1874.
 3,177.—G. J. and J. B. Wilson, Ottawa, Carleton county, Ont. Machine for washing clothes, called "Wilson's Common Sense Washer." March 5, 1874.
 3,178.—J. A. Knight, Auburn, Androscoggin county, Me., U. S. Improvements on tables, called "Knight's Improved Drawing or Writing Table." March 6, 1874.
 3,179.—T. A. Norris and C. Lockman, Hamilton, West-
 North county, Ont. Apparatus for stifling coal cin-

ders without dust, called "Norris & Lockman's Improved Coal Cinder Sifter." March 6, 1874.
 3,180.—S. F. Cowles, Coventry, Vermont, U. S. Improvement on apparatus for cooling and preserving milk, called "Cowles's Milk Preserver." March 6, 1874.
 3,181.—G. Morton, Orwell, Elgin county, Ont. Improvements on a machine for burnishing photographs, called "Morton's Improved Burnisher." March 6, 1874.
 3,182.—S. W. Emery, Portland, Cumberland county, Me., U. S. Improvements on four wheel railway cars, called "Emery's Improved Four Wheel Railway Safety Car." March 6, 1874.
 3,183.—W. R. Jolley, North Repps Rectory, Norfolk county, England. Improvements in life rafts, called "Jolley's Life Raft." March 6, 1874.
 3,184.—A. MacKay and G. Jones, Montreal, P. Q. Process for preventing and neutralizing sour beer, stout, ale, and other malted liquors, called "MacKay & Jones's Preservative and Neutralizer of Beer, Ale, Stout, and Findings." March 7, 1874.
 3,185.—Jas. Morrison, Toronto, Ont.—Improvements on check valves, called "Morrison's Combined Adjustable Check and Globe Valve." March 7, 1874.
 3,186.—Jas. Morrison, Toronto, Ont. Improvements on water gages for steam boilers, called "Morrison's Improved Adjustable Water Gage for Steam Boilers." March 7, 1874.

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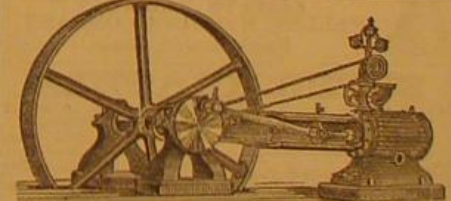
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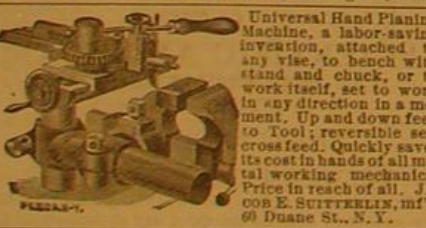
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SCIENTIFIC AMERICAN

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NEW YORK, APRIL 11, 1874.

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IMPROVED DROP HAMMER.

A volume might be written upon the hammer and its uses. The historian, if adhering to the Scriptural tradition, would doubtless begin with the labors of Tubal Cain, in the days before the flood; or, if inclined to Darwinism, with the probable efforts of our simian ancestors to break the thick envelope of the cocoon by pounding it with stones in order to reach the food within; or, if non-committal to either belief, his opening sentences would tell of the stone implements of the cave dwellers (inhabitants of the world ages ago) which now are found mingled with the bones of strange creatures long since passed from the face of the earth. Tracing the history of the hammer from the rude pestle of the barbarian, through the ages of stone and iron, up to the present day, he would find its use a necessity in every trade, its forms of infinite variety, extending from the tiny implement of the jeweler, barely a fraction of an ounce in weight, to the colossal mass of a hundred tons of solid metal, delivering its blows with almost terrific might.

It is to the worker in metals that the hammer is the most important of tools, and it may be interesting, especially in connection with the subject of this article, briefly to note the adaptations of the implement to meet the requirements of the forge. The hand sledge, swung by the powerful arms of the smith, no longer able to cope with the increasing size of the work to be fashioned, gave place to the apparatus driven by machinery.

The most ancient form of forge hammer is probably the tennant helve, known in France as the *mar-teau frontal*, a heavy mass of cast iron, lifted by projecting arms fixed in a cam ring and falling through a certain space by its own gravity. Then came the tilt hammer, which, instead of being raised at the front end, was depressed by a cam ring from a part projecting behind. Another improvement on the original tennant helve was to lift the helve between the head of the hammer and the pivots on which it works. The last innovation, and the one which has remained longest in use, is the belly helve, which is raised under the bottom part of the helve by means of a bray, which could be lengthened or shortened according to the size of the piece to be acted upon. After all appeared the steam hammers in their various forms, possessing capabilities to the future extent of which no limit can be set. With these, however, we have not now to deal; for it is our object, at present, to refer simply to efforts made to drive hammers in connection with motors, and not by the direct application of the source of power to the implements themselves. While the steam hammer is susceptible to a great variety of uses, there are circumstances under which a device of the first mentioned class may serve certain purposes with even better

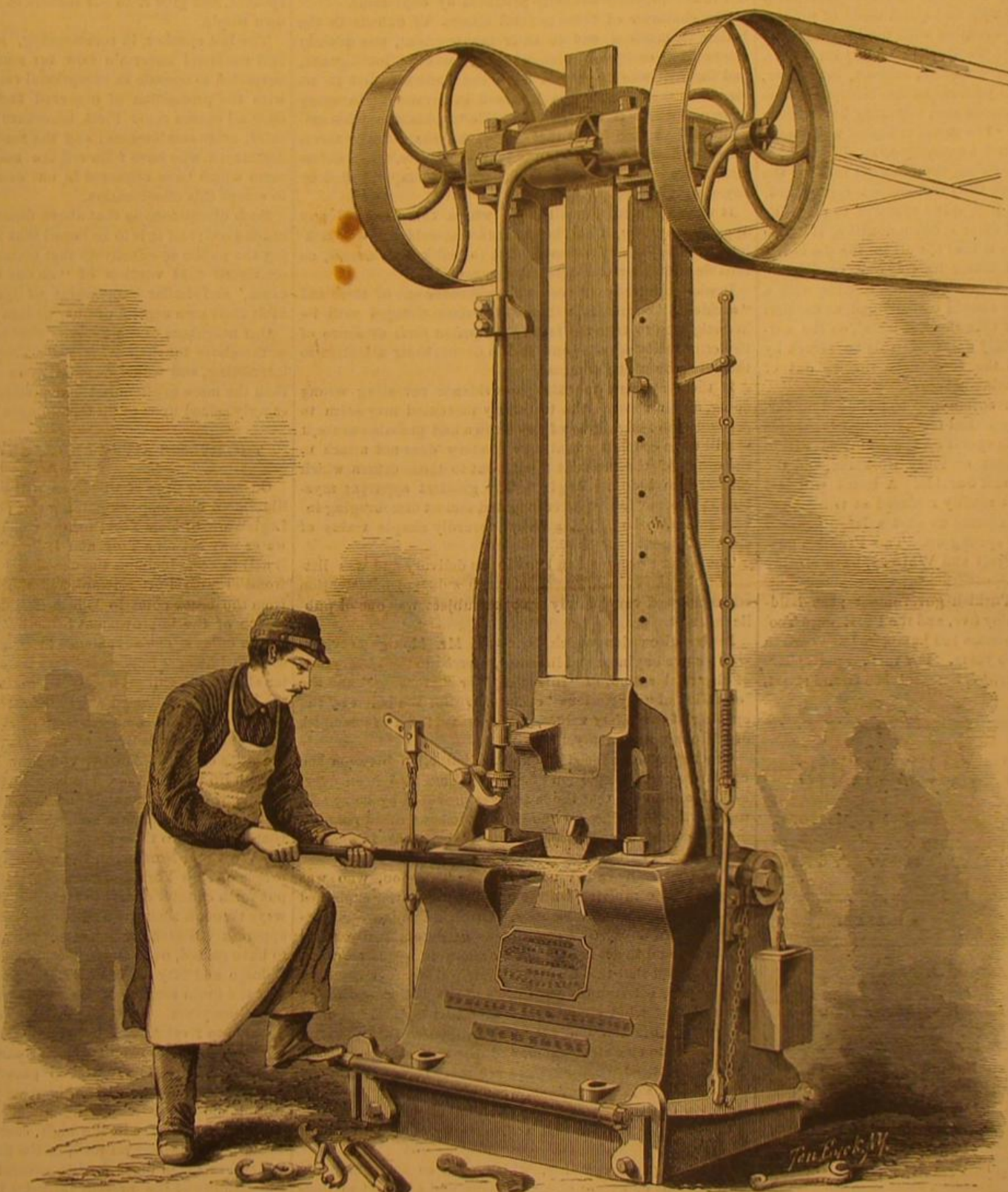
results, while in other respects the latter may be sufficiently efficient to meet all requirements. As a particular instance of this, we take occasion, in the following description, to direct attention to a new machine for the making of forgings by a single blow, by forcing the metal into suitable dies. Hammers, both hand and power, have been always used for

steam hammer, and indeed in many now employed, seem to be loss of power by gearing, trouble in regulating pressure or adapting it to work required, and the fact that the head, moving as it does in the arc of a circle, does not, on thick metal, strike a direct blow.

A glance at the engraving of the machine herewith presented will at once demonstrate that two of the disadvantages above cited are absent, namely, the complicated gearing and the indirect stroke; and the following explanation will show that the force and extent of the blow can be governed with the utmost certainty and ease.

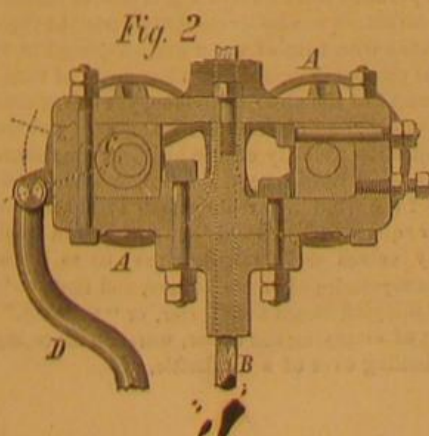
The heavy hammer head, which is constructed to weigh from 300 to 1,500 lbs., travels between two uprights and to it is attached a board of white oak or other suitable wood, which passes between two smooth friction rolls located in the upper portion of the machine. These rolls revolve in opposite directions, and each is driven by a separate pulley from one driving shaft, with cross and open belts. When they are closed together and pressed against the board, their friction upon each side of the latter raises it, and thus elevates the hammer; then, when the rolls are separated, the head is free to fall by its own gravity. The mechanism by which the operation is effected will be understood from the sectional view, Fig. 2, in which A A are the rolls, and B the board between them.

The shaft, upon which the front roll is keyed, runs in eccentric sleeves, one of which is shown at C, which are placed in stationary boxes. Hence, when these sleeves are rotated a small portion of a circle, the front roll is moved nearer to or further from the rear roll. To the arms of the sleeves is attached a drop rod, D, which connects with a lever, and the latter with a treadle. We will suppose the hammer to be at the upper portion of the frame and to rest upon the latch shown at the right. This latch, it will be seen, is adjustable, and may be pivoted at any elevation, and is connected with the treadle bar. When the workman presses the treadle down with his foot, he raises the drop bar, D, and, as is evident, at the same time pulls back the latch. Raising the drop bar causes a separation of the rolls; and the latch also being removed, the hammer, being unsupported, falls. At that instant, the blow being delivered, the operator removes his foot from the treadle, the drop rod then falls, and the eccentric sleeve turning the front roll, aided by the pull of the belt, is forced against the board, raising the hammer up again. If it be desired to give a series of heavy blows, the latch is thrown back out of operation and the hammer allowed to rise until it strikes a projection upon the drop rod; this it impinges against and rises, and so lifts the rod, causing, as we have shown, a separation of the rolls. The position of the projection on the drop rod is such that the latter will be lifted by the upper surface of the head when the hammer rests upon the latch, so that the machine may



MERRILL'S IMPROVED DROP HAMMER.

thus molding plates of metal, and one of the best known mechanical forms is the Oliver, an apparatus governed by the action of a spring pole controlled by the foot of the workman. The difficulties, however, with the large majority of the old implements in use preceding the introduction of the



and the latter with a treadle. We will suppose the hammer to be at the upper portion of the frame and to rest upon the latch shown at the right. This latch, it will be seen, is adjustable, and may be pivoted at any elevation, and is connected with the treadle bar. When the workman presses the treadle down with his foot, he raises the drop bar, D, and, as is evident, at the same time pulls back the latch. Raising the drop bar causes a separation of the rolls; and the latch also being removed, the hammer, being unsupported, falls. At that instant, the blow being delivered, the operator removes his foot from the treadle, the drop rod then falls, and the eccentric sleeve turning the front roll, aided by the pull of the belt, is forced against the board, raising the hammer up again. If it be desired to give a series of heavy blows, the latch is thrown back out of operation and the hammer allowed to rise until it strikes a projection upon the drop rod; this it impinges against and rises, and so lifts the rod, causing, as we have shown, a separation of the rolls. The position of the projection on the drop rod is such that the latter will be lifted by the upper surface of the head when the hammer rests upon the latch, so that the machine may

be left thus set, the rolls not gripping the board until the rod is lifted by the treadle. The hammer, as a moment's consideration will show, follows the motion of the foot, and blows of any degree of shortness or lightness may be delivered. It may be instantly arrested at any point of its stroke, by simply removing the foot from the treadle, and thus caused to rise without delivering its blow. In a word, the machine is under complete control of the operator and is managed with perfect facility. In order to compensate for the gradual wearing down of the plank, the movable box, in which the rear friction pulley has its bearing, is provided with two screw bolts, as shown to the right of Fig. 2. The upper of these bolts extends through the box, but the lower one, only to its outer side. After loosening the upper screw bolt, the lower one can be turned in, thus pushing the box closer up to the board. Then, by tightening the upper bolt again, the box is rigidly secured in place.

As we stated in the outset, although the apparatus is excellently suitable for any variety of forging, it is especially adapted, by reason of its quick sharp blow and the means provided of instantly catching the hammer and preventing rebound, for the making of drop forgings. The articles which can thus be formed by the aid of dies are remarkably numerous; and when this simple and quick mode of producing them is considered in connection with the labor of casting or cutting them from the metal, the economy is obvious. Numbers of articles, such as wrenches, scissors, set screws, rings, bolts, hooks, and small portions of machinery, are thus instantly and accurately stamped out, requiring but a little finishing to complete them. The metal is heated and placed in the lower die, but not in such a quantity as to fill the same. As the drop falls, the blow forces the material into all the recesses of the mold, of which the exact shape is reproduced. We would remark here that it is quite common to place the hot metal above the die and drive it down, doubling it up, so to speak. The result of this is that the air in the die is tremendously compressed and forces its way out, scoring the cast steel of the latter almost as sharply as if done with a file. Again, but a single blow should be delivered, as the first stroke usually spreads out a thin sheet of metal, on the surface of the die, which rapidly cools. If this be struck by the hammer, not only will the forging be thrown out of shape, but the die itself is liable to injury.

The uses to which this invention may be put need no further explanation, as to the practical mechanic its advantages will be clearly apparent. Its operation is simple and within the comprehension of the most ordinary workman, and the materials used are strong and durable. A board will last several months and may be readily replaced at trifling expense. The manufacturer informs us that a large demand for the machine has already sprung up. The Prussian government, through Messrs. Pratt and Whitney, have already ordered thirty machines, and others have been shipped directly to the Spanish and Turkish governments; the Baldwin Locomotive Works employ five, and the Providence Tool Company twenty-five, while some 180 hammers have been in all made during the past two years. For further particulars address Messrs. Charles Merrill & Sons, No. 556 Grand street, New York city.

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BOILER EXPLOSIONS NO MYSTERY.

We had the pleasure, recently, of listening to a lecture by Mr. McMurtrie on the subject of steam boiler explosions, delivered before the Polytechnic Club of the American Institute.

The speaker is a well known citizen of Boston, an engineer by profession, and formerly of the United States Naval Engineer Corps. He is one of the working friends of the Massa-

chusetts Institute of Technology, and is considered, by the members of his profession, to be one of its ablest representatives.

The lecturer gave a succinct and very intelligent account of the principal of the many known causes of explosions, showing that they were all very simple and very easily understood, and that the mystery of steam boiler explosions arose merely from a difficulty in determining, from the scanty and usually conflicting evidence presented, to which of the known causes the disaster should be ascribed, rather than from the existence of any mystery in the nature of the cause itself.

It was stated that, out of thousands of cases of explosions which had been examined by experts, but a limited number, which might be counted on the ends of the fingers, were still involved in uncertainty as to cause; and even in these cases, the evident difficulty was insufficiency of testimony.

Neglect of boilers which required repair, ignorance of the proper methods of management, defective safety valves and other appurtenances, and the innumerable other causes arising from gross faults in those having boilers in charge, were shown to be invariably chargeable with the terrible loss of life and property annually produced by explosions.

The character of these several classes of defects in the boilers themselves, and in their management, was plainly shown to be easily comprehended by average intelligence, and the fact was impressed upon the audience that in no case was the phenomenon involved in mystery. In every example, where it had been possible to obtain reliable evidence, it had been found that the cause was readily ascertainable; and it was also found that the cause, when determined, was perfectly simple and readily comprehended by any well informed person.

It was shown that, in all cases where there existed any apparent mystery, it had been found that evidence was lacking, and that, were the disaster due to well known causes, no reliable testimony was obtainable to reveal it.

It was therefore concluded that, whenever one of these sad "accidents" occurs, it is the duty of those charged with its investigation to take the fact to be *prima facie* evidence of the criminality of some one, and to devote their attention to the detection of the criminal.

If there appears to exist no evidence revealing wrong doing, and although the testimony presented may seem to preclude the assignment of any known and probable cause, it is still to be concluded that the mystery does not attach to the cause of the accident itself, but to those causes which conspires to hide its origin. The greatest apparent mysteries are often found, after long and almost discouraging investigation, to be explainable by absurdly simple trains of circumstances.

The lecture occupied an hour in its delivery and was listened to by the crowded audience with a degree of attention which showed very plainly that the subject was one of public interest.

In the discussion which followed, Mr. Montgomery, the well known engineer and inventor, referred to the phenomena of electrical action, of "furrowing" or "grooving" and the formation of "mysterious" cyclones within the boiler by the opening of the safety valves, and presented them as examples of still unexplained mysteries.

Other gentlemen insisted that the distinction between the bursting and the explosion of steam boilers had been overlooked, and urged that the latter was produced by some still unknown cause, since no known phenomenon could possibly be the cause of such tremendous violence as frequently characterized explosions.

The chairman called up Professor Thurston, who was present, and, complying with the request, the latter explained the several apparent mysteries. Electrical action was considered to be a cause of some cases of exceptionally rapid corrosion, and to act in a greater or less degree in all cases. It was stated that the slightest difference, whether chemical or physical, between different parts of the boiler, causes the formation of what electricians call "local circuits" and the acceleration of oxidation. It is even supposed that all corrosion is due to electrical action, and the less rapid oxidation (which is noticed when surfaces are most perfectly uniform in character, as, for example, when zinc is amalgamated) is simply a consequence of the reduction of voltaic action by lessening the number and the intensity of action of local circuits.

Furrowing and grooving, which occur so frequently and to so serious an extent along the laps, and adjacent to lines of exceptional stiffness throughout the shell of locomotive and other boilers, was shown to be the evident result of long continued and frequently repeated bending (along lines of weakness where the action is concentrated by the stiffness of the adjacent seam), this change of form being a consequence of the continually occurring variations of pressure and temperature of steam and changes in the water level, which naturally produce considerable alteration in the shape of so flexible a structure as a boiler shell of quarter or three eighths metal, loaded with tons of water and subjected to variations of internal pressure amounting to hundreds of tons.

A statement of the almost obvious, yet seldom recognized, fact that steam, issuing from an open safety valve, possesses ten times the velocity of the heaviest hurricanes known among the West Indies or in the Chinese seas, and that the pressure of the wind in a real cyclone is but a fraction of a pound per square inch, showed that cyclones in a boiler, when the safety valves were raised, were not to be catalogued among the mysteries of steam boilers, and that the "entrainment" of mingled steam and water, or "priming," even to the extent of emptying the boiler, were no more mysterious than the boiling over of a tea kettle.

The apparently mysterious phenomenon which the French call a "detonating explosion," with its fearful power and disastrous effects, was shown to be perfectly free from all mystery by a simple calculation of the amount of energy pent up in the steam boiler which was exploded by Mr. F. B. Stevens at Sandy Hook. Had it all been expended in raising the whole boiler directly upward, without waste in other directions, this confined force would have raised the mass to the tremendous height of five miles. The mystery, if any exists, is therefore that such explosions are not usually far more terrible than they actually are.

Finally, a short explanation was given of the nature of the "internal strain," as it is called, which is so common a cause of weakness in large masses of cast iron, and which seriously affects large pieces of steel, and even of malleable iron. The bearing of the recent discoveries and investigations of the speaker upon the existing theory of rupture was briefly given, and the conclusion was drawn that the greatest care should be taken to select the purest and most ductile irons, wherever changes of form and dimensions, such as had been described, were to be met. We have obtained a short description of the process of rupture, as it was given by the speaker, and give it to our readers in another column in his own words.

The last speaker, in commencing, stated that, although it still remained uncertain how far some causes, which were suspected to operate in exceptional cases, were to be credited with the production of observed facts, he was inclined to class all causes thus: First, ignorance; second, carelessness; third, utter recklessness; and the readers of the SCIENTIFIC AMERICAN who have followed the many discussions of such cases which have appeared in our columns will be very apt to accept this classification.

Such discussions as that above described cannot fail to do much good; and it is to be hoped that they will aid in educating the public so effectively that coroners' juries will become convinced that verdicts of "no one to blame," "unknown cause," and similar expressions of ignorance, will only exhibit their own neglect of duty or lack of intelligence.

Our neighbors of the *Tribune* should secure such lectures as the above for their "extras." They would be hardly less interesting, and would be even more useful to the world, than the more brilliant but less practical essays which are so eagerly seized upon to fill those pages.

THE HUDSON RIVER AND LAKE CHAMPLAIN SHIP CANAL.

On another page of this issue will be found a description, illustrated by a map, explaining the scheme now before the Legislature of New York, for the construction of a navigable water way between Troy and Lake Champlain. The work, it will be seen, includes the deepening of the Hudson River from Troy to Fort Edward, and the excavation of a canal from the latter point to White Hall on the lake, the entire length of the improvement being but sixty-three and three tenths miles. The advantages to be gained by the work are of such immense importance that its cost is rendered a matter almost insignificant. By an outlay of a sum which at the highest is estimated at \$10,000,000, water communication from the Missouri and Mississippi rivers, and from all the ports and navigable inlets of the great lakes, to tide water at the cities of Troy, Albany, and New York, for vessels of a burden up to 2,000 tons, is to be secured.

In view of the strenuous endeavors which are being made by Boston, Philadelphia, and other cities of the Atlantic sea board to bring to their markets the enormous commerce of the West and Northwest, the necessity which exists for the people of New York, and more especially of the metropolis, to put forth counter efforts to maintain the most feasible highways through their own State is becoming more and more apparent. Boston, by her recent railroad connections, claims to have gained, over the Erie canal, six days in time from Chicago and fifty per cent of transportation; while it is a fact that the grain receipts of the city have trebled during the past three years. Burlington within ten years has risen to a position to rival Albany in her great lumber trade. On the other hand, the Controller of this State in a late report shows that New York does not keep pace with the commerce of the West, and that the ratio of increase of tonnage is far from what it should be.

We need not refer to the high cost of transportation of western produce per railroad, or the immense waste of crops, which has taken place during several years past, owing to the inability of the present facilities to carry off the excess. No facts, we believe, are more generally understood. Hence it is certain that, not as a rival, but as an addition, to the Erie canal and other great highways now taxed beyond their limit, some other grand outlet must be opened. We cannot have too many such and that their construction will be forced by the constantly increasing amount of western productions which must find markets in the East, we believe to be only a question of time: while the State first in the field to offer the best facilities will find, in the great consequent augmentation of its commerce and revenues, the richest rewards for its enterprise.

The work contemplated, in the bill before the Legislature, is nothing, either in point of labor, time, and expense, beside the construction of the Erie canal. It could be entirely completed, it is stated, within four years; and estimating the transportation carried over it for the next twenty years at five million tons per annum, a toll of forty cents per ton would within a decade repay its entire cost. The latter is within the means of many individual citizens of the State, and when distributed by taxation would be scarcely felt. It is small enough for the merchants of New York city to raise it by subscription, a project which appears worthy of considera-

on, if another session of the Legislature pass by and no provision be made for initiating operations.

We would bespeak for the details of the plan, which we take from the able speech of Hon. Smith M. Weed, member of assembly from Clinton county, N. Y., the careful examination of all our readers. It is certain that no great work of internal improvement is now contemplated which is of more pressing importance, not merely to the metropolis or the State of New York, but to the vast section of the country whose commercial needs it must so materially meet.

CHAMELEONS.

There is a curious little lizard, the name of which is so coupled with fable that many believe it has never even existed. We mean the chameleon, which, though never seen on this continent, abounds in the old world. It is generally imagined that the reptile is capable of changing its color at will to the brightest of rainbow hues, and there is a wide spread popular belief that it lives on air, both of which ideas, though naturally arising from the peculiar appearance and habits of the animal, are far from the truth. Some years since, we captured a pair of these lizards among some ruins in Asia Minor; and for the three months during which they lived very comfortably in a wooden birdcage, we were enabled to study their strange peculiarities, and notably the phenomena for which M. Paul Bert, a member of the French Biological Society, has recently suggested some interesting explanations, which to us seem more in accordance with appearances than any yet adduced. The chameleon measures from five to eight inches in length and has a curious pyramidal shaped head, apparently separated from the neck. Its body is short and thick and ends in a prehensile tail of medium length. The ears are concealed under the skin, the mouth is large, and the eyes, which are very prominent and full, are closely covered by a circular lid in which is a small round perforation just in front of the pupil. The legs are long and slender, and terminate in a hand formed of five toes, divided into two bundles so as to resemble one broad finger and a thumb. By the aid of these members, and by winding their tails around the branches, the lizards climb about shrubs and trees in search of insects. Their motions are, however, very slow, and their habits sluggish in the extreme. They will cling to bars of their cages for days at a time, giving not the slightest sign of life, except perhaps the occasional twinkle of one eye. Handling them does not seem to disturb their equanimity, as they rarely struggle as long as they are permitted to cling to a finger, while they are perfectly harmless.

The strange peculiarity of the animal, however, is its faculty of changing its color, not in bright tints, but from a pale gray to light green, yellow, brown, reddish and violet shades, all, however, dusky and undecided. These changes sometimes occur very rapidly and are apparently provoked by anger and fear. In handling the lizard, we have noticed that, although it would, as we have already intimated, show no symptom of uneasiness, the clear light tint which covered its whole body would give place to dark brown blotches, some of which shaded curiously into black, resembling in form the spots of a leopard. The cause of the phenomenon has generally been considered to be soft granules, under the skin and of different colors, which are more or less extended according to the quantity of blood which reaches them; but the recent investigations of M. Bert show clearly that the nervous system acts directly without the intermediation of the blood. If the arteries of a member be tied so that no blood can pass, and the nerve affected, the colorations still continue; while on the other hand, if the nerve be destroyed, the tissues assume a black tint from which they do not change. It is very probable that the nerves thus acting are of the same order as the vaso-motors; for when the animal is poisoned by curare, and the other nerves are consequently paralyzed in their functions, it at once becomes black. If the sciatic nerve be electrified in a thickness at which the nerves of color should exist, the muscles do not contract but the tint of the member changes, proving that the current acts separately on the color nerves. The action of the latter also persists exactly as does that of the vaso-motors in spite of the curare poison. The microscope shows tubercles beneath the skin, which become differently colored through the singular bodies, of which they are composed, contracting or expanding as governed by the nerves.

Another curious feature of the chameleon is the independence of its eyes. It moves them separately; and when the animal sleeps, it seems as if but one half of it were awakened at a time. If a light be placed before one eye, the half of the corresponding side of the body becomes of a different color from the other side; but the tint becomes uniform all over when the light is carried before the other organ. It would seem from this that the reptile has two distinct luminous perceptions.

So sluggish a creature, it might be supposed, would be hardly suited for catching insects, and such indeed would be the case were chasing the latter the only way of entrapping them. The chameleon, however, resorts to strategy, and grabs its prey from a distance over which the unsuspecting fly or bug hardly deems it possible that its enemy can reach. The lizard's mode of seizing the insect is not only peculiar but also gives further proof of the dull nature of its perception. It never uses but one eye, and, while its body is perfectly motionless, will follow the movements of its prey with intense attention until it comes within about three inches of its nose; and then a tongue will dart out, more like a streak of pink lightning than anything else, strike the insect, and carry it back into the mouth. This tongue, which is out of all proportion to the size of the animal (sometimes twice its entire length), is a hollow tube terminated by a fleshy knob

which has a cup-like cavity on its anterior surface, always covered with a viscid fluid. It shoots out a perfectly straight rod, and strikes the insect with unerring accuracy.

M. Bert, who has dissected the operating mechanism, says that the tongue is squeezed out, just as a cherry stone can be forced out by pressing the fruit between the fingers. Strong bands of muscles, surrounding the tongue, serve to apply the necessary pressure.

THE BEHAVIOR OF METALS UNDER STRAIN.

BY PROFESSOR R. H. THURSTON.

The resistance of metal to rupture is dependent upon two conditions: the first is the magnitude of cohesive force; the second is the homogeneity of the material.

A metal is homogeneous in composition when all portions exhibit the same chemical constitution; it is homogeneous in structure when all parts exhibit the same arrangement of particles; it is homogeneous as to strain when all portions exhibit the same degree of what is called "internal strain."

This internal strain is produced whenever particles are given positions which are not those of equilibrium, and, consequently, such that they exert greater or less force to change their relations with surrounding molecules. The character, and the occasionally serious amount, of this kind of strain is exhibited by the weakness of large masses of metal, whether cast or forged, which is so frequently observed. Every one who has seen much of large work has known instances in which castings have cracked while cooling in the mold, and every pattern maker and every molder understands the necessity of making allowance for "shrink," and the advisability of avoiding the combination of thick with thin parts in the same piece of casting.

In brass and bronze castings, the difficulty is less than with cast iron, and in iron forgings the difficulty is still less. This condition does, however, sometimes exist to a serious degree, even in wrought iron when worked in large masses; and the steel rods, several inches in diameter, which it was attempted to make some time ago for one of our great bridges, were found in some cases to possess but a fraction of the strength, per square inch of section, which the same metal exhibited when cut into small pieces.

It follows, therefore, that to secure the most reliable metal for purposes of construction, uniformity in composition and structure and freedom from liability to internal strain must be secured, if possible, as well as high cohesive strength.

It is, however, usually impossible to avoid the presence of internal strain, since artificially produced materials, like the metals, cannot be given form except by external force. It becomes important, therefore, to study the character, the effects, and the means of relieving or avoiding internal strain in order that we may know where to look for it, and how to prevent difficulties consequent upon its existence.

The existence of internal strain in castings has been long well known, and the large masses of cast iron frequently produced in every foundry are always either very slowly cooled in order that uniform contraction and solidification throughout shall prevent dangerous strain occurring, or they are carefully annealed, or they are artificially cooled—as in making the Rodman gun, for example—in such a manner that the strain which may occur shall be of actual service by aiding in resistance of external forces.

The extent to which wrought iron may be weakened by internal strain, and the behavior of the various qualities as affected by its presence have only recently attracted much attention from engineers.

A somewhat extended experimental research, made by the writer, has resulted in the discovery of some interesting facts and leads to some useful deductions. The limits of a short article like this forbid such an extended account of these investigations, as is given at length in more purely technical journals; and a mere *resumé* of the work and of the conclusions derived from it must suffice.

It was found that all metals exhibited the presence of more or less of this cause of weakness, the harder varieties being most seriously affected, and the ductile and soft kinds showing it least. The same grade of metal was found to contain an amount of internal strain, which varied according to the treatment to which it had been subjected during, or subsequent to, its manufacture.

The harder kinds of iron were capable of taking up additional strain when subjected to the process which produces hardening in steel, and all grades were found to lose it by the operation of annealing. The harder metals were found to be more liable to injury, by reduction of their ultimate strength in consequence of the presence of internal strain, than were soft varieties.

It was found that internal strains could be modified by external forces, and that this fact has a most important influence upon the behavior of the metals, and consequently, upon their availability for purposes of construction.

It has already been stated in the SCIENTIFIC AMERICAN that the discovery was some time ago made that a piece of iron or steel, left for some time under a load, acquired an increased power of resisting further change of form. It has become very evident, as further experiments have been made in studying this remarkable action, that this is the effect of the gradual relief of pre-existing internal strain. It is unobservable in bodies free from such strain, and is noticed in cases where internal strain exists, sometimes producing a very large variation of resistance.

This relief occurs by the "flow" of particles, as it has been called, a well known property of solid bodies subjected

to great force, and which is best illustrated by the process of "squirting" lead pipe, and less strikingly whenever metals are worked in the rolls or under the hammer.

A piece of metal being placed under the action of external force, some of its lines of particles are more strained than others, and the mass does not resist change of form or ultimate fracture with its maximum power. Its forces are overcome in detachments. Left under a load not capable of breaking it, however, the particles are gradually shifted by the applied force and "flow" into new positions with a rapidity which is greater as the material is more ductile. The available forces of cohesion are now combined, and, pulling together, can offer more resistance than at first.

After this fact had been discovered and its probable cause had been ascertained, it was considered very likely that the converse might be true, and that rapid change of form and sudden rupture might be less resisted than a slow action. Experiment promptly proved the correctness of the conjecture, and it was found that a very serious loss of resistance frequently took place under such sudden strains as those produced by blows. The second discovery, which had been made by Kirkaldy* at an earlier date, although apparently not accepted by the profession on account of the possible action of inertia in his experiments, is even more important than the first, since it shows that structures and machinery exposed to shock are not as safe as they have been supposed, although the first described effect of internal strain would appear to produce an increase of resistance to static forces.

Dead loads can therefore be sustained with greater safety than had been previously supposed, while with live loads the contrary is the fact.

It would seem that rapid change of form introduces internal strain more rapidly than it can be relieved, and thus weakens the metal, while very slow alteration permits a certain amount of "flow" and relief of strain, and gives a higher strength in consequence.

The effect of relief of internal strain was discovered nearly forty years ago by Professor Johnson, while conducting the Franklin Institute experiments on the causes of boiler explosions. He does not, however, seem to have suspected the cause, and speaks of the phenomenon as "anomalous." He relieved internal strain by what he called "thermo-tension," heating the metal to a high temperature, applying a heavy load, and allowing it to cool under tension. He states the amount at about 15 per cent for Salisbury iron, and 20 per cent for some specimens of Tredegar. It would appear that we find here the secret of the exceptional behavior of wrought iron, in exhibiting a gain of strength at high temperatures.

From this fact, and from the experiments of the writer, the inference has been drawn that, the more ductile the material, the more readily and completely may internal strain be relieved, and the safer is the material against shock.

I conclude also, that parts should always, if possible, be so proportioned that all parts shall stretch uniformly if liable to accidental injury, in order that the reduction of strength, due to rapid distortion, may not weaken it on several lines of strain successively, and produce rupture by thus taking the parts at a disadvantage.

Where parts are liable to injury by shock, they should also be slightly thickened up near the part exposed to the blow.

In selecting material for constructions peculiarly exposed to injury by shock, we see that it is particularly necessary to obtain pure and ductile iron.

For structures like steam boilers, which are continually changing form with variations of temperature and pressure, it is even more necessary to select the best of iron.

STEVENS INSTITUTE OF TECHNOLOGY, March, 1874.

SCIENTIFIC AND PRACTICAL INFORMATION.

RAISING WRECKS.

In raising sunken vessels, it has been common to use flexible airtight bags, which, when properly secured to the vessel, are inflated with air by pumps. A recent improvement, by Mr. Sowerbutts, of England, consists in supplying acid and alkali to the bags, which, on being mixed, generate carbonic acid within the bags and produce the necessary inflation, no air pumping being necessary.

NEW APPARATUS FOR REGISTERING THE DIRECTION OF CLOUDS.

M. de Parville proposes for this purpose a board some 12 inches long by 8 inches broad, fixed on a suitable support. A square of unpolished glass, placed vertically, divides the plane in two equal parts. The left hand side of the latter is covered with a mirror; on the right is a sheet of paper. As the clouds pass above the horizontal glass, they are reflected; and at the same time the observer sees their images on the vertical glass projected on the paper. It is only necessary to trace their direction on the latter with a pencil. On the mirror is engraved a compass card, which is also reproduced on the paper, and a small magnetic needle is suitably arranged so as to adjust the apparatus.

THE WASTE OF COTTON SEED.

Mr. Alkin, of South Carolina, says that the loss by neglecting to save cotton seed is immense; piles of seed are allowed to decompose and waste at nearly every gin house, and yet the seed is a valuable manure. For cultivated crops, 30 bushels of cotton seed in the drill, or 50 bushels broadcast, to the acre will increase the crop considerably. Seed can be rotted by composting it in alternate layers of leaves, straw, and stable manure; 100 bushels of green cotton seed, mixed in bulk with a ton of soluble phosphate and allowed to remain a fortnight, will make a capital compost for 10 acres of any cultivated crop.

* Experiments on Strength of Iron and Steel.

* See current volumes of Trans. Am. Soc. C. E. and Journal Franklin Institute.
† See Trans. Am. Soc. C. E., Vol. II, p. 330. Journal Franklin Inst., March 1874, pp. 150, 151.

THE LIGHTNING SCREW PLATE.

The chief feature of the invention represented in the annexed engravings, to which the reader's attention may be first directed, is that the die does its work in a single cut, thus forming the screw thread at once, instead of by several trials, as is the case with the implement in ordinary use. In order to compensate for wear, the die is capable of proper adjustment, so that it is claimed to keep its size with accuracy until used up, or over a long period of constant employment.

The complete tool is represented in Fig. 1. A is the die, which is secured in a suitable collet, B, which, in turn, is held by the set screw, C, in the plate. A $\frac{1}{4}$ inch die, that being the largest size, is represented as secured in the latter, and below are shown the remaining six sizes of dies with their corresponding taps, namely, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, $\frac{1}{128}$, and $\frac{1}{256}$ inch, all of which are supplied with the tool.

In the sectional view, Fig. 2, the construction of the die and its mode of adjustment are depicted. D are taper headed screws, which spread the die when driven in, while the screws, E, serve to close the parts of the latter together from the sides. The taper screws govern the size of the cut; and after they are regulated, the binding screws hold the portions firmly in place.

It is claimed that this invention will accomplish five times the work possible with any other screw plate. The threads are cut neatly and sharply into the bolts, and not, as is frequently the case with the common tool, jammed out of the iron so as to raise the threaded portion above the normal surface, thus impairing the accuracy and regularity of the operation. The dies allow of nuts and bolts for different purposes being made to fit together tightly or loosely, as desired. When worn out they can be replaced, the plate and collets remaining good. The articles threaded need not be matched and kept together, as they always correspond without being tried or fitted. The collets holding the dies have guides, as shown at F, Fig. 2, for starting bolts true, though, when it is desirable to cut close under the heads of the latter, the face side is used. The design of the plate combines ample strength with remarkable lightness; and in quality, style, and finish, the device appears to be an excellent tool.

For further particulars address Messrs. Wiley & Russell, Greenfield, Mass.

THE GRASS EATING FISH.

Nature makes no leaps; on the contrary, she appears to fill up, by design, the gaps which appear to exist between each parallel series of beings. Numerous examples exist, or have existed, of these odd connecting links; the Australian ornithorincus, a quadruped with a bird's beak; the apteryx, a bird with hair and no wings; the pterodactyl, or winged lizard of antiquity; the fossil turtles, with teeth, found in the Cape diamond diggings—are illustrations in point, and still another is found in the queer fish represented in our engraving. It is called the *ceratodus Forskeri*, and is allied to the fishes through the *lepidosiren*, a singular animal found in the streams and ditches near Bahia, Brazil. The *lepidosiren* is popularly termed the caracurus, and is known by its odd shaped, elongated body, covered with scales, appearing to terminate in a fish's tail, while its means of locomotion consist in four fins located underneath. French naturalists have placed this animal in a distinct class of amphibious reptiles. Owen, on the other hand, pronounces it a fish, and the connecting link between fishes and reptiles.

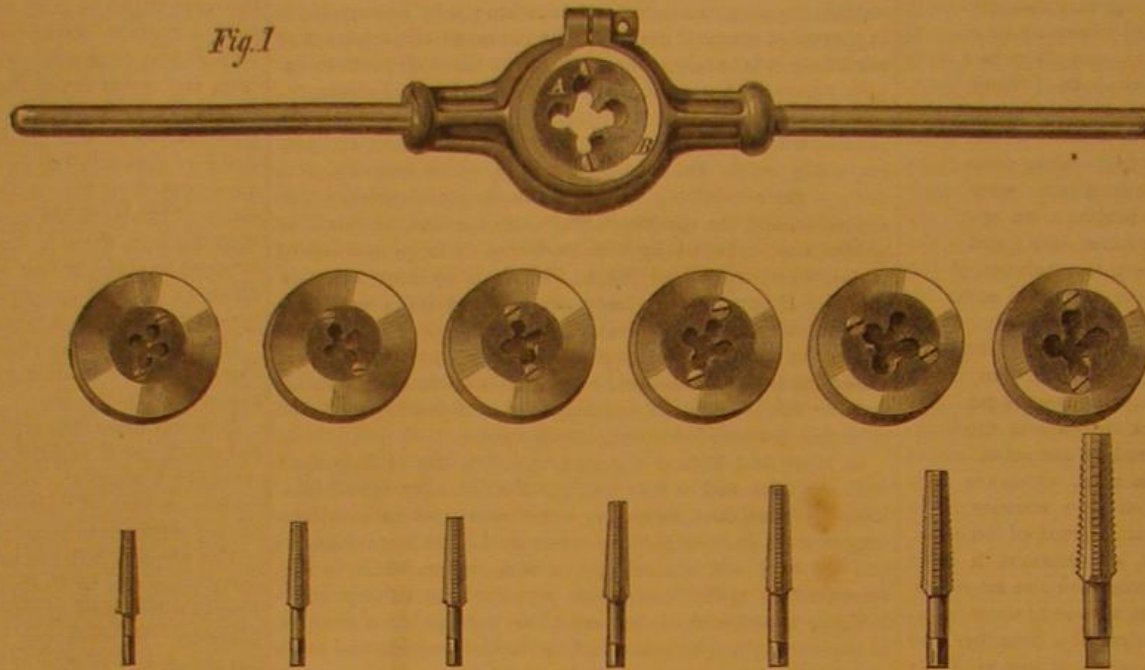
The discovery of the *ceratodus*, however, adduces an even closer connection between the two families. The genus was established by Agassiz, who found the fossil teeth and jaw bones of the animal in the jurassic and triassic formations of many parts of Europe. It was supposed that, save in these ancient remains, the creature did not exist, until a few years since, when living specimens were found in the rivers of northern Australia, exactly corresponding to the fragmentary relics.

In the annexed engraving is represented the appearance of the living fish and also of the skeleton. Its length is about 38 inches, and its diameter 7 inches. Its habits are as peculiar as its form. Although living in the rivers, it rarely ascends above the brackish water, and finds its sustenance in the vegetation which, growing in shallow places, is left uncovered by the ebb of the tide. At night the fish leaves the water, crawling in among the plants and feeding. The quantity of nourishment it needs is enormous, and it is said that the amount of half-digested myrtaceous and graminaceous foliage found in its intestines is out of all proportion to the

apparent requirements of the animal. In order to pursue its habits, it is evident that air-breathing apparatus must be present in the organization, and such is the case. Its gills are a sort of porous lung, of very complicated construction, having ramifications which expand into cavities filled with a coagulum, the function of which has not been definitely determined.

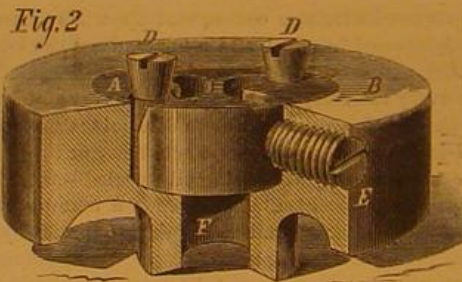
Inventors' Mistakes.

Inventors are too liable to think that upon the granting of their patents success is certain, which it would be if they would display as much business tact as they have done inventive ability. Upon the granting of a patent the inventor thinks his "future made" and thereupon sits down,



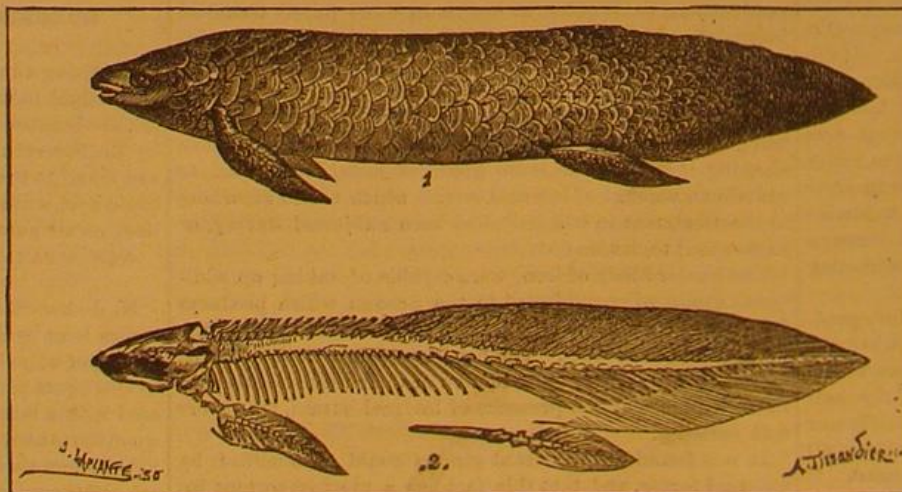
THE LIGHTNING SCREW PLATE.

waiting for the dollars to come without any effort on his part to induce a flow of coin into his treasury. After a season of such inactivity, with poverty finally staring him in the face, he parts with his patent for a small sum to a shrewd business man, who places the matter before the public in a business-like way, advertises it in mediums through which it reaches the attention of all in need of that particular invention,



eventually creating for it a large demand, and bringing a correspondingly large revenue to the advertiser.

The day has passed when people having any desirable thing to sell may expect to reap success by waiting for the public to seek them out. At the present day, every important branch of manufacture has its own special organ; if an inventor has



THE GRASS EATING FISH.

anything to sell which is worth buying, the attention of purchasers is expected to be called to the fact through such publications, as well as through the mailing of circulars, etc. A large proportion of the patents granted are for inventions of real merit, and of value to the public, and inventors and the public are alike sufferers for this very want of business tact on the part of inventors, who should, immediately upon the issuing of the patent, have it properly engraved and published in such journals as reach readers who require the use of such particular inventions. "Masterly inactivity" has ruined many an inventor who might otherwise have been to-day in the possession of a fortune.—*Newark (N. J.) Manufacturer.*

No pillar or support of brick or stone should ever exceed in height twelve times its least thickness at its base.

Hints on House Papering.

This is the season, among good housewives, for cleaning, whitewashing, painting, papering, and otherwise renovating the domicile.

After the cleaning, whitewashing, and painting is accomplished, comes the process of papering the walls; but the first thing, frequently, to be done is the removal of the old paper. To do this successfully, wet the wall thoroughly; and, when well soaked, the old paper can be stripped off very quickly. After the paper is removed, wash the wall to get off all the particles of paper which may remain, and leave the walls till nearly dry before commencing to lay the new paper. If the walls have been whitewashed instead of papered, wash the walls with vinegar, which will make the paste and paper adhere more securely. A bench is easily made for measuring and cutting the paper, by placing boards of suitable length across two flour barrels. The paper should be unrolled and cut to proper length and in sufficient quantity to cover the room, before the pasting process commences. These sheets should be laid one over the other, to be readily at hand when the paster is ready to begin work. The liability of turning the edges or damaging the paper will be greatly obviated by adopting this course. Flour paste is the usual article for the purpose, and rye flour is considered better than wheat, as it has more adhesion. Mix the flour in cold water thoroughly, by stirring, until the paste has a thin creamy consistence, and then boil, when it will thicken, according to the length of time it is submitted to the heat. If found too thick in cooling, add boiling water till the desired degree of thick-

ness is obtained; then add a little carbolic acid to prevent the paste from souring or becoming moldy. A broad white wash brush is the best to apply the paste with, and the paper should be laid quickly after pasting, to prevent its becoming soft and tender to handle.

Two persons are required to lay on paper with rapidity, one to paste and one to apply the paper. When the paper is pasted it should be handed to the person on the ladder, who holds it about a foot from the top end, and lays it evenly against the wall at the top, allowing the upper end to hang over on the backs of the hands. By looking down the wall, it may be seen when it matches the previously laid length; and after adjusting to match, it should then be brought gently to the wall, the backs of the hands then pressed against the wall and passed upwards towards the ceiling, spreading them out towards the corners of the length of paper. The scissors are then run along at the juncture of the wall and ceiling, making a mark which can be easily seen, when the top of the paper is removed for a little distance, and it is cut off even and replaced. Then a soft cloth is gently passed downwards and the paper pressed against the wall to the bottom, where it is cut off as at the top.

Iron Electrotypes.

A brief item on this subject appeared in a former issue of the *Journal*, to which we may now add the additional declaration that M. Klein, a Russian chemist, has succeeded in obtaining very satisfactory results from a series of experiments in this direction.

The process followed by him is described as follows: The bath employed consists of a concentrated solution of sulphate of iron and ammonia, and the battery of four Meidinger cells. For an anode, an iron plate is used, with a surface about eight times that of the cathode; and connecting this with a copper plate, a perfect coating of iron is obtained. On leaving the bath, the iron, it is said, is as hard as tempered steel, and very brittle. When heated, however, to a cherry red, it is said to become malleable, and may then be engraved as easily as soft steel.—*Journal of the Franklin Institute.*

[Our readers will find a full account of M. Klein's process, above alluded to, for the production of iron electrotypes, in the *Scientific American* of November 18, 1868. The invention was patented in this country by M. Klein, of St. Petersburg, Russia, September 29, 1868. The Hon. Cassius M. Clay, then United States Minister to Russia, brought home some examples of the new process, consisting of iron electrotype plates for printing, being copies of engraved copper plates. These examples were very perfect. They were for some time on exhibition in this office and were noticed in this paper November 27, 1869, a full account of the process being then also given.—EDS.]

The Choctaws and Cherokees of Indian Territory raised 5,000 bales of cotton last season, more than twice as much as the crop of 1872. Most of it went to the St. Louis market.

SELF-ACTING FLOOD PIPES FOR BUILDINGS.

We herewith publish engravings of a device, designed by Mr. Stewart Harrison, of London, England, for the purpose of automatically flooding with water the interior of a building attacked by fire. It is exceedingly simple, and its operation may be understood at a glance.

The self-acting preserver valve (Figs. 1 and 2) is so constructed that the valve is held in its seating, so as to prevent the efflux of water, only by a conical brass plug, carrying the stem or spindle of the valve, and retained in position within a suitable conical recess or seat by an annular wedge of fusible metal. Between the valve and the plug there is a perforated hollow spheroid, which acts like a rose, to distribute the water when issuing under pressure on all sides; and this rose and the plug beneath it necessarily project downwards below the ceiling, for obvious reasons, the supply pipes being affixed by holdfasts to the joists above. Then, in case of a fire occurring by accident, generating flames and elevating the temperature, so soon as the boiling point of water is attained the fusible plug melts, the plug drops out, the valve falls, and water in continuous streams is at once discharged upon the fire and flame, extinguishing them before they can spread or gather strength so as to become uncontrollable; in fact, the fire is the immediate agent and exciting cause of its own destruction.

So far it is clear there is nothing out of the way or impracticable in the scheme; nothing involving any departure from existing practice, as in the case of gas and water pipes, bell wires, speaking tubes, and the like; of which, indeed, it is the corollary and extension. But it obviously involves the absolute existence of a constant public water supply, at high pressure, accessible and available; or, in default thereof, of adequate storage of water in cisterns, of sufficient dimensions, suitably placed, to give the requisite supply and pressure. It is obvious also that some expedient in adaptation to the circumstances of a frost, by saline ingredients and due circulation, would be advantageous or necessary.

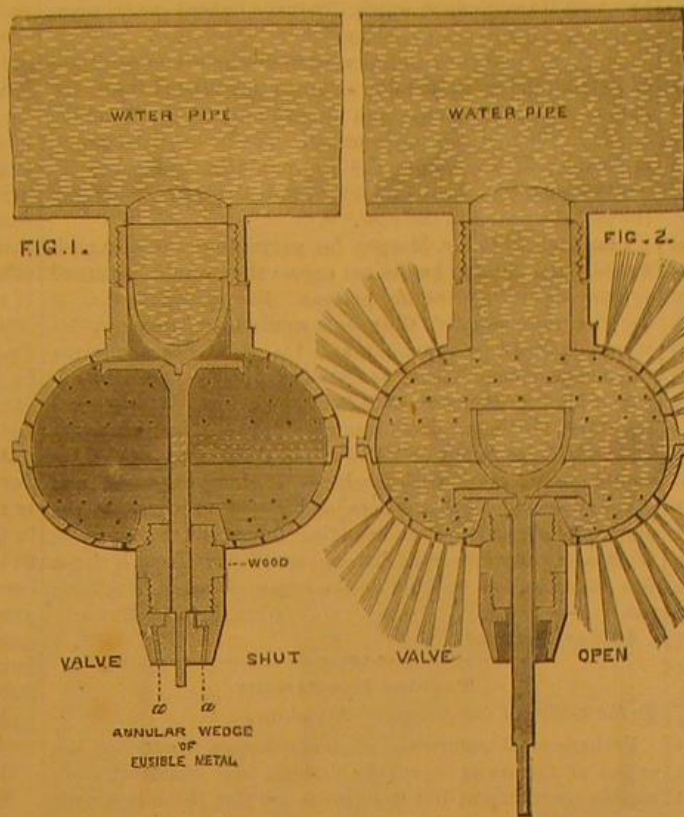
Individuals of an inquiring turn of mind may speculate upon the case of a fire breaking out at night, and being thus extinguished, of necessity without being discovered; when, of course, the water would continue to flow, to the serious injury of furniture, goods, merchandize, etc. Without entering on the discussion as to which of the two evils, excess of fire or water, be the least, it will suffice to remark that Mr. Stewart Harrison has at least not neglected this aspect of the case. He provides for the difficulty (says *Iron*, to which we are indebted for the engravings) by a very simple contrivance, the adoption of an arrangement to give warning of the occurrence of a nascent fire, by the flow of water being made to depress a piston, releasing and setting in action a suitable alarm on the premises; which, by the very simple aid of making a connection with a galvanic battery, and completing a circuit, might, if required, be made to ring an alarm bell situated anywhere, these alarms continuing until attention is aroused, and enforcing the active agency of a human being to turn off the water and stop the flow and the alarm simultaneously.

LESLEY'S ZERO REFRIGERATOR.

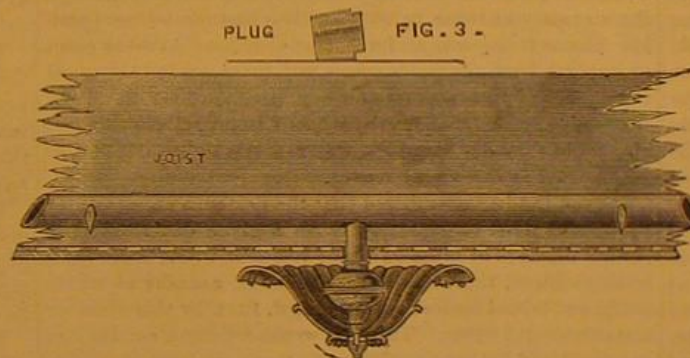
We remember reading, some time ago, a queer story—very much on a par with the veracious recitals of Baron Munchausen—about a party of hunters in the arctic regions, who, while pursuing the chase, suddenly discovered two strange objects protruding through the frozen soil. Closer examination proved the articles to be nothing more or less than a pair of boots, and a still more rigid scrutiny indicated the fact that said boots contained legs. Setting to work with axe and pick, the hunters proceeded to dig out the balance of the body, and finally uniced a remarkable individual, dressed in the garb of centuries back, and, of course, frozen stiff. The story goes on to tell how, while they were debating as to the disposition to be made of the odd discovery, they left the body by the camp fire, where it thawed, and its owner, to their astonishment, signalized his return to existence by a howl for brandy. Then the romancer recounts the yarn, which the resuscitated ancient tells his deliverers, of life a few hundred years back, and how he became frozen in the ice and had slept a Rip Van Winkle sleep, preserved by the intense cold. The sequel is that the old gentleman tells entirely too many stories, and becomes a bore, whereupon the afflicted hunters suggest that he is sufficiently indurated to cold to sleep out of doors. He does so, and again freezes stiff, in which condition the party very gladly leave him to his fate. While the return to life of an individual who had been frozen several centuries is rather without the bounds of probability, the fact of his keeping that length of time is not. In the frozen earth of Northern Siberia, the bodies of mastodons, still covered with flesh and skin, have been found in a state of such preservation as to furnish food to living animals—a circumstance which doubtless, in some way, gave rise to the foregoing story; and, in general, it is a well known fact that, in organic substances, when kept at a cold temperature, decomposition is arrested. If, in addition to cold, the atmosphere be both dry and uniform in temperature, decay may be prevented by artificial means for an indefinite length of time.

The necessity of securing, as complete as possible a freedom from humidity in the air, of receptacles in which meats and vegetables are to be preserved, is a point of importance which deserves to be widely understood. In some climates,

as in South American countries, parts of Texas and California, and in special localities where a naturally dry atmosphere prevails, articles of food are kept without the aid of the refrigerator and with little trouble. Generally, however, in the climate of the United States, moisture is present, a circumstance plainly exhibiting itself by the condensation on the cold surface of pitchers containing ice water in summer, or on the exterior of the window panes of warm rooms



in winter. Hence, it must be one of the principal objects of a refrigerator, which imitates the action of Nature, to keep its contained air in as dry a state as possible. This manifestly cannot be done if meat, vegetables, milk, butter, and other substances are all packed in a single compartment with the ice.



Professor Loomis points out that if moisture is present, no temperature greater than the freezing point can wholly prevent decomposition. Meat, therefore, once placed upon ice, prepares itself to decay at that temperature, and if removed spoils quickly. Hence it is that, when removed from the butcher's chest, in hot weather, it frequently becomes unfit for use in a few hours. It needs no argument to prove the dampness present in single compartment refrigerators, and from their close earthy smell, the mingling of odors within them, the neglect of servants to keep the blankets used to cover the ice perfectly clean, and from similar defects, their sanitary value is at best questionable. In recep-



tacles where the ice is in one division, and the articles in another, a point of advantage is aimed at; but, clearly, if the moisture in the food compartment be allowed to condense on the cold surface of the ice box and then to flow back on the meat, etc., the object sought is not secured.

A full knowledge of the considerations above advanced has, however, been brought to bear in the construction of an improved refrigerator, manufactured by Mr. A. M. Lesley, of

224 and 226 West 23d street, in this city, the newest form of which is represented in the annexed engraving. The Zero refrigerator, as heretofore made by Mr. Lesley, differs from that illustrated herewith in having less ice space, the ice compartment being in the center of the top, and having curved sides meeting just below the faucet in front. This necessarily gave more room for articles in the lower divisions; in many cases, it is desirable to secure a supply of ice which will last a considerable time, the section for the same has been enlarged. In this division the blocks are placed, upon a wooden tray, through which the water runs to a charcoal filter, which covers a small central compartment, shown through the right hand open door. This gives a supply of pure ice water, which may be drawn off as needed by the faucet. The moisture condenses upon the surface of the ice box adjoining the food receptacles, and thus leaves the air in the latter in an almost dry state. It then runs to a trough, and thence is conducted, to a pan located under the apparatus, by a suitable pipe, in which a trap or siphon is placed so as to prevent an escape of cold or an influx of warm air. On top, and beside the ice box, is arranged a receiver for wine bottles, milk, etc. Each compartment has its own door, so that access may be had to any one without disturbing the others, and hence no warm air gets to the ice except while the supply is being replenished. The inventor states that moisture is never seen on the inside lining, and that the provision chambers are always sweet and clean. Matches, we are informed, which absorb dampness readily, have been placed in the refrigerator, as a test, without injuring them in any wise. The consumption of ice is said to be remarkably small.

The Zero refrigerator is constructed of clean, well seasoned lumber, filled with cork, lined with zinc, and is provided with a galvanized iron ice box.

Mr. Lesley submits a very large number of commendatory testimonials, together with premiums from three American Institute fairs, and from many expositions throughout the country. Further particulars may be obtained by addressing the inventor as

The Artificial Production of Low Temperatures.

BY PROFESSOR EDWIN J. HOUSTON.

By the Windhausen process, a steam engine is employed to condense air to, say, two or three atmospheres. The heat developed by the compression is drawn off during the passage of the condensed air through pipes in a series of chambers, in which cold water is flowing. The cooled air is then allowed to expand into a cylinder under a gradually diminishing pressure, the expansion being attended with the development of great cold. It is claimed that under a pressure of but 35 pounds to the square inch, a reduction of -54° Fah. has been obtained, a surprisingly low temperature, considering the means employed.

The following modifications of the apparatus would render its cold-producing power almost unlimited:

1. A communication between the expansion cylinder and the chambers through which the condensed air is conducted before it is allowed to expand. Supposing this outlet regulated by a cock, a blast of very cold air could replace the running water, and reduce the condensed air to a very low temperature.

2. The introduction of a second compressing cylinder, with which the condensed air, after being cooled, could be still further compressed, again cooled, and finally conducted into the expansion cylinder. Under a pressure of, say, 60 atmospheres, a considerable mass of air at the temperature of say -100° Fah. would, in its expansion, produce a reduction of temperature greater perhaps than any yet obtained. Since by means of the communication between the expansion cooling chambers, the condensed air can be lowered to any temperature obtainable in the expansion cylinder, there would appear to be no other limit to the reduction of temperature save what would arise from the strength of materials, or the liquefaction and subsequent freezing of the nitrogen, or the oxygen of the air, or of the air itself. Among the advantages that we may rationally expect to accrue from the apparatus thus modified are the following:

1. The confirmation or otherwise of the "absolute zero," as determined by the expansion or contraction of gases by heat or cold.
2. The liquefaction and subsequent solidification of many of the incoercible gases, the determination of their physical peculiarities as liquids or solids, together with their crystalline form.
3. The action of intense cold on the chemical affinities of certain gaseous compounds.
4. The action of intense cold on the color of certain chemical compounds.—*Journal of the Franklin Institute.*

[In the SCIENTIFIC AMERICAN, September 28, 1850, is given a description of a refrigerating apparatus, by Dr. Gorrie, which presents an arrangement apparently analogous in idea to that suggested above by Professor Houston.—Eds.]

THE FROG BAROMETER.—In some countries frogs are used as barometers: the species employed for this purpose is the green tree frog. They are placed in tall glass bottles with little wooden ladders, to the top of which they always climb in fine weather, and descend at the approach of bad weather. This is a cheap and highly interesting weather glass where the green tree frog is to be procured in its natural state.—*Science Gossip.*

Correspondence.

The Ventilation Question.

To the Editor of the Scientific American:

I am glad my remarks on the present mode of ventilating the senate chamber, Washington, have called some attention amongst your scientific correspondents.

Some time ago I was requested to examine the lecture hall of the Paisley Free Library, with a view to its ventilation. This choky place had become proverbial for its insalubrious state with even a thin audience. The hall is well proportioned, and will seat 400 or 500 people. On examination I found the "sarking," whereon the slates are fastened, to be grooved and feathered, and as tight as a cask. The plastered ceiling is pierced with open fretwork. Several air grates are in the masonry below the level of the floor, but the floor itself is as tight as the sarking. When the hall was filled, no indraught could be detected at the air gratings. In the center line of the floor and along its whole length is a strip of iron grating over the hot water pipes. These pipes lie in a boxed channel, airtight except at top. From this arrangement, it will be seen that no fresh air could enter the hall unless by an occasional opening of a door or window. To effect a cure, the first thing was to get a hole made through the roof. Luckily there is a hatch in the roof for repairs. Here was the very thing wanted. This hatch was tilted a few inches and kept partially open by two small blocks of wood. This secured the "outlet," and so far no more was required. Under the floor a few of the "dwangs" were then knocked out from between the joists. These dwangs formed the sides of the channel where lie the hot water pipes. A communication was thus made between the outer wall gratings and the hot pipe channel, and consequently to the hall itself. Having thus made an opening between the hall and the outer fresh air, and having secured an escape for the warm foul air by the hatch in the roof, the arrangement was complete. Next lecture night, the audience no sooner began to assemble than the inevitable result manifested itself. The inward current at the wall gratings was not to be mistaken. A paper torch flame was sucked in. It worked lively to begin with, and got more so as the hall filled. At the same time, the hatch outlet did its work to a wish. The result of this simple and inexpensive plan is that everybody is satisfied. To arrange this did not take much longer time than it has taken to describe it. One hall ventilated in this way and found to answer is as good as a thousand for conviction, and Nature knows no difference between the senate chamber and our lecture hall. It only requires the same arrangement to obtain the same result. A trial by objectors would save them the trouble of creating bugbears against its adoption, for the arguments against my plan by your correspondents are simply nothing. "Prove all things" is as good in this as in higher matters, and would be more philosophical than railing against an untried plan.

It would not be difficult to answer every objection raised by Messrs. Morgan and West; and if I were unable to do this, the fact remains that the plan has been tried and has not been found wanting. It has worked, is working, and will work so long as the laws of Nature remain as they are.

Mr. West supposes I allude to summer ventilation only; but I include all seasons. So long as a crowded hall is warmer than the outer air, the upward current is bound to flow. The dread of cold can only come from the unnecessarily large supply of air forced into public halls by such philosophers as suppose that it is required that each person should have twenty-five cubic feet per minute, that is, fifty times more than he can consume. The rapid lowering of the cosy warmth of a hall by the admission of a large quantity of cold air in winter is not to be feared in my plan. To keep a crowded place sweet, not much fresh air is required; and if it be admitted under the hot water pipes, it will keep the place snug and comfortable.

Mr. Morgan, "purposely ignoring the special subject of my article, the senate chamber," shows a wise discretion. He says, misquoting me: "If our halls, like the ancient Greek houses," etc. I never spoke of Greek houses. I only instanced halls, which were very different. My remarks referred to a crowded place—the senate chamber—with probably 1,200 people in it. Mr. Morgan's tall glass jar is no proper illustration of the senate chamber, which, looked at as a vessel, is not tall but flat. Its narrowest diameter is more than twice its depth, so that an old-fashioned punch bowl or a wash hand basin would better represent it than a tall jar. He says: "If a bit of lighted candle be placed at bottom of a tall glass jar and subjected to a stream of carbonic acid from the lungs, the light will be extinguished." Likely enough. But this is no illustration of the action of natural ventilation in a roofless hall. I did not say that if a flood of carbonic acid were poured into such a place, the people in it would live. What I said was that pure air would descend and replace that vitiated. Nature does not supply carbonic acid in the manner of Mr. Morgan's experiment.

But I also offer the same experiment, minus the impossible carbonic acid, as a proof that my position is correct. Place a bit of lighted candle at bottom of a tall glass jar open at top, and it will not be extinguished so long as any of it remains to burn. This is the position of an audience in a roofless hall. The vitiated air produced by the lighted candle, being lighter than the atmosphere, rises and escapes at the jar's mouth, while pure air at the same time takes its place through the same opening. This jar experiment reversed shows that carbonic acid whilst warm rises. Hold the same jar mouth downwards, and thrust a lighted candle half way

up. The foul air will collect at top; and when it has filled the jar down as far as the flame, the candle will be extinguished. Light the candle again, and hold it only a little way up; and when the carbonic acid has filled the jar, the candle will go out. According to Mr. Morgan's false theory, the carbonic acid should have fallen out of the jar and left the candle to burn.

Another experiment with the tall jar, and I will lay it aside. Cut a hole, say half an inch, in the bottom of the jar, and hold it mouth downwards. Thrust a lighted candle up as before and it will not be extinguished. And why? Because the carbonic acid rises and escapes by the hole, and a current of pure air enters by the down-turned mouth and feeds the flame. The same events take place in a crowded hall having a hole in the roof and inlets below. The inverted jar represents the hall; the candle, the heat-producing audience; the down-turned mouth, the inlet for fresh air; and the hole in the jar, the outlet in the roof.

I am obliged to Mr. Morgan for suggesting these experiments, but I daresay he did not expect they would be turned against his crude scientific notions. His statement that, if my plan were adopted, the people would be "frozen out" by warm air needs no comment, and his platitudes about the "destroying angel" need as little, as nobody denies them. About my running counter to Reid and others, if it be so, all the worse for them. Reid knew well enough the principles I have laid down, but he failed to put them in practice. He would help Nature with machines, engines, exhausts, and other superfluous contrivances, and failed to ventilate the parliament houses, after spending thousands of pounds; whereas a carpenter with his saw could have done it for a few shillings, and so could he the senate chamber, Washington.

WILLIAM MACKEAN.

Paisley, Scotland.

Turbine Limitations.

To the Editor of the Scientific American:

Perhaps most waterwheel engineers have a theory of the action of the water upon the turbine, and construct their wheels accordingly; but it seems to me that there is a very important item (which may be called "turbine limitation") generally overlooked. It is simple enough, and as follows: The guides of all turbines divide the water into jets impinging upon the buckets in a forward direction. It is generally conceded that these jets in passing through the wheel, must be deflected from their forward to a perpendicular direction (neither more nor less); also that the wheel buckets must be as thin as possible, and shaped so as to enter and pass through them exactly endwise, or with as little disturbance as possible. Hence it becomes an important question: At what point or how far, from the guide issues, will these jets have changed their forward into a perpendicular direction? for here, and here only, is the point for the wheel's issues, since nowhere else could they discharge the water in the right direction, or just so fast as the wheel moves.

It need but be remembered that the pressure necessary for propulsion must of necessity cause a given deflection in a certain distance or lapse of time; hence it would seem that, in all turbines, there is a limited distance asunder at which guide and wheel issues can be placed, fixed by this time or distance of deflection. This law would require a certain size and length of bucket, together with distances apart of guides, irrespective of the size of the wheel, a practice very different from that at present in vogue. Good wheels are made that do not comply with this idea; yet I am convinced that, as turbines have evidently improved as more guides and thinner and smaller buckets are used, it is because of a nearer approach to compliance with this law.

Springfield, Mo.

J. B. REYMAN.

The Attraction of the Sun and the Earth.

To the Editor of the Scientific American:

That the relative attractions of the earth and the sun on the same terrestrial body are subjects of calculation, the tides furnishing the data, is well known. The only question in my mind was: Are the data so exact as to render nothing further desirable? In making the experiments suggested by me, the object sought would be an accurate measurement of these forces, respectively, by means of the same instrument. Of course common lever scales would not answer; and it is a question whether springs could be constructed of sufficient strength and delicacy combined.

Two expedients have occurred to me: First, the use of a delicate spring balance having a mirror attached, by means of which effects, insensible to the eye on an ordinary register, may be made sensible and measurable by the reflection of a beam of light to different points of a graduated arc. Secondly: I can see no reason why the minutest difference in these attractions may not be accurately measured by means of the pendulum. This instrument serves us in determining the sphericity of the earth, the earth's density, and the height of mountains, and it certainly would serve for the purpose of measuring the solar attraction also.

Brownville, Neb.

W. B. SLAUGHTER.

Railroad Curves.

To the Editor of the Scientific American:

The radii of curves, with their corresponding deflection angles, can be more readily found from the relations between the arc and diameter than from those between the chord and diameter, the latter being the method in use at present by railroad surveyors.

If we assume the lineal value of 1° of arc to be 1 foot, as the measuring unit, then the radius is known to be 57-29578 feet. If, instead of calling the arc of 1° equal to 1 foot, we call it 100 feet, then the above radius is also 100 times greater.

Hence we have the radius of a 1° curve, by simply removing the decimal point of the above figures two places to the right, that is, the radius of a 1° curve is 5729-578 feet. It is also known that, if a given amount of arc be developed lineally, on circles of different radius, the angles subtended will vary inversely as the radii. Hence, to find the radius of any other deflection angle, we have only to divide the radius of a 1° curve by the number of degrees in the given angle. The radius of a 4° curve is thus one fourth that of a 1° curve; and for a 7° curve, one seventh and so on.

Again: If the deflection angle is less than 1°, we have only to multiply by the fraction of the degree inverted, thus: Multiply the radius of a 1° curve by 60 for that of 1' curve; for a 4' curve, multiply by 15; for a 10' curve, multiply by 6, and so on. By reversing this process, the deflection angles corresponding to different radii may be found.

Furthermore, we may compute any of the trigonometric functions for the radius of a 1° curve, and then pass, by the method of inverse ratio, to the corresponding function of any other deflection angle. Thus the tangent of 38° of arc on a 1° radius would be 4476-43 feet. On the radius of a 4° curve, it would be but one fourth as much, namely 1119-11 feet. To find this element by methods in present use, we should be obliged to resort to trigonometry, or be satisfied with some approximate method. In the same manner, other functions may be determined.

Among the many advantages resulting from assuming a portion of arc rather than of chord, for the constant quantity, are the following, namely: 1. The saving of immense labor in the computation of radii for different deflection angles; 2. the method of inverse ratios, much in use by surveyors because of its simplicity and ease of application, but which gives only approximate results, will then become rigorously correct; 3. the total deflection of a curve is known from its length in feet. If for a 1° curve, we have only to cut off two figures to the right, and we have the total deflection in degrees and decimals. If for any other curve, we have only to further multiply by the number of degrees in the deflection angle.

A hint to the practical man is sufficient.

Ferrysburgh, Mich.

H. C. PEARSONS.

[For the Scientific American.]

Poisons and their Antidotes.

BY G. J. ROCKWELL, A. B.

Fatal results of poisoning are most frequently occasioned by delay in applying, or by ignorance of, the antidote. The following is a list of the antidotes of the common poisons, and I suggest that chemists, dyers, druggists, and others who are brought daily in contact with poisonous substances, post this list in some conspicuous place in their laboratories.

For alkaloids, such as morphine, quinine, etc.: Emetics and the stomach pump must be relied upon rather than chemical agents. Astringent liquids may be administered, such as tannic acid, which precipitates many of the alkaloids from their aqueous solution, absorption of the poison being thus retarded.

For antimony (tartar emetic, etc.): Any form of tannic acid may be administered (infusion of tea, nutgalls, cinchona, and oak bark, or astringent solutions or tinctures), an insoluble tannate of antimony being formed. The stomach pump must be also applied as speedily as possible.

For arsenic (Paris green, etc.): Recently precipitated moist ferric hydrate, best administered in the form of a mixture of a solution of perchloride of iron with carbonate of soda. Emetics should be also given, and the stomach pump applied.

For copper (verdigris, etc.): For an antidote, administer iron filings, also white of an egg (albumen), which forms with copper a compound insoluble in water. Apply the stomach pump.

For hydrocyanic acid (cyanide of potassium, etc.): A mixture of green sulphate of iron, solution of perchloride of iron, and either magnesia or carbonate of soda, is the recognized antidote in cases of poisoning with prussic acid. Inhalation of ammonia is also advised.

For lead: Administer a solution of Epsom salts or alum, and induce vomiting.

For mercury (corrosive sublimate, etc.): Swallow the whites of several eggs. Albumen gives a white precipitate with salts of mercury, which is insoluble in the juices of the stomach.

For oxalic acid: In cases of poisoning with oxalic acid or salts of sorrel, chalk and water may be administered as a chemical antidote, with the view of producing the insoluble oxalate of lime. Emetics should also be applied.

For tin: In cases of poisoning by tin salts (dyeer's tin liquor), solution of carbonate of ammonia should be given. White of egg is also said to form an insoluble precipitate with compounds of tin. Vomiting should also be speedily induced.

For zinc: Large doses of zinc, fortunately, act as powerful emetics. If vomiting has not occurred, or has taken place apparently to an insufficient extent, a solution of carbonate of soda (common washing soda), immediately followed by white of eggs and demulcents, may be administered.

A NEW method, by Mr. Wilson, for lighting street gas lamps is as follows: The lamp has two burners; one, very small, burns all the time. When the gas pressure is raised, a small gas holder, on the top of the column, is elevated, affording a passage for the gas to the larger of the two tips, which is lighted by the small jet. Thus all the street lamps in the district may be lit automatically.

SNOW.—More snow has fallen on the Sierra Nevada mountains the present season than ever before known. This looks well for a prosperous season in the milling and agricultural industries of that region.

THE PROPOSED CHAMPLAIN SHIP CANAL.

By reference to the annexed map, the reader will be enabled to trace the extended route which it is proposed to open to commerce, by the construction of a ship canal and the improvement of the Hudson River between Troy, N. Y., and Whitehall on Lake Champlain. A perfectly feasible engineering work is contemplated, which, while inconsiderably small beside others of similar nature which have been completed throughout the world during recent years, nevertheless offers beneficial results of the highest importance to the North and Northwest of the United States, in that it provides undeniably the natural and best route from the Great Lakes to tide water.

From New York to Troy, a distance of 150 miles, the Hudson is navigable, as is well known, by vessels of large tonnage. From Troy to Fort Edward, a distance of forty miles,

average rate of eight miles per hour for steam vessel. From all the ports on the upper lakes to the foot of Lake Erie, all vessels whose cargoes are destined for tide water by any route will be upon equal terms. At that point Nature has presented a barrier, and here the products of the west take different routes to different markets. By the Champlain route a boat could come from Port Colborn, near the foot of Lake Erie, to tide water (without breaking bulk) in four days' time, allowing only the same rate of speed in the eighty-four miles of canal as are now made on the Erie canal, as against an average of at least ten days from Buffalo to Albany by the latter. This saving, of time and interest, of the expense of breaking bulk, of transshipment and division of cargo, requires no argument to prove its importance. It is believed, moreover, that a canal adapted for a vessel of 1,000 tons—as it is proposed to construct that under consid-

Aniline Violet on Woolen Yarn.
One lb. of sulphate of magnesia is added to the flot at a hand heat; the goods (10 lbs.) are moistened therein, and methyl violet is gradually added while the temperature is quickly brought to a boil. For dove color, dye as for violet, using only $\frac{1}{2}$ to $\frac{1}{4}$ oz. of color.

Madder Red, topped with Cochineal, on Wool and Woolen Yarn.
One hundred lbs. of goods are boiled for an hour with 3 lbs alum, 6 lbs. tin crystals, 5 lbs. tartar, $\frac{1}{2}$ lb. flavin. They are then lifted and boiled for an hour in a fresh bath with 15 lbs. madder. Meantime 4 lbs. of ground cochineal, $1\frac{1}{2}$ lbs. of tin crystals, and 1 lb. oxalic acid are boiled up, cooled, the wood entered, and boiled for an hour.

Armand Müller prepares an oil mordant for Turkey reds with an emulsion of olive oil and a solution of glue. Into



there is an elevation of 116 feet to be overcome; from Fort Edward to the summit, a distance of two miles, an elevation of thirty-one feet; from the summit to Lake Champlain, at Whitehall, a distance of twenty-one and three tenths miles (seven miles of which is in Wood Creek), there is a descent of fifty feet to Lake Champlain. Thus it will be seen that the highest point between tide water and the St. Lawrence is 147 feet, and that the entire length of the river and canal improvement is but sixty-three and three tenths miles. Eleven locks and dams are required, the former to be 300 by 45 feet in size, to overcome the elevation and to give ten feet of water in the river. Wood's Creek, which runs into Lake Champlain, is already nearly ten feet in depth, and would require little straightening, so that the canal portion to be constructed is reduced to but seventeen miles, requiring but two locks. The width at the bottom is to be 110 feet and at the surface 150 feet.

The route from Whitehall extends up through Lake Champlain to the Richelieu river, and thence to St. John's, where the latter stream is entered by the projected Caughnawaga canal. For this enterprize a charter has already been granted by the Canadian government, and work is to be speedily begun. The canal extends to Caughnawaga upon the St. Lawrence river, and is twenty-nine miles in length. The country through which it passes is almost a dead level, there being a rise of but twenty-five feet, so that the entire work can be built in half cutting—that is, a cut of six feet and a bank of six feet would be all that would be required to construct a canal of 12 feet in depth. From Caughnawaga the route continues, *via* the Beauharnais canal of eleven miles and the Cornwall canal of twelve miles (which canals are constructed around rapids in the St. Lawrence river, and which rapids are now being improved so that vessels on the downward course do not need to use the canals), through the St. Lawrence to Lake Ontario, and thence through that lake and the Welland canal (twenty-seven miles) to Lake Erie. From Lake Erie, vessels of any tonnage can pass into Lake Huron, Lake Michigan, and Georgian Bay; and, *via* the Sault Ste. Marie canal, of a little over one mile in length, vessels of 2,000 tons can pass from the waters of Lake Huron to Lake Superior. From Green Bay, an arm of Lake Michigan, there is now an improvement in process of construction which will, when completed, so improve the Fox and Wisconsin rivers that water communication will be opened between the Mississippi and Green Bay, a distance of 278 miles, and another already concluded by the Illinois and Michigan canal and the Illinois river to the Mississippi river, a little above the mouth of the Missouri. Through this entire distance, from the lakes to tide water, with the exception of eighty-four miles of ship canal, there is, so far as speed is concerned, a free and uninterrupted water way upon which steamers or sailing ships can be propelled at an

eration—will lessen the cost of transportation between the foot of Lake Erie and the Hudson river fifty per cent, a gain of two dollars per ton on the commerce of the west, or at least \$20,000,000 annually.

The Canadian government is now contemplating the construction of a water way, known as the Ottawa and Lake Huron canal. This leads by a natural chain of rivers, as a glance at the map will show, from Georgian Bay to French river, thence through Lake Nipissing to Trout river, thence to the Ottawa, and *via* the Ottawa to the St. Lawrence at Caughnawaga. It would make a route of 980 miles from Chicago to Montreal against 1,348 miles by the St. Lawrence route, showing a saving of 368 miles. This, therefore, when built, must tend to cut off comparatively the Erie canal and the Oswego canal from competition with the commerce over the Ottawa route, while the Champlain and Caughnawaga canal would be in the direct line and would give New York all the advantages of the saving in distance. There are also local considerations which point to the advantages gained in the construction of the Champlain route. It would afford a highway and materially lessen the cost of transportation of the lumber manufactured in the Ottawa district, nearly 500,000,000 per annum; of the iron ore also from Lake Champlain, 400,000 tons of which are yearly raised and shipped; of the products of the great fishing trade of Labrador and Newfoundland, and also of the coal from Picton.

The bill before the New York legislature provides for the survey and location of the work at once, and calls for the raising of the necessary sum for its accomplishment, \$10,000,000, by suitable taxation.

NOTES ON DYEING.

[From Reimann's Farber Zeitung.]
Nicholson Blue on Cloth.

To 100 lbs. of material use 1 lb. color of the shade required; dissolve in boiling water, filter, and make up a dye bath with the addition of $\frac{1}{2}$ lb. sulphate of zinc. In this the goods are worked for an hour, while the liquid is gradually raised in a bath of warm water at 190° Fah., containing 2 lbs. sulphuric acid and $\frac{1}{2}$ lb. sulphate of zinc. The dye resists acids and soaps.

Nicholson Blue with a Wood Bottom.

One hundred lbs. of woolen cloth are boiled for an hour with 1 lb. chromate of potash and 1 lb. of sulphuric acid, and allowed to cool in the liquid, lifted, rinsed, and dried in a fresh bath with 30 lbs. of cam wood. Two lbs. of Nicholson blue are now dissolved in boiling water, filtered and made up into a dye bath with the addition of $1\frac{1}{2}$ lbs. of sulphate of zinc. In this bath the goods are boiled for two hours, lifted, rinsed and raised in a bath containing 8 lbs. sulphuric acid and 2 lbs. of sulphate of zinc.

this solution hyposulphite of soda is introduced, the frothing mass is allowed to stand two or three hours, and immediately used.—*Chemical News.*

Professor Thurston's Investigations on Metals.

Those of our readers who have already perused with interest the valuable papers contributed by Professor R. H. Thurston to these columns, relative to the strength, elasticity etc., of materials of machine construction, will find the subject treated in extended form, and illustrated by a number of carefully prepared diagrams and engravings, in the recent published transactions of the American Society of Civil Engineers. Professor Thurston in the present issue offers still another communication on strains on metals, which will doubtless be read by mechanics generally with much profit.

A Chance for Inventors.

A common, well built country wagon, weighing about 800 pounds, will carry 3,000 on any fair country road, and without injury pass over obstructions which cause it to fall one, two, or more inches, the paying weight being about 79 per cent of the whole. The ordinary box car in use upon our railways at the present time weighs about 10 tons; its maximum load is generally about 11 tons, while its average load is about 8 tons; the paying weight being from 44 to 52 per cent of the whole. It does not seem reasonable that the weight of a car constructed to run upon a smooth even track, without a fall, should be so disproportioned to the load carried. There is here a chance for inventors to devise a light form of freight car, strong enough to carry 11 tons.

ARTIFICIAL coral is made as follows: To two drams of vermilion add one ounce of resin, and melt them together. Have ready the branches or twigs peeled and dried, and paint them over with this mixture while hot. The twigs being covered, hold them over a gentle fire, turning them round till they are perfectly smooth. White coral may also be made with white lead, and black, with lampblack mixed with resin.

A FAIRLIE locomotive with twelve 3 feet 6 inches drivers and 16 by 20 inches cylinders, weighing 62 tons, made to burn either wood or coal, has lately been completed in England for the Mexican Railway. It is equipped with the Westinghouse brake, and also with the Le Chatelier counter pressure steam brake, which acts only on the locomotive. The engine is to work on a long grade of more than two hundred feet to the mile, and the boiler flues are inclined to suit this grade.

IMPROVED POTATO DIGGER.

The invention herewith illustrated is a simple and, it is claimed, efficient implement, by means of which the hills containing the potatoes are broken into furrows; and from the earth thus loosened, the potatoes are separated by suitably arranged clearing teeth. The apparatus is essentially an inside or under digger, and consists in a double mold board plow, A, which splits each hill or row in the middle into two opposite furrows, pushing the latter sufficiently outward and apart for the teeth, B, to act upon them from the inside, as so many little plows or coulter. The plow may be made to raise these furrows to any required angle. The teeth are constructed so as to have about the same inclination forward and outward as the mold boards, so as to enter and remain in the earth readily, in order to give a lifting cut against the furrows to a depth of from one to two inches, causing the dirt and potatoes to cave inward, and thus press against them. The potatoes, as they are loosened, fall into the spaces (about 3 or 3½ inches) between the teeth, which, at the same time, break off the tendrills. The plow is made flat on top for the easier attachment of clearer and beam, and their handler adjustment to the draft. The depth of furrow is regulated by the nuts and bolts at C, in connection with wedges or other suitable devices. The teeth may be made of wood or of round, square, or triangular rods of iron or steel, from 13 to 14 inches in length, slightly tapered from the under side of the frame downwards, and having any suitable form of point. They are firmly inserted in suitable holes or mortises in the arms. Their main object is to deal only with the roots of the vines, weeds, etc., as the points follow in the wake of the plow-shares, which remove the principal obstacles from their way.

Draft is applied to the beam in the ordinary manner, as represented in the illustration. The inventor has also devised an ingenious form of gatherer, which is applied to the rear of the digger, and which serves to collect the potatoes into line or in heaps as the implement advances.

Patented January 6, 1874. For further particulars address Mr. Hiram Strait, 18 6th street, Troy, N. Y., or his authorized agents in other localities.

REBER'S PORTABLE BLACKBOARD.

The accompanying illustration represents a rear view of a convenient and useful form of portable blackboard, which may be readily inclined into any position, and raised to any suitable height. It may also be employed as a table, and when out of use may be folded into small compass so as to occupy but little room.

For teachers and others who have occasion to demonstrate graphically the subjects of instruction, or for engineers and architects who frequently need a handy surface to try the effect of a sketch or to work out a problem occurring during the course of a calculation, a device of this description will, without doubt, be found an excellent assistant. It will also prove useful in churches, Sunday schools, and, in brief, in any locality where wall boards are not at hand.

The standard, which, with the supporting legs, may be made of any desirable form or material, guides centrally a vertical rack, A, which is raised or lowered by the ratchet, B, actuated by the crank shown, and held in any desired position by the pawl, C. To the upper end of this rack is secured, by means of a screw and thumb nut, a horizontal arm, D, one extremity of which is T shaped and hinged to the back of the board, while the other end is slotted and guides a bow-shaped lever, E. The latter is also hinged to the blackboard, as shown. By means of this arrangement the board may be readily placed at any desired inclination and so held by the thumbscrew which binds lever, E, in the slot of arm, D, the movement of the former toward raising the table to a perpendicular position being limited by the projecting lugs at its lower end. The board is made in three pieces, the two outer leaves being hinged to the middle one so as to be readily folded. Levers, F, turning on bolts on the outer sections, secure the same rigidly by thumbscrews, when placed, as shown in the engraving, in an extended position. The whole board turns easily on the rack. To reduce the apparatus to its smallest compass, the rack is lowered in the stand, the table placed horizontally, and the leaves folded down. It may then be rolled into a corner and used as a stand, or for any other convenient purpose.

Patented through the Scientific American Patent Agency, November 4, 1873. For further particulars regarding purchase of rights at wholesale or in sections of territory, address the inventor, Mr. James Reber, Nebraska, Pickaway county, Ohio.

Linoleine.

The activity of modern chemists is very remarkable, and has borne most important fruits. Among other useful work, they have studied almost every vegetable or animal substance that has any active properties, and have sought to isolate or separate their active principles. Thus the pungency of mustard, the exhilarating principles of tea and coffee, the narcotic of tobacco, the coloring essence of madder, and a countless multitude of other such active principles, have been separated and examined, and in many cases their elements have not only been discovered by analysis, but have been put together synthetically, and the active essence has been obtained from entirely new materials, even from oth-

It exists to the extent of about 80 per cent in the best linseed oil, and has some remarkable properties. In its original state, as it exists in the fresh oil, it is a clear liquid, having the property of combining with oxygen and then solidifying without any decrease of bulk. This retention of its bulk is very important, and is one of the sources of its value to the painter. Colors may be ground into copal, mastic, or other varnishes, and when first used these form very brilliant mediums; but varnishes are merely solutions of gums or gum resins in a volatile oil or spirit; and as they dry by the evaporation of the solvent, their bulk decreases, they shrink, and thus, if any considerable thickness is laid on at once, it displays this shrinkage by cracks. Artists who have been tempted by the brilliancy of a copal or other similar medium have had the vexation of seeing their pictures covered, after a year or two, with a network of cracks, and gradually becoming worthless. Hence the necessity, whenever varnish is used, of laying it on in a very thin film.

Another especial merit of linoleine is that it solidifies into a remarkably tough substance, which does not become brittle by further drying. It also has sufficient elasticity to bear a considerable amount of bending. If a picture were painted with a varnish medium, and the canvas bent or rolled, it would crack most ruinously; but with a linoleine medium it will bear a considerable degree of such violence without suffering serious injury. Further than this, linoleine is insoluble in alcohol, in turpentine, in petroleum spirit, in naphtha, and even in the bisulphide of carbon, which so effectively dissolves india rubber and many other stubborn substances of this class. This affords the great advantage of enabling the painter to go over the surface of his work with almost any kind of varnish. If the medium which holds his colors were soluble in the oil or spirit which serves as the solvent of the varnish, his picture would be smeared in the act of varnishing.

The work of the picture cleaner and restorer, and even of the humble housemaid in cleaning painted walls, depends upon this insolubility of the linoleine. Strong solvents may be used to remove the varnish and the adhering dirt, without attacking the picture itself, though in this work some care and skill are required, as even linoleine is not absolutely insoluble in all liquids. It happens, unfortunately, that the most convenient of all cleansing agents, namely, soap, if it contains free alkali, as often is the case, will soften and gradually remove this otherwise stubborn film which holds the painter's colors together, and thus we see that the persevering housemaid, after many efforts, at last render visible the original woodwork of a painted wainscoat or door. Every practical painter knows that the less turpentine and the more linseed oil he uses, the more durable is the coat of paint laid on. This depends on the fact that it is the oil and not the turpentine which contains the tough and nearly insoluble linoleine; the turpentine merely dilutes it, and renders the drying process somewhat more rapid.

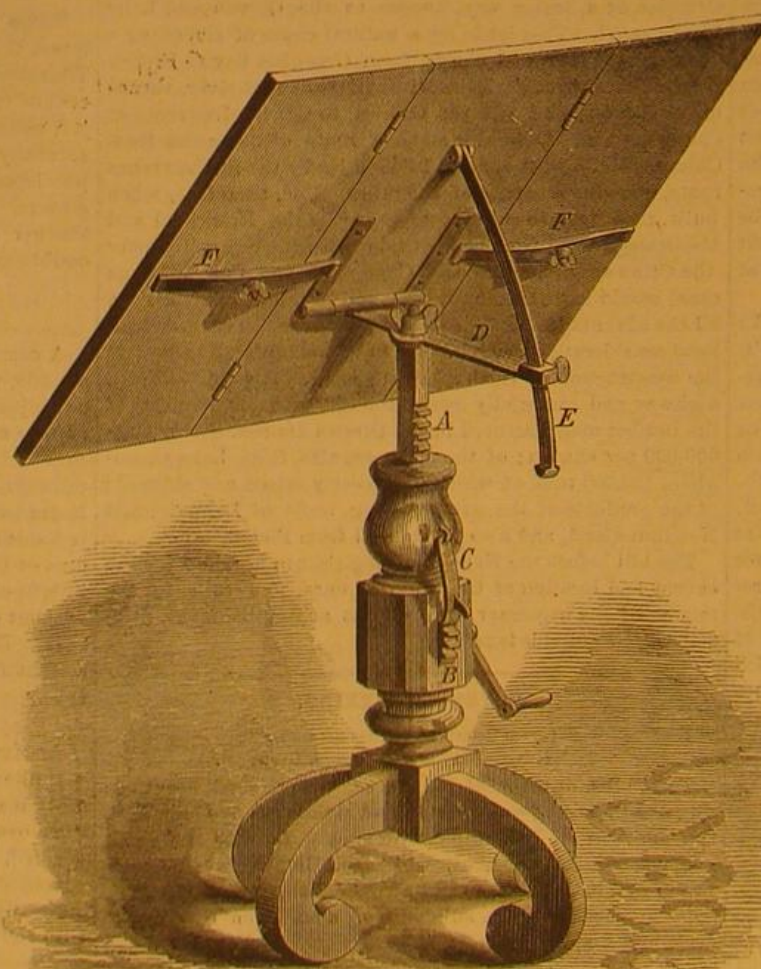
The chemist has not yet succeeded in fairly and practically separating this linoleine, but we may hope that he will do so. Ordinary boiled oil rudely approximates to such separation, but we may hope some day to have a clear, bright, limpid, and colorless medium, consisting of the pure substance, and capable of being brought into the market at a practical price. At present such a thing is merely a chemical curiosity; but so many other useful things have been chemical curiosities first, and commercial commodities eventually, that we are justified in hoping some day to see linoleine in the columns of our price current. —London Grocer.

Japan Lacquer.

It has been generally supposed that the beauty of Japan lacquer work was due to ingredients derived from unknown plants, and that the secret was confined to the Oriental workmen. Recently, however, in Holland, objects of art have been produced, lacquered and covered with mother-of-pearl, in pieces facsimiles of those made in Japan. The lacquer used is prepared from the hardest varieties of gum copal, principally that of Zanzibar, which is colored black with India ink. The articles are covered with several layers of this substance, upon which, while still wet, or rather pasty, the mother-of-pearl is inlaid. Drying in a furnace follows, another coat of lacquer is applied, then more drying, and smoothing with pounce. These operations are repeated until the surfaces are perfectly united and smooth, when a final polish is given with tripoli.

**STRAIT'S IMPROVED POTATO DIGGER.**

wise useless or offensive refuse. Thus the modern chemist, not satisfied with superseding the coloring matter of the cochineal insect by the brilliant dyes he has obtained from coal tar, has separated the dye essence, alizarine, from madder, has laboriously studied its chemical composition and relations, and, after years of investigation, has finally learned how to procure this also from the refuse of gas works. He will soon supersede altogether the cultivation of the madder plant, for his new product is not a mere imitation, but is far better, because purer, than the original substance. In like

**REBER'S PORTABLE BLACKBOARD.**

manner he is now struggling with indigo; he has separated its active principle, and ere long will doubtless supersede the tropical plant by making indigotine from house refuse.

Among such investigations is the search for the principle upon which the painter depends for the adhesion and drying of his colors. To this the name of linoleine has been given.

COLORADO MINES.—The area of land known to be rich in gold deposits in Colorado is about 7,200 square miles, lying in various parts of the Territory, on both sides of the main range. There can be hardly a doubt but that this extent will be largely increased in coming years, for new discoveries are constantly being made upon the foothills and plains.

BETON COIGNET ARTIFICIAL STONE FOR ORNAMENTAL ARCHITECTURE.

Some seventeen years ago, M. Coignet introduced his *béton* stone into France. Although at first encountering popular prejudice, the material speedily made its way, through its intrinsic merit, into favor, and finally, after being experimented upon for a period of two years, was adopted by the French government in the construction of many important edifices and structures. Forty miles of sewers in Paris, the immense aqueduct of Le Vauve, the arches of which cross the sandy valley of Fontainebleau for a distance of thirty-one miles, the supporting arches of the Exposition building, the docks at Bordeaux, and in various other prominent engineering works, the *béton Coignet* has been entirely employed; and also in Egypt the material has been used, for lighthouses and in forming the massive blocks used in the building of the Suez canal. In a large number of private and public edifices in the vicinity of this city, recently erected, this stone has been applied. Prominent instances among these are the arches, columns, and traceries of the great Roman Catholic cathedral, now in progress on the corner of Fifth avenue and 50th street, and in the various architectural ornamentations of Prospect Park, in Brooklyn. Our engraving represents Cliff Ridge Span, in the latter grand pleasure ground, a very beautiful arch, highly decorated, and the design of Mr. Calvert Vaux. This structure it was at first intended to build of granite and brick, but subsequently it was determined to make the whole of artificial stone, the material being especially advantageous for decorative purposes, as it offers great facilities for the reproduction of ornamental detail. A design, once well modeled and prepared for carving, can readily be repeated.

A large new manufactory of *béton Coignet* has been established by the New York and Long Island Coignet Stone Company; it is on Third avenue, between 3d and 6th streets, in Brooklyn, N. Y. The works are very extensive, covering an area of five acres, and are capable, we understand, of turning out fronts of ten ordinary houses per day, besides a large quantity of fine ornamental work, giving constant employment to some one hundred hands. The process of manufacturing consists in first grinding down the constituent elements of the stone to be imitated, and mixing them by machinery until they reach a plastic state. The molds are then filled by a peculiar process which entirely excludes the air, and are immediately removed. The stone, within a few days, is ready for transportation, and continues to increase in density.

The *béton* is impervious to water; and so far as experience proves, withstands the effect of frost or extreme northern climates, and will withstand a crushing pressure of about four tons to the square inch. Structures composed of it are much lighter than those of natural stone, while the strength is equal, if not, in many instances, greater. A cubic foot of

the material weighs about one hundred and forty-six pounds. Walls made of it present a homogeneous mass, and are not liable to the accidents common to brick and mortar structures.

We learn that, since the failure of both granite and marble in the great fires of Chicago and Boston, tests have been made as to the capability of *béton Coignet* to resist intense heat, and the results show that it neither explodes like granite, calcines like marble, nor warps and twists like iron structures. It is, besides, a non-conductor of heat to no small extent, and therefore tends to check the passage of conflagrations from building to building.

General Gillmore, of the U. S. Engineers, some time since visited Europe for the express purpose of inspecting the structures made from this stone, and on his recommendation the government has adopted it for use in the construction of the casemates, sally port, floors, and other portions of Fort Wadsworth, on Staten Island. It would be difficult, we imagine, to limit the employments for which the material appears eminently suitable. As illustrated by Cliff Ridge Span, its peculiar character adapts it to the imitation of the most elaborate tracing and sculpture in the rarest stones; for by admixture of pigments, tiles of any color may be accurately reproduced. The cost of manufacturing is said to be about half that of natural stone when cut.

Photographic Engraving.

The subjects suitable for printing blocks, of the kind now to be described, are those known as line and dot subjects, that is, pen and ink sketches, line drawings, engravings, and such like, to the exclusion of objects in pure graduated tint, like a silver print from a negative of a natural subject having graduation of tint.

A plate of glass is coated with a solution of beeswax in ether, the relative proportions of the two being about half an ounce of wax to ten of ether. This leaves a very thin coating of wax upon the plate, which is still further attenuated by rubbing with a cloth. The object of this waxing is to prevent a too close adhesion of the gelatin coating, to be next applied.

To prepare the sensitive surface, gelatin is steeped in water for half an hour or upwards until it has become swollen from the absorption of water; most of the superfluous or unabsorbed water is now poured off, and the vessel containing the gelatin is placed in hot water, or otherwise subjected to heat, by which the gelatin immediately becomes liquefied. To this is added sufficient of a saturated solution of bichromate of potash to render it of an orange color, yet not sufficient to cause the salt to crystallize out and show itself upon the surface of a glass plate coated with the mixture. The film is dried and then removed from the glass, which is permitted to be done by the agency of the wax substratum. It is now ready for exposure.

Suppose, now, that a reproduction of an engraving or piece of ordinary print or sheet of music be the subject that is to be produced; a transparency—not a negative—of this subject must have been obtained and superimposed upon the side of the gelatin pellicle next to the glass plate. After exposure to light for a quarter of an hour—or more or less, according to the light and the quality of the negative—this gelatin film is pressed into contact with any handy flat surface, such as glass or metal, care being taken that the surface that was next the negative be placed outside. It is now sponged copiously with, or immersed in, cold water, by which a considerable amount of relief is obtained, the parts corresponding with the black of the original print or drawing being seen standing in high relief, while the whites are sunk. This, it will be seen, supplies the conditions for a surface block to print in connection with type, all that is now wanted being the conversion of the soft gelatin into hard unyielding metal.

The gelatin relief or mold obtained in the manner described is, first of all, made surface-dry by means of bibulous paper, and is then lightly dusted over with finely pulverized plumbago or bronze powder. A cast from this surface is then taken by means of molten beeswax, which, when cold, readily parts company with the gelatin relief, owing to the intervening sprinkling of plumbago or bronze. This wax cast is then sent to the electrotyper, who, in a few hours afterwards, will deliver a metallic cast, mounted upon wood and ready for working in the printing press. This process originated with Mr. Thomas West, of London.—*British Journal of Photography.*

Thallium.

The optical process of detecting thallium in a mineral is very simple, says Dr. Crookes. A few grains of the ore are crushed to a fine powder in an agate mortar, and a portion taken up on a moistened loop of platinum wire. Upon gradually introducing this into the outer edge of the flame of a Bunsen's gas burner and examining the light by means of a spectroscope, the characteristic green line will appear as a continuous glow, lasting from a few seconds to half a minute or more, according to the richness of the specimen. By employing an opaque screen in the eyepiece of the spectroscope to protect the eye from the glare of the sodium line, thallium may be detected in half a grain of mineral, when it is present only in the proportion of 1 to 500,000. The sensitiveness of this spectrum reaction is so great that no estimate can be arrived at respecting the probable amount of thallium present.

NEW HOT WATER FUNNEL.—This consists of a tin funnel, with a perforated rubber stopper in the neck, through which the glass funnel is passed; the whole is covered with thick felt; the space between the glass and tin funnel is filled with hot water.



THE CLIFF RIDGE SPAN, PROSPECT PARK, BROOKLYN.

New Fireproof Construction.

A new and cheap plan for rendering buildings free from danger of conflagration has been produced in many prominent buildings of Chicago, by Mr. James John, of 457 Wabash avenue, in that city. The mode of application of the invention consists of first nailing rough boards to the underside of the furring, between the wooded joists, and then to fill, in even with the furring, with coarse hair mortar gaged with sufficient plaster or cement to make it set. On the mortar is cemented a row of square boxes, cast also of mortar, above which a second row is laid so as to break joints. The boxes are slightly smaller than the spaces in which they are laid, so that the intermediate crevices can be filled up with a liquid concrete. Finally a coarser composition, like the concrete of lime, cement, plaster, etc., with screened ashes of cinders, is packed on top of the boxes to a thickness of one inch. This leaves about half an inch to the top of the strips on the joists to which the floor is nailed. The ceiling of the room beneath the joists is formed by securing sheet iron strips to the latter, close to the wall and extending, across and between them, iron wires some two or three inches apart, after which more sheet iron strips are nailed on to secure the wires to the furring. Over the latter the plastering is laid. The weight of filling and concrete is 20 lbs. to the foot when dry, and it costs about \$3.25 per yard.

The inventor claims that the joists thus protected cannot burn any more than the wood blocks in a paved street.

CHEESE factories are going up rapidly in New England, as well as in the New Western States. The farmers of Pawlet, Vt., are giving up sheep raising, and going into the manufacture of cheese. Nine factories are already within its limits. The demand for American cheese in England only increases with the supply; as cheese is found to be the most palatable as well as a cheap substitute for animal food.

THE largest pork-packing house in the world has been erected in Indianapolis. That city now claims the third place in the list of the pork-packing cities.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

PATENT OILS.—JOSHUA MERRILL vs. DAVID M. YEOHANS & al. [In equity.—Before Shepley, Judge.—Decided February 13, 1874.]

A process cannot be embraced in the same claim with the product as an article of manufacture. A claim for "the above described new manufacture of deodorized heavy hydrocarbon oil suitable for lubricating and other purposes, free from the characteristic odors of heavy hydrocarbon oils, and having a slight smell like fatty oils, from heavy hydrocarbons," if it stood alone, would be a claim for an article of manufacture.

If the words "by treating them substantially as hereinafter described" are added, it becomes a claim for the product when formed by the process described.

To distill petroleum in vacuo at so low a heat that the product contains a heavy incrusting oil comparatively free from offensive odor is not an infringement of a patent for the residuum left, after distilling at such a low heat as to drive off the offensively odorous elements of petroleum oil from which the lighter elements have been previously distilled, and the paraffin separated, although the distillate, after being separated from the paraffin contained, cannot be readily distinguished from the patented residuum.

Hill dismissed. Benjamin B. Curtis, Chauncey Smith, and Walter Curtis, for complainant. Chauncey Brown, William Bakewell, and James S. Holmes, for defendant.

PATENT ABDOMINAL SUPPORTER.—MOODY vs. TABER. [In equity.—Before Shepley, Judge.—Decided February 13, 1874.]

Defendant is charged with the infringement of letters patent (reissue numbered 2,165) granted to Sarah A. Moody for improvements in corsets and abdominal supporters.

The complainant was an abdominal supporter intended to sustain the viscera of web-formed persons will not be set aside upon the testimony of a medical man that, previous to the plaintiff's making the invention, he had made several supporters of the same general character for diseased and deformed patients, as they were primarily intended for the relief of the spine, the support of the viscera being a secondary object, and each was adapted especially to the condition of the patient for whom it was prepared.

No one can justify making and selling a patented article under a license from the patentee after he has repudiated the license and refused to pay the stipulated royalty.

One who purchases from such licensee with knowledge of his having repudiated the contract will also be liable for the sale of the articles he purchases, as well as for the sale of those he makes afterward.

Decree and injunction granted. T. B. Wakefield and J. B. Bobb, for complainants. Chauncey Smith and W. W. Suggs, for defendants.

Supreme Court of the United States.

PATENT REVERSIBLE LOCK.—COFFIN vs. OGDEN and WOODRUFF. [Appeal from the Circuit Court of the United States for the Southern District of New York.—October term, 1873.]

Swayne, Judge, delivered the opinion of the court: This is an appeal in equity from the decree of the circuit court of the United States for the southern district of New York.

The appellant was the complainant in the court below and filed this bill to enjoin the defendants from infringing the patent upon which the bill is founded. The patent is for a door lock with a latch reversible, so that the lock can be applied to doors opening either to the right or the left hand. It was granted originally on the 11th of June, 1861, to Charles R. Miller, assignee of William S. Kirkham, and reassigned to Miller on the 27th of January, 1865. On the 10th of June, 1864, Miller assigned the entire patent to the complainant. No question is raised as to the complainant's title, nor as to the alleged infringement by the defendants. The answer alleges that the thing patented, or a material and substantial part thereof, had been, prior to the supposed invention thereof by Kirkham, known and used by divers persons in the United States, and that among them were Barthol Erbe, residing at Birmingham, near Pittsburgh, and Andrew Patterson, Henry Mastis, and Bernard Brosel, residing at Pittsburgh, and that all these persons had such knowledge at Pittsburgh. The appellees insist that Erbe was the prior inventor, and that his priority is fatal to the patent. This proposition, in its aspect of fact and of law, is the only one which we have found it necessary to consider.

Kirkham made his invention in March, 1851. This is clearly shown by the testimony, and there is no controversy between the parties on the subject. It is equally clear that Erbe made his invention not later than January 1, 1861. This was not controverted by the counsel for the appellant; but it was insisted that the facts touching that invention were such as not to make it available to the appellees, as against the later invention of Kirkham and the patent founded upon it. This renders it necessary to examine carefully the testimony upon the subject.

Erbe's deposition was taken at Pittsburgh upon interrogatories agreed upon by the parties and sent out from New York. He made the lock marked H. E. (It is the exhibit of the appellees, so marked). He made the first lock like it in the latter part of the year 1850. He made three such before he made the exhibit lock. The first he gave to Jones, Wallingford & Co. The second he sent to Washington, when he applied for a patent. The third he made for a friend of Jones. He thinks the lock he gave to Jones, Wallingford & Co. was applied to a door, but is not certain.

Brosel, in 1860 he was engaged in lock making for the Jones & Nimmick Manufacturing Co. He had known Erbe about seventeen years. In 1860 Erbe was foreman in the locksmith shop of Jones, Wallingford & Co., at Pittsburgh.

In that year and before the 1st of April, 1861, he went to Erbe's house. Erbe there showed him a lock and how it worked, so that it could be used right or left. He says: He (Erbe) showed me the follower made in two pieces. One piece you take out when you take the knob away. The other part—the main part of the follower—slides forward in the case of the lock with the latch, so you can take the square part of the latch and turn it around left or right, whichever way a person wants to.

He had then been a lock maker eight years. He examined the lock carefully. He had never seen a reversible lock before. He has examined the exhibit lock. It is the same in construction. The only difference is that the original lock was made of rough wrought iron. It was a complete lock and capable of working. Erbe thought it was a great thing. Erbe showed him the lock twice afterward at Jones, Wallingford & Co.'s. He saw such a lock attached to the office door there and working, but does not know whether it was the first lock made or one made afterward.

MASTIS. In 1860 he was a pattern maker for Jones, Wallingford & Co. He had known Erbe fourteen or fifteen years. Erbe showed him his improvement in reversible locks New Year's day, 1861. He examined the lock with the case open.

"You had to pull out the spindle, and the hub was fitted so that it would slide between the spindle and the plate and let the latch forward. The whole hub was made of three pieces. One part was solid to the spindle or hub shanks, and then the hub that slides between the plate and case and a washer at the other side of the spindle. There is not a particle of difference between the exhibit and the original lock. It is all the same."

He identifies the time by the fact that he commenced building a horse in 1861, and that year he worked on the water conductor under the roof. PATTERSON. Until recently he was a manufacturer of locks and other small hardware. In the year 1860 he was the superintendent of the lock factory of Jones, Wallingford & Co., and their successors in Pittsburgh. He had known Erbe since 1856. About the 1st of January, 1861, Erbe showed him an improved reversible lock of his invention like the exhibit lock.

The improvement "consisted in constructing the hub or follower so that when the spindle was withdrawn the hub would slide forward between the cases so that the head of the latch would protrude beyond the face of the lock, so as to permit its reversal from right to left, the latch head being connected with the yoke by a swivel joint, so that it might be reversed."

It was our uniform practice to put our new locks on the doors about the office to test them, and I believe that one was put on; but at this distance of time I cannot say positively that it was. The whole act is to be taken together and construed in the light of the context. The meaning of these sections must be sought in the import of their language and in the object and policy of the Legislature in enacting them. (Gayler vs. Wilder, 10 How. 496.)

The invention or discovery relied upon as a defence must have been complete and capable of producing the result sought to be accomplished; and this must be shown by the defendant. The burden of proof rests upon him, and every reasonable doubt about that fact is resolved against him. If the thing which he embarks upon is at once its practical efficacy and utility. (Bedford vs. Cutter, 1 Story's R. 590.) The prior knowledge and use by a single person is sufficient. The number is immaterial. (Bedford vs. Hunt, 1 Mason, 302.)

Until his work is done, the inventor has given nothing to the public. In Gayler vs. Wilder the views of this court upon the subject were thus expressed: We do not understand the circuit court to have said that the omission of Coffin to try his safe by the proper tests would deprive it of its priority; nor his omission to bring it into public use. He might have omitted both, and also abandoned its use and been ignorant of the extent of its value; yet, if it was the same with Fitzgerald's, the latter would not, upon such grounds, be entitled to a patent, provided Coffin's safe and its mode of construction were still in the memory of Coffin before they were recalled by Fitzgerald's patent.

What is here expressed by the proviso in the last sentence is a sound one, it is not necessary in this case to consider. Here it is abundantly proved that the lock originally made by Erbe "was complete and capable of working." The priority of Erbe's invention is clearly shown. It was known at the time to at least five persons, including Jones, and probably to many others in the shop where Erbe worked; and the lock was put in use, being applied to a door, as proved by Brosel. It was the fact, and shown to be so, that once its practical efficacy and utility. (Bedford vs. Cutter, 1 Story's R. 590.) The prior knowledge and use by a single person is sufficient. The number is immaterial. (Bedford vs. Hunt, 1 Mason, 302.)

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NEW BOOKS AND PUBLICATIONS.

THE ANÆSTHETIC REVELATION AND THE GIST OF PHILOSOPHY. By Benjamin Paul Blood. Amsterdam, N. Y.

The author maintains that "there is an invariable and reliable condition (or uncondition) ensuing about the instant of recall from anaesthetical stupor to sensible observation, or 'coming to,' in which the genius of being is revealed." He falls to show the import of this discovery, and indeed seems anxious to return it to its native limbo by smothering it in a collection of meaningless verbiage which no one would attempt to unravel.

A TREATISE ON THE METHOD OF GOVERNMENT SURVEYING, as Prescribed by Congress and the Commissioner of the General Land Office. With Complete Mathematical, Astronomical, and Practical Illustrations. In pocket book form, price \$2.50. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

This volume is likely to prove valuable to students of the important branch of civil engineering of which it treats. It is written in a practical and pointed style, and well illustrated; and it contains the necessary logarithm and transverse tables in a compendious and convenient form.

FUEL. By C. W. Siemens, F.R.S. With an Appendix on the Value of Artificial Fuels as Compared with Coal, by John Wormald, C. E. 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

This is No. 9 of Mr. Van Nostrand's Science Series, and consists, in chief of an excellent lecture to working men by Mr. Siemens, already commented on in our columns.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.) From February 17 to March 9, 1874, inclusive.

- BANK LOCK.—T. B. Worrell, Philadelphia, Pa.
BOLT AND NUT, ETC.—W. J. Reid, New York city.
BRAKE.—W. B. Chapin, Wickford, R. I., et al.
BREECH-LOADING FIRE ARM.—E. Whitney, New Haven, Conn.
CENTRIFUGAL MACHINE.—D. M. Weston, Boston, Mass.
COMBINATION LOCK.—H. Clarke, Baltimore, Md.
DRESSING MILLSTONES.—Chisholm Brothers, Ottawa, Ill.
DRY GAS METER.—T. C. Hopper, Philadelphia, Pa.
GRINDING MILL.—Enterprise Manufacturing Co., Philadelphia, Pa.
LIGHTING GAS.—O. Siebert (of New York city), London, England.
PACKING CHLORIDE OF LIME.—M. L. Bush, New York city.
PRESERVING ANIMAL SUBSTANCES, ETC.—G. Napheysi (of New York city), London, England.
PROTECTING THE EYES, ETC.—J. H. Beardsley, Brooklyn, N. Y.
PURIFYING MIDDINGS.—C. E. Whitmore, Quincy, Ill.
ROTARY HAY TEDDER.—S. Perry, Newport, N. Y.
SHARPENING TOOL.—O. W. Taft, Brooklyn, N. Y.
SNOW CLEARER.—C. H. Perkins (of New York city), Providence, R. I.
STEAM AND SAILING VESSEL.—R. Lo Forte, New York city, et al.
STEAM ENGINE.—J. H. McGhee et al., Kansas city, Mo.
STRENGTHENING GUNS, ETC.—J. F. Allen, New York city.
TREATING SPONGE.—F. S. Devlan, Jersey City, N. J.
WRITING TABLE, ETC.—N. Knight, Auburn, Me.

Recent American and Foreign Patents.

Improved Machine for Cutting Glass in Oval Forms. George Helfrich, Boston, Mass.—This invention consists of a table, on which the glass is secured having on its under side a slotted disk of a trammel or ellipsograph, and supported in a large ring, so as to be revolved to turn the trammel plate around the blocks of the trammel bar, which is held stationary in the frame or base of the machine as to the rotation of the disk, but may have endwise motion; and the trammel supports, by standards rising up from it on opposite sides of the base, a horizontal bar, which passes over the glass-holding plate, and also a holder for the cutter, under which the glass is carried by turning the plate to which it is clamped to cut the glass. By shifting the holder cutter toward and from the center, the

tool is adjusted for cutting different sizes, and by shifting the blocks of the trammel bar, which works in the slots of the disks, toward and from each other, the apparatus is adjusted for cutting ovals of any required form. A rack and pinion are arranged with one of said blocks for changing it. The invention seems to be well adapted for the purpose for which it is intended, and is a vast improvement over any machine previously invented for cutting oval glass.

Improved Tool Holder.

Frank Funk, Beverly, Ill.—This is a handy little tool for carpenters' and pattern makers' use. It consists in a tube having the bore at one end larger than at the other, and one or both ends internally threaded to receive at the larger end an ordinary lead pencil, with which it corresponds in size, and at the small end a scratch awl or a knife blade.

Improved Car Coupling.

Abraham Rust, Vacca, Cal.—The cavity of the bumper extends inward and is fitted with a sliding block, which is held forward by a coiled spring. The coupling pin passes vertically through a hole in the forward part of the bumper, and moves up and down through a tube. A lug on the upper part of the pin projects through a slot in the rear side of the tube, and to it is attached a short chain which is also secured to the rear of a slide which slides in a recess upon the bumper, so that its forward end may pass beneath the lower end of the tube to support the pin when raised to uncouple the cars. To the slide is attached an arm which projects upward into a recess, and is held forward by a coiled spring. A flat spring holds the slide down to its place. As the pin is raised to uncouple the cars, the rear end of the slide is raised from a small pin by the chain allowing the said slide to be pushed forward by the spring beneath the coupling pin. As the link is withdrawn from the bumper head, the sliding block is pushed forward by its spring, so that the small pin may again enter a hole in the slide, and the coupling is arranged to couple automatically as the cars are run together. As the cars are run together, the entering link pushes back the block which carries the slide with it, allowing the coupling pin to drop into place through the link coupling the cars.

Improved Windlass for Presses, etc.

Melancton Bryant, Northport, N. Y.—The holding pawl, by which the windlass is retained while the pawl lever and its pawl are moved back on the ratchet wheel, is constructed in two parts, which are jointed together by a knuckle joint, which closes by rising upward, but is held open by the weight of the pawl, so that when the latter rests on the ratchet wheel, the pawl has the function of an ordinary rigid pawl of one piece. Below is a trip lever for throwing up the joint to trip the pawl and release the windlass. Before tripping the pawl in this manner, the ratchet pawl is thrown back, so that it will not hold the ratchet wheel, and, in order that it may not be struck by the teeth of the wheel and thrown forward again, it is secured by a pin.

Improved Curtain Fixture or Rolling Shutter.

Charles H. Reynolds, Williamsburg, N. Y., assignor to himself and Henry G. Richardson, same place.—A ring of cast iron is made with two notched lugs upon its inner surface, to receive the bolts by which two disks are secured to each other and to the said ring. The disks are made larger than the ring, so as to project beyond it and form a groove to receive the hoisting strap which is wound around the wheel thus formed. The strap is held to support the shutter in any desired position by a clamp consisting of two corrugated cams which are arranged to move exactly together. A counterbalancing weight to the shutter shaft, consisting of a chain, is attached to one end of a strap, which is wound around the shaft, in the opposite direction from the hoisting strap. As the shutter is raised so as to diminish its downward draft upon the side of the shaft, the lower end of the chain comes in contact with the floor, so as to diminish the downward draft upon the other side of the said shaft. In this way the shutter will be exactly balanced, however much or little it may be rolled up, the weight adjusting itself to the weight of the shutter.

Improved Combined Plow, Planter, and Cultivator.

John Urban, Belton, Tex.—Two parallel beams are connected and held at the proper distance apart by straps bolted to them. To the rear part of the beams are bolted two cross beams, the said bolts passing through holes in the beams, and through longitudinal slots in said cross beams, enabling them to be adjusted as required. The cross beams are connected by bars, attached to the upper and lower sides of their ends. There are also two side beams, to the inner sides of which, near their ends, are attached arms which slide along the inner sides of the cross beams, and are secured to said cross beams by bolts which pass through holes through the cross beams and through slots in the arms. The inner ends of the arms are halved, so that they may overlap each other, and are connected by bars attached to them near their inner ends. This enables the side beams to be adjusted wider apart or closer together. The whole forms a convenient frame adapted to be used with planters, plows, or cultivators.

Improved Car Coupling.

Ransom Hemenway, New Cassel, Wis.—This invention consists of a drawbar at each end of the car, which is provided at one side with a strong outwardly curved part, having a laterally sliding spring catch, and at the other side with a broad vertical hook, which enters into the recess between the curved part and hook of the drawhead of the adjoining car by pressing the spring catch sidewise. The spring catch locks over the hook after the entrance of the same into the recess. As both drawheads interlock with each other, a double coupling is obtained.

Improved Draft Equalizer.

Aaron Wilson, Tekamah, Neb.—This invention is a triple tree pivoted at one end to a projecting bar and centrally to a lever, which is pivoted at its opposite end to a link of the double tree, and centrally to a tongue. By this construction the resultant line of draft will run along the tongue, so that there will be no side draft caused by the use of a third horse.

Improved Cotton Bale Tie.

Edwin W. Whiteman, Bayou Sara, La.—This invention is a bale tie made with a hole in one end, loops or bends upon its other end, and with a tongue on its middle part, to adapt it to be used with a wire. The wire is passed around the bale through one of the loops, bent round the tongue, and is sprung into the other loop. When the bale tie has been put under the compress, the end of the wire is sprung out of the loop and tongue, the slack is taken up, the wire is again passed around the tongue, and sprung into the loop, and its end, which is now long, is passed beneath the adjacent tie.

Improved Lever Motor for Converting Motion.

John Stone, Mill Grove, Mo.—The invention relates to imparting mechanical power to a drive shaft through the pendulum movement; and consists in the mode of combining the pendulum with the crank pitman and an actuating lever, so that the leverage is greatly augmented, while the arc of vibration is brought within shorter and more convenient limits, an extra and horizontal lever producing the first, and the mode of connecting the pitman evolving the second, effect.

Improved Watch and Clock Calendar.

Levi Berger, Danville, Pa.—This invention consists in a clock or watch calendar, in which are exhibited automatically the day of the week, the day of the month, the month, and the year, without cog or gear mechanism, and in such a limited space that all may be confined in the cavity of a comparatively thin plate, the device being thus applicable either to a clock or watch.

Improved Pitman Connection.

Andrew J. Van Atta, of Van Atta, assignor of one half his right to George Van Atta, of Newark, O.—This invention is an improved pitman connection so constructed as to throw the force of the stroke to one side or outward, instead of direct, and to enable lost motion and wear to be taken up, and it consists in a pitman connection provided with one or more eccentric V-shaped ring corrugations upon its adjacent surfaces, fitting into each other, but so formed that the points of the corrugations of the one part cannot reach the bottoms or bases of the corrugations of the other part. The parts are secured to each other by a bolt which passes through the center of the said parts. By this construction the force of the stroke will be received upon the corrugations of the connection, and will be thrown to one side instead of being direct.

Improved Permutation Lock.

Joseph G. O'Neill, Grass Valley, Cal.—A spindle extends through the door and lock and projects on each side, and has a knob at each end for turning it. Arms on this spindle are inside of the lock case, for throwing back a plate, which withdraws the spring latch bolt. The arms are also to turn a disk for shifting combination rings. All these rings have a notch, and said notches must be adjusted to coincide with prongs of the plate, to allow said plate to be withdrawn for pulling back the bolt. A conical cap is screwed into a hole in the door latch, through which the notches of the rings can be seen when in the right position for allowing the latch to be pulled back. When this cap is removed, the numbers on the dial plate and the number of turns and parts thereof, and the directions for turning the spindle, to set the rings so as to ascertain the numbers for the combination can be readily ascertained by turning the rings till the notches are seen through said opening, and noting the turns and the numbers whereat the pointer stands when the notches are seen. To open the lock at night, when the pointer and the figures of the dial cannot be seen, four deep notches are made in the dial plate equidistant from each other in the circumference, and a series of holes corresponding to the numbers on the dial. These are to guide a feeler to the hole for stopping the pointer at the right number.

Improved Boring Machine.

George W. McCready, Petticoe, Canada.—The object of this invention is to provide an improved boring machine, which is to be used in the manufacture of brushes, or for making the internal mechanisms of musical instruments, or for drilling holes into a number of articles made of iron or other metals, or for such other purposes where a number of holes are required to be bored at fixed intervals. Three borer plates are perforated according to the pattern of the article to be bored, and two of them are placed into the case, through which the front parts of the borers are inserted. The third plate is then placed upon the heads of the borers which are made with any one of the approved bits in common use, each being provided at its rear part with a collar and an oblique crank. The collars hold the borers in position on the second borer plate during use, while the oblique cranks turn the borers. The parallel position of the cranks while turning prevents their interfering with each other, no matter how many be used or how closely they are arranged together. As the borers rotate without advancing, it is necessary to feed the articles against them by mechanical power. For this purpose a feeding apparatus is employed, into which the articles are readily placed and removed, while they are at the same time firmly clamped to prevent their splitting during the boring operation.

Improved Cotton Press.

Matthew Hussey, Troy, Ala.—The object of this invention is to furnish, for the use of cotton planters and others, a powerful press, by which cotton and other material can be rapidly and closely packed. The invention consists of a plunger block operated by pivoted levers in connection with suitable pulleys or windlasses. The upper ends of the levers are of wedge shape, and connected at the pointed extreme ends by a strong hinge. Their lower ends are attached, by strong ropes, to pulleys or windlasses, and by lowering and lifting them the machine is operated. The beam levers transmit the motion to the plunger rods and block, and press the cotton or other material closely into the packing box. The plunger block is raised above the packing box by pressing in an upward direction, the plunger rods yielding and supporting the block above the box till the same is filled with the material to be pressed. The block is then brought down into the box, and the levers applied in the manner described.

Improved Car Coupling.

Walter Stiles, Bloomfield, Iowa.—This invention consists of an elbow-shaped frame, arranged on the drawhead so as to hold up the coupling pin above the link; also to hold the link up level, or a little inclined, so as to enter the drawhead of an approaching car, so that, when the two cars come together, the two frames will push each other forward at the top, so as to release the coupling pins, and let them fall through the link, and couple the cars self-actingly. Full description and illustration of this device will be found on page 195 of our current volume.

Improved Iron Fence.

George Forsyth and Moses R. Counter, Seaforth, Can.—The gate posts and others to which the braces are attached, and which are of iron, are placed with their flat sides parallel with the line of fence. The intermediate posts are placed with their flat sides at right angles to the line of fence. All these posts are perforated for the wire, and the wires are keyed in the intermediate posts to prevent longitudinal motion. The braces are riveted to the end posts, and they reach to the adjacent intermediate posts, and have a toe which passes through a mortise in the latter. All the posts pass through a mortise in angle stakes. This angle stake adds very materially to the support of the fence, and counteracts the effects of the wind. Wire rails are stretched between the posts.

Improved Automatic Gate.

Winston W. Gilbert, East Enterprise, Ind.—To the upper part of the rear cross bar of the gate is attached an eye through which passes a rod, the lower end of which is pivoted to the post, and its upper end connects with a bow, the ends of which are attached to a block pivoted to an arm. The block rocks freely upon its pivots, and to it are attached levers projecting upon the opposite sides. The rod in its movements operates a short lever which acts upon another rod, and draws the latch close to the cross bar of the gate, withdrawing it from a catch, and allowing the gate to be swung open by the movement of the rod first mentioned. As the levers are operated to open the gate, the first effect is to raise its forward end, which frees it from the stops, and allows it to swing freely in either direction. A block is attached to the post, just above the angle of the latch, so that the gate cannot be opened without first withdrawing the said latch. This prevents the gate from being raised and opened by stock. The gate may be raised to allow small stock to pass beneath it, in which position it may be supported by a suitably arranged bar.

Improved Station Indicator.

Daniel H. Close, New York city.—An endless belt passes over rollers and is held taut by springs. By suitable construction, when a rod is drawn back, a cam is released from a pawl, and it is caught by another pawl, allowing a spring to revolve one roller one half a revolution. As the rod is released, the pawls move forward and the roller completes its revolution, bringing the name of the next station into view. One end of the cord connecting with the rod is attached to the bell cord passing from the engine through all the cars of the train. The other end of the cord is attached to a spring roller attached to the rear end of the rear car, and which is designed to take up the slack of the bell cord as the cars are stopped or backed. When the train is about to leave a station, the engineer pulls the bell cord toward the engine. This draws the cords and draws back the pawls, allowing the roller to make a half revolution; then, as the bell cord is released, the rollers complete their revolution and the name of the next station is displayed.

Improved Harvester.

Jacob D. Martin, Frazeyburg, O.—This invention is an improved harvester, so constructed as to deposit the cut grain in the rear of the machine, and at such a distance from the standing grain as to be entirely out of the way of the machine in its next round. By suitable construction, by moving the upper end of a lever to the rearward, the rear edge of the platform rack will be lowered to allow the cut grain to slide therefrom, and, by moving the upper end of the said lever forward, the rear edge of the platform rack will be raised into position to receive the cut grain. As the rear edge of the platform rack is lowered to discharge the grain, a guard rod is moved forward by the same movement into such a position as to receive the falling grain and prevent it from being intermingled with the grain being discharged. As the platform rack is again raised, the guard rod or cut-off is moved back out of the way, allowing the grain to fall upon the said platform rack. As the grain slides from the platform rack, it is received upon the dropper, which is provided with end guards, and is attached to and supported by a pivoted frame. The latter connects with gearing so formed as to swing the dropper back through a quarter of a circle, and then return it to its proper place in the rear of the platform. The movement of the lever to lower the rear edge of the platform also actuates mechanism which swings the dropper, tilts it, and thus drops the grain. The dropper may also be operated automatically, and without its being necessary to actuate the lever.

Improved Machinery for Forcing and Exhausting Air.

William I. Ellis, Manchester, England.—This invention is an improvement on the well known McKenzie blower, and consists in a cranked shaft and revolving inner and stationary outer cylinder. Quadrants are hinged to the inner cylinder, and caused to oscillate through openings therein by means of radius rods connecting them with the shaft. Thus the inner cylinder acts as a driver for the fans or quadrants, carrying them round with it, and by their operation in the space between the two cylinders, drawing in and forcing out the air.

Improved Harvester Rake.

John J. Dewey, Red Wing, Minn.—This invention is an attachment for harvesters for collecting the cut grain and delivering it in compact gavel either to binders or upon the ground. As a rocker begins its return movement, a chain causes a bar to sweep longitudinally along the forward part of a platform, collecting the grain into a compact gavel against the downwardly projecting end of the inner side bar of the frame. As the bar reaches the inner end of its stroke, a trip rod strikes a catch plate, and allows the bar to move to the rearward across the inner end of the platform, carrying the gavel with it to the rear edge of the platform. As the bar again begins its outward movement, the gavel is left upon a spout attached to the rear edge of the platform, whence it is taken by the binders and bound. The binders sit upon adjustable seats attached to the binders' platform, which is secured to the rear part of the platform frame. By detaching the spout and binders' platform, the gavel may be allowed to drop upon the ground.

Improved Wagon Brake.

Jesse C. Coleman, Clifton, Kan.—There are two brake bars of wood hung to the wagon body by chains. One bar extends across the body and connects with a handle lever. The other and shorter bar moves with its curved end in a staple of the cog bar, and presses, by the forward motion of the lever end of the latter, toward the wheels. Skid shoes are attached to the ends of both bars, so as to be adjustable above or below the hubs of the wheels. A metallic guide bar is firmly applied to the short bar, and extends back over the end of the long bar, serving as support for the same. Chains connect the bars from their points of suspension to a double hook, pivoted in the central axis of the wagon. They serve to keep the brake bars from swinging sidewise off the wheels. The whole brake arrangement may be taken off, and every part easily be replaced.

Improved Lozenge Cutter.

James A. Dingwall, New York city.—By this invention, lozenges may be cut with great rapidity, either by hand or machine power. It consists of a supporting frame, to which a perforated main plate, with tubular cutters is attached. This guides, in suitable holes and recesses of the frame, a perforated spring plate, which passes up around the tubes on pressing the cutter into the dough, and detaches, by its downward motion, the waste parts from the cutter tubes, while the cut lozenges are carried upward in the same.

Improved Running Gear for Vehicles.

William Hemme, Michigan Valley, Kan.—The rear extensions of the front hounds join together at the center, a short distance from the axle, and have a swivel, which connects with the reach by a pivot joint, so that the front and hind parts may oscillate vertically to any extent, and may oscillate horizontally at the center, between the front and hind parts. A spring is combined with the rod and socket of the swivel, so that the draft will be transmitted through it when not too great, so that the irregular resistance of the hind wheels will be less severe on the horses than when positively connected. The axles are also connected by a system of jointed rods, which remain slack, except when the limit of the contraction of the spring is reached, when they come to its aid, and sustain a portion of the draft. By this means, an elastic connection of the two axles is provided for ordinary draft, and an inelastic connection for heavy or sudden draft.

Improved Drying Apparatus.

Benjamin F. Cawthon, Elizabethtown, and Andrew J. Conner, Louisville, Ky.—This invention is applicable to the drying of lumber, peat, or other substances. There are two drying chambers, one of which connects with a furnace so that the products of combustion pass through it. The other is a communication with air pipes in said furnace. Consequently, the heat of the gases, etc., is used in one chamber, and the heat absorbed by the pipes in the other.

Improved Combined Seed Sower and Harrower.

John W. Smith, Nashville, Tenn.—The draft strain is sustained by the axle in such a way that the frame may be raised from the ground for convenience in turning and passing from place to place. Bars are kept constantly moving back and forth as the machine is drawn forward, so that the ground will be thoroughly stirred. These serve, together with the suitably arranged toothed frame and a seed sower of simple construction, as a two way cultivating harrow, for sowing and cross harrowing the seed into the soil.

Improved Method of Preparing Tea for Use.

James Spratt, of the Island of Guernsey.—The tea is to be solidified by placing it in molds of iron, when it is subjected to such a pressure as will reduce it to one third its former bulk, which pressure will reduce the tea to a block, which shall have a smooth glossy surface, and will not crumble. This pressure breaks up the cells or sacks of the tea, so that the strength and flavor in making a decoction can be more thoroughly and much more quickly extracted than is possible when the ordinary loose tea is used. The bottom of the mold and of the follower are provided with V-shaped transverse projections, which enter the tea, and, as the pressure is applied, they pack it more closely, and leave deep transverse grooves in the upper and lower sides of the blocks. The grooves upon the opposite sides of the block should be opposite each other, so that one or more of the sections formed by the grooves may be broken off, according to the quantity required to be used at a time.

Improved Sheet Iron Scoop.

John C. Milligan, New York city, assignor to Lalanc and Grosjean Manufacturing Company, same place.—This improved scoop has a short side and a prolonged one, the whole being formed from one piece of ductile metal. It is made from a cylinder with one closed end, by simply making a diagonal cut thereacross and affixing a handle to the closed extremity.

Improved Stalk-Cutting Attachment for Cultivators.

Samuel Crossley, Rock Island, Ill.—This invention consists of a lever combined with suitable mechanism, so that, when raised, it causes bars to lock and hold the caster wheel suspended. When the lever is lowered, the caster wheel is lowered, to bear upon the ground, and the frame is raised, so that the machine may be turned and drawn from place to place without allowing the cutters to touch the ground.

Improved Paper Pulp Screen and Dresser.

John S. Warren, Fishkill-on-the-Hudson, N. Y.—This invention consists in oblique pulsation plates inclined in relatively opposite directions and rotating at different velocities. In these plates, near their centers, are formed openings to allow the pulp to pass through as it passes toward the discharge opening. To the angles of a screen are attached plates, which project toward the shaft between the oblique plates, and are designed to prevent the pulp within the screen from receiving a rotary movement from the friction of the oblique plates. To the angles of the screen, especially when said screen is made with more than four sides, are attached outwardly projecting flanges, to give the proper agitation to the pulp within the vat.

Improved Manufacture of Halters and Bridles.

Theodore L. Wiswell, Olathe, Kas.—The crown piece passes through a slot of a metallic plate, and is fastened at both ends, being made adjustable. The throat band is passed through converging oblique slots of the plate, riveted, then passed down into a groove of another plate and again riveted. One end of the nose piece is carried through two slots, while through the latter the doubled and adjustable rear strap is passed. The throat band and rear strap are connected by a vertical strap, which is trebled and provided with a ring, at the lower end, for the reception of the halter strap. The connection of the crown piece and the throat band by the obliquely slotted plate prevents the throat band from tearing out while it causes a more easy set on the head, any adjustment of the two leather pieces drawing equally on either.

Improved Trace Fastener.

William Rombaugh and James C. Mears, Olivet, Pa.—A hook is swung up sidewise on a shoulder into the longitudinal direction of the single tree, to the extremity of which it is fastened, in which position the end of the trace may be slipped easily over the pointed end. The hook is then turned over, so as to be under right angles to the tree, and forming a link-shaped piece with a shoulder, from which the trace cannot release itself, being held securely inclosed therein.

Improved Boiler Feeder.

Charles Wright, Catlettsburg, Ky.—A chamber, the upper end of which is made close, has a valve in the middle of its bottom. The valve stem rests against the end of a screw that passes in through the closed end of the case, so that, by adjusting the said screw, the valve may be held to its seat with more or less force. In the valve, upon the opposite sides of the stem are formed two passages, in such positions that they may, by suitable adjustment of the valve, be opposite two of four passages in the bottom. In using the device, it is connected with the boiler at a little higher level than the water line. One passage is connected by a pipe with the top of the boiler; another, with the boiler at the water line; the third, with the water cistern, which must be at a higher level than the device, and the fourth, also with the cistern, to convey away the steam or air from the chamber. To the valve in one passage is secured a pipe, the upper end of which projects nearly to the closed upper end of the vessel, so that water may pass into and steam or air out of, and also that water may pass out of and steam into, the said chamber without the two streams interfering with each other. The movement of the valve is limited by a stop pin attached to its edge, and which strikes alternately against a stop pin on the bottom. By this construction, as the valve is turned so as to make the passages correspond, respectively, with the third and fourth ports, the water will flow, by its own weight, into the chamber, while the air or steam in said chamber escapes into the said cistern, or some other receiver. When the valve is so adjusted as to make the passages correspond, respectively, with the first and second ports, the water will flow, by its own weight, into the boiler, while an amount of steam escapes into the chamber.

Improved Machine for Raking and Baling Hay.

John Trout, South Pass City, Wyoming Territory.—One side of a triangular case is hinged to the rear edge of the top, and is provided with short spring teeth at the lower edge, so as to constitute the rake for gathering the hay in front as the apparatus is drawn along the ground. A packing or stuffing fork, also pivoted and arranged in front of the side, is swung forward from time to time by a lever, to press the hay gathered in front of the rake into the case. It can be lifted up when swung back to pass over and drop behind the hay gathered up during a movement forward for stuffing the case. A couple of strong ropes are connected to the swinging side and are provided with clutches geared to the axle, so as to be turned by the horse to force the side on the case for pressing the hay and forming the bale. The tying cords are attached to the lower edge of the swinging side and passed around the interior of the case over spring holders, from which they can be readily detached, also over a rod, which can be pulled out to release them, and around the edge to a shaft having a hand crank by which they can be drawn tightly around the bale for fastening it.

Improved Perch for Dumping Cars.

George Richards, Boston, Mass., assignor to himself and Albert Thayer same place.—This invention is a perch for railroad dumping cars, by which the drawheads may be arranged at standard height, being stiff and strong enough to support the rocker bed from its ends, and avoiding the continuous annoyance from rotting of the parts and consequent rocking of the cars. It consists in making the perch of the dumping car of two bars of channel iron, T beam, or other form of iron, and fastening it laterally, in such a manner that the draw rigging passes between them, and the whole structure becomes stiffer and stronger.

Improved Well Boring Apparatus.

Alfred White Morgan, Brownville, Neb.—The invention is an improvement in well borers of the class in which a spiral flanged auger is arranged to be operated by a sweep or other suitable device, and to be raised from the well to discharge the earth loosened by, and packed upon, the spiral flange. By suitable construction, by turning a crank, the driving shaft will be raised from the journal of a drum, and by turning another crank, the driving shaft will be carried over the boring shaft with which it is coupled, an arm enabling it to be readily guided into place. The arrangement is also such that, when the cutter encounters a stone, the boring shaft is slightly raised, so that the cutter may pass over it and again enter the ground at its other side, and so on until the cutter passes beneath the said stone and thus removes it. A flat steel plate, twisted into spiral form, and made pointed, serves as a bit to force its way into the soil when the cutter does not enter the soil freely. A hollow cylinder, of such a size as to slide up and down freely upon the boring shaft, and to which is attached a spiral plate, receives the dirt from the cutter and carries it out of the well hole. Devices are provided which prevent the possibility of the carrier being overloaded or clogged, and from being turned by the pressure of the dirt against the spiral.

Improved Harvester Rake.

William M. Howe and George H. Howe, Lansing, Mich.—This improvement in the raking apparatus consists of teeth arranged to project from the rake head up through slots in the apron, and to swing down horizontally at the beginning of the backward movement to pass under the grain accumulated on the platform during the forward movement. The teeth then swing up and are locked automatically at the beginning of the forward motion, so as to carry the grain forward.

Improved Cotton Chopper.

William J. Johnson, Spring Place, Ga.—In the inner sides of wheels are formed grooves arranged in the form of an equilateral triangle with curved sides. These gradually increase in depth from angle to angle, so that there will be a shoulder at each angle of the groove. This form of the grooves carries the cutters upward, outward, and again downward into position to make a level cut when the ends of levers drop from the shoulders of the said grooves. To the forward ends of the levers are attached the cutters by which the cotton is cut. Springs connect the forward parts of the levers with the frame, and are so arranged as to draw the cutters inward with a sharp and forcible blow to chop the cotton as soon as the rear ends of the levers reach the shoulders of the grooves. The wheels may be adjusted so that the cutters will both operate at the same time or alternately.

Improved Speculum.

Gustave W. Schumacher, Portland, Me.—This invention consists of a single adjusting screw and nut only, in combination with the arms of the speculum plates for forming the latter. The screw-jointed to one of said arms, passes through the other, and receives the nut outside, so that the arms may be forced together, and the plates forced apart by screwing the nut upon the screw. This arrangement gives a wider range of movement to the inner ends of the plates, so as to have either one extend beyond the other, which is very useful in some operations.

Improved Process of Waterproofing Paper.

Ambrose G. Fell, New York city.—This invention is a process of treating paper for paper collars, cuffs, bosoms, show cards, window shades, and other uses, so that it will resist the action of moisture; will not mildew, change color, or otherwise decompose; will require less coloring matter; will add brightness to the colors used and render them insolubly fast; will render it capable of being more readily polished by friction, and will require much less material for enamelling it than ordinary paper. It consists in treating sized paper with a solution of alumina in sulphuric acid, and afterward in a solution of carbonate of soda, or other precipitant of alumina, in water.

Improved Pruning Shears.

John C. Seger and John Hollingsworth, Jr., Mooresville, Ala.—These pruning shears consist of a main lever, having a curved stationary blade and guard and a sharp curved beveled cutting lever blade and operating lever. A compound lever purchase is obtained on the cutting blade, and a drawing out is given its edge by the location of the fulcrum pin. The guard is rigidly attached to the stationary blade. Its face is on the plane of the faces of both the blades, and it guides and supports the thin beveled cutting blade and prevents it from twisting.

Business and Personal.

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

For Sale very cheap—Gear Cutter for clock wheels up to 14 inches. B. F. Hope, Sag Harbor, L. I.

Wanted—To know the names of some party or parties who manufacture a machine to shave the hand rived Shingle. T. B. Slade, Whiteville, N. C.

The "Little Monitor" Sewing Machine is the greatest achievement of the age. It uses the commercial Spool without rewinding, & makes three kinds of stitches. Agents wanted. G. L. Du Laney & Co., 709 Broadway, N. Y.

Wanted—Situation by a young Millwright in a Machine Draughting Room under instruction. References furnished. Address F. S. W., care H. Watters, M. E., Akron, Ohio.

An experienced Mechanical Draughtsman from Glasgow, wants employment. Address G. S., 701 Chestnut St., Philadelphia, Pa.

Lovell's Family Washing Machine, Price \$5. A perfect success. Warranted for five years. Agents wanted. Address M. N. Lovell, Erie, Pa.

To Capitalists—To be sold, one half of patent Steam Street Car. Will put a car on the road for the benefit of all concerned. For particulars, address W. W. Crane, Auburn, N. Y.

Brass Castings of superior quality. Send your patterns to Bailey, Farrell & Co., Pittsburgh, Pa.

Wanted, by a Mechanic who has had Experience in Manufacturing and Selling—now going to California—the Superintendency of a Factory, or the agency of some good article not yet introduced there. Address Business, P. O. Box 468, Schenectady, N. Y.

Wanted—To correspond with dealers in manufactured Suncas. Address Geo. Johnston, Caldwell, Burlington Co., Texas.

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S's query as to the weight of the locomotive does not give sufficient data.—W. H. C. is referred to p. 130, vol. 25, for directions for building an ice-house. Galvanized iron will do for maple sugar utensils.—M. M. does not send anything new in his note on the cycloid.—B. M. will find the description of a waterproof cement for leather on p. 133, vol. 25.—A. S. B. can try watch glasses in his scales.—A. G. M. will find full descriptions of paper mache decorations on p. 15, vol. 27.—R. H. F. can harden screw plates and dies by the process described on p. 75, vol. 25.—G. H. W. can find recipes for vinegar on p. 58, vol. 35. This vinegar will keep for an indefinite time in a tight cask. Acetic acid is C2 H4 O2.—W. H. K. cannot remove the tattoo marks from his arm.—T. C. W. A gallon of water contains 27.74 cubic inches.—S. S. will find a full description of nickel plating on p. 91, vol. 29.—A. J. S. will find the pantograph fully described and illustrated on pp. 99, 179, vol. 28.—E. S. G. will find that meerschaum is fully described on pp. 73, 99, 193, vol. 26.—G. H. will find the answer as to galvanized water pipes on p. 570, vol. 26.—See also p. 264, of the same volume.—P. should address the Girard College, Philadelphia, Pa., where free technical education and maintenance is given to orphans.—J. W. W. will find the description of the fireless locomotive on p. 118, vol. 27. For a red indelible ink, see p. 129, vol. 28.—O. A. F. will find a description of blasting powder on p. 190, vol. 30.

E. K. W. B. says: I. I have a barrel of molasses that was made from white corn which soured last summer from the effects of hot weather. Can it be put to any use? A. We know of none. 2. Can fish, such as herring, put up in oil in barrels, be of any use, as the fish and oil are dissolved together? A. The oil might be distilled off from them, and used for illuminating purposes.

A. N. asks: How can I kill birds, when caught alive, for preserving, without injuring their looks? A. By suffocating them in a closed box with a little burning sulphur.

T. P. D. asks: Can zinc be plated with brass without a battery? A. We know of no such process.

R. C. C. asks: How can I make artificial ivory? A. Make isinglass and brandy into a paste with eggshells very finely ground. Pour the paste into a mold, which must be well oiled, and leave in till dry. Collodion with oxide of zinc makes another form of artificial ivory.

E. S. asks: How is percussion priming for gun caps made? A. The fulminate of mercury is generally used for this purpose. It is made as follows: 25 grains of mercury are weighed out and put in a half pint pipkin and 1/2 oz nitric acid, of specific gravity 1.42, is added, and a gentle heat applied. When the mercury is dissolved, hold the pipkin at arm's length and put in quickly 5 drams by measure of alcohol of specific gravity 0.87. When the heavy white cloud which arises has ceased to form, fill up with water, allow the fulminate to settle, and pour off the liquid acid. Collect the residue on a filter and wash till the water no longer tastes acid. This should be taken when it contains about 20 per cent water, and mixed with 2-5 its weight of oil, on a marble surface with a wooden muller. A little of this paste should be put in each cap, and a thin coat of varnish put in to keep the fulminate from moisture.

C. L. W. asks: Which are the largest and purest diamonds known? What are their weights in carats? Is the Koh-I-Noor the largest known diamond? A. The largest are the Pitt diamond (now in France) weighing 410 carats when uncut, 136 cut; the Koh-I-Noor (in England) weighing 186 carats before it was recut; a very large one in Borneo, said to weigh 367 carats; and the enormous stone belonging to the Portuguese crown jewels, but there are doubts as to its genuineness, no one being allowed to see it. It is reported to weigh 430 grains. The Koh-I-Noor is, we believe, the purest of these gems.

W. H. says: Mr. Editor, Please send me A receipt to make Stove and boot blacking I want to make it during Vacation of school if I make any money I will pay you or make you a present. P. S. I am 8 going on 9 years old. A. For stove blacking, use plumbago. For boot blacking, take 1 part ivory black, 1/2 part molasses, 1/2 part sweet oil, 1/4 part hydrochloric acid. Dilute each ingredient with three times its water before mixing.

W. H. C. asks: 1. What are the best driers for paint? Are litharge and sugar of lead good? A. Those named are excellent. 2. I used litharge and sugar of lead, and it ran into very hard lumps in the paint, and effervesced for a length of time. What was the reason? Probably they were not properly made, and sufficient care was not used in mixing. 3. What is the most durable paint for galvanized iron for inside work? A. Use the ordinary paints.

J. P. G. asks: 1. What are the mechanical difficulties in constructing an achromatic lens? A. In so grinding the surfaces of the simple lenses, by whose combination an achromatic is produced, as to cause a perfect union of the rays of different refrangibilities, and produce white light. 2. Where can the flint and crown glass, suitable for a lens 8 or 10 inches in diameter, be obtained, and what would be the probable cost? A. From Alvan Clark, of Cambridge, Mass. 3. Must a lens to be correct be ground to a perfect curve, that is, a segment of a circle? A. The curvature must be perfect. 4. How long should the focus of an 8 inch achromatic lens be? A. This would depend upon the material and form of the parts of the lens. 5. If I strike a circle, 10 feet in diameter, and take a portion, 8 inches from the side of the line, to represent the lens, would a line drawn from the edges of this to the center of the large circle be the focus of this lens, or would it reach the opposite side of the circle? A. At neither point.

J. L. S. asks: 1. What will make soft water hard? A. Lime. It will render the water not palatable. 2. What shall I use to destroy the solvent properties of water? A. Solvent powers cannot be destroyed. Some other less powerful solvent must be used. 3. Can you tell me what chemical substance I shall inject into a tree, to destroy it at this time of the year? A. A solution of chloride of zinc.

W. G. B. says: It is said that the method of refining gold, now used at the United States mint, is a Chinese secret for which the government has paid a sum with the understanding that it shall not be divulged to any one but the refiner at the mint. Is there any truth in the assertion? A. We believe not.

R. B. R. asks: I. To whom and how does the Agricultural Department distribute seeds and bulbs? A. It distributes them when a written application is made in proper form. 2. I have a red scar on my cheek caused by a wound. Can the red color be removed? A. We think not. 3. What is cryolite used for? A. For the manufacture of caustic soda, of alum, and of cryolite glass or hot cast porcelain, which is composed of silica, 67-19, cryolite, 23-84, and oxide of zinc 8-97 per cent. 4. Will ink mold quicker in one kind of a bottle than in another? A. No.

J. W. asks: 1. How can I make an electric machine so that the armature can be kept in constant motion when the current of electricity is on, so that it will ring a bell, like a burglar alarm? A. By using a mercury interrupter such as is employed in an induction coil. 2. How is dualin made? A. Dualin is a mixture of nitro-glycerin with sawdust or wood pulp, as used in paper mills, both previously treated with nitric and sulphuric acids. 3. What makes the strongest battery? A. A compound battery in which nitric acid is used with a platinum plate in the inner porous cell, and dilute sulphuric acid with a plate of zinc in the outer cell.

P. J. B. asks: How can scrap paper or rags be reduced to a pulp for the manufacture of paper? A. The process is as follows: 1. Cutting the rags by knives suitably arranged in a machine. 2. Cleansing them from dust and other impurities by a sifting machine. 3. Boiling with an alkaline lye or solution of 4 to 10 lbs. of carbonate of soda, with one third of quicklime to 100 of the material.

H. O. P. asks: Why is it that heat from the sun in passing through glass will warm a person, but does not heat the glass? A. Because glass is diathermanous, or allows the rays of heat to pass freely through it, just as it is transparent, and allows the rays of light to pass through it. It does, however, arrest some of the heat, and is proportionately warmed.

T. S. asks: 1. Will a magnet lose its power if kept near a piece of steel, say within about one sixteenth of an inch? A. No. 2. When a magnet loses its power, how can it be charged? A. By rubbing it with another magnet, or by placing it in the axis of a helix through which a galvanic current is passing. 3. What is the best non-conductor to place between a magnet and a piece of steel? A. A short interval of space.

R. S. H. asks: Why does not the secondary current from an induction coil magnetize? A. The secondary current is transient, and is itself in part derived from the magnetization of temporary magnets.

R. E. W. asks: How can I construct an oxyhydrogen microscope? A. By using a calcium light in front of a series of condensing lenses, which will converge the light upon the object placed nearly in their focus, and supported upon the stage of a microscope. The light and condensing lenses in this case take the place of the illuminating mirror in an ordinary microscope. The image is projected by a suitable objective moved by a rack and pinion, the tube of the microscope and the eyepiece being left off.

W. H. B. asks: Is there any kind of solution by which wool and woollens may be bleached by putting them through a bath, as well as in the ordinary way of bleaching with fumes of burning brimstone? A. Yes, by means of chlorine.

M. M. asks: 1. Is there any gas that I can substitute for coal gas in a chemical laboratory? A. Not conveniently or economically. 2. Can I use hydrogen? A. Not for general purposes. 3. Is there a safe way of making a good gas out of petroleum? A. Your best plan would be to purchase one of the numerous forms of machines already made for this purpose. 4. Will commercial zinc do for a Bunsen battery? A. Yes. 5. Could I make coal gas answer my purpose? A. Coal gas is universally employed in laboratories. 5. What would the apparatus cost? A. No estimate could be given until the quantity of gas desired is known.

G. G. asks: Can you give me a good recipe for invisible ink? A. Ink made of a weak infusion of nut galls will be invisible until it is moistened with a solution of sulphate of iron. You will find information about your questions on electricity in Noad's "Text Book of Electricity." Dussauce's "Practical Guide for the Perfumer" will give you information in regard to the other questions.

E. D. E. asks: 1. Has the government or any society offered a premium for making a try square that will square a block perfectly? A. No. 2. Does the earth turn on its axis 365 times in 365 days? A friend of mine says it only turns 364 times. Which is right? A. The solar or apparent day is the time of one revolution of the earth on its axis. Solar days are of different lengths, sometimes longer and sometimes shorter than the civil day. Hence, while the earth would make 355 revolutions in 365 solar days, it might lack a little of having completed its 365th revolution in 365 civil days. You can readily determine whether this will happen in any particular period by consulting the Nautical Almanac.

M. B. says: It has been stated that a lighted candle held near the prime conductor of an electrical machine furnished with a point will be nearly blown out by the current of air furnished by the escape of the electricity. Is not this a conclusive proof that electricity is matter in actual movement, and not a mere vibration of the adjoining particles of matter which do not move from their places? For example, would it be possible to blow out a light by placing it alongside of a row of adjoining balls and then striking the ball at the extremity of the row? A. It is not the motion of electricity that blows out the candle; but electric repulsion being produced in successive particles of air by contact with the point, they make a draft in moving away. The nature of the electric force is no more involved in the mechanical result of its action than is that of gravitation in making a body fall or heat in running a steamboat.

C. B. A. asks: 1. How is the expansion and contraction provided for in the great bridge at St. Louis? A. We do not think that any provision is made. 2. Will wire rope work in pulleys subjected to heavy pressure, and stand the wear and tear better than common sea-grass cable? A. Yes, if the pulleys are properly turned. 3. What power does it take to cut 1/2 inches plate iron with shears? A. To find the pressure required for shearing wrought iron in pounds, multiply 50,000 by the thickness of the plate and this product by the length to be sheared, both dimensions being expressed in inches.

L. S. P. asks: 1. Is there any longer a question as to the theory of the earth's internal heat? A. The evidence as to the internal heat of the earth is everywhere accepted as conclusive. 2. Does hydrostatic pressure in artesian wells depend on the degree of heat found in them? A. No.

K. asks: Is there such a thing as a fixed unit of time in music? A. No. The metronome numbers now affixed to classical music are attempts to establish such a standard, but the speed at which music is performed must vary with different conductors, and even with the same conductor at different times.

C. F. asks: I. What is Draper's process for silvering glass? A. A solution of nitrate of silver and Rochelle salts is applied to the glass, a film of metallic silver being deposited. 2. Does it give a perfect reflecting surface as seen through glass, as well as on its exterior surface? A. Yes.

J. P. asks: How can I make yeast? A. Take 6 ozs. hops, 3 gallons water. Simmer, strain, and (in 10 minutes) stir in 2 gallons ground malt; then re-bell the hops in water, as before, and let the strained liquor run into the first mash, stir up, cover, and leave for 4 hours. Drain off the wort, and when the temperature has fallen to 90° F., put in 1 pint of yeast, and stand for 24 hours in a warm place. Take off the scum and strain through a sieve.

G. B. asks: 1. What form of battery is considered the best and is most used by the great telegraph companies and others in large numbers? A. Grove's and Daniell's. 2. Which is most used by electro-platers? A. Smee's.

J. D. D. asks: Having an engine that runs our nail factory and will not run up to the speed with less than 90 lbs. to the inch, if we speed our engine at one fourth, maintaining the same speed to our factory as before, can we run with less pressure? If so, how much? A. You can run with less pressure, in all probability, but you do not send enough data to enable us to determine how much.

H. G. says: I. I have been trying to make some violet ink from aniline, but I cannot get rid of the bronze which appears upon the pens or upon the inkstand. It appears to crystallize, forming a bronze color when dry. Can you tell me how to destroy the bronze without injury to the color itself? A. No. 2. Can you recommend some good work upon aniline? A. "On Aniline and its Derivatives," by M. Reimann.

N. L. F. asks: With what velocity does air flow into a vacuum? A. About 1,300 feet per second. Send a list of the back numbers you require.

T. asks: Why is there so much more difficulty in keeping the fire going when the sun shines on the stove than when the window is darkened with a blind? A. You are mistaken if you suppose that the striking of the window makes a difference.

H. asks: How can I make objects in telescope vision look right side up? If I put in another lens of the same size and focus (size 1 1/4 inches diameter and 4 inches focus) where in the tube should it be placed? A. See Dick's "Practical Astronomer"

J. R. M. Jr. asks: What is the cost for an object glass for a telescope and eyepiece, the object glass to be 3 or 4 inches in diameter? A. Relative prices of the best American objectives are 3 inch, \$40, 4 inch, \$100, 5 inch, \$230, 6 inch, \$350.

G. N. L. says: I wish to construct a transit for obtaining the time of day at noon on a new plan; and if I can obtain in New York what I want for the purpose, I think I can succeed. I want a concave reflecting lens of about 12 to 15 feet focus, and about 2 inches in diameter. I think a glass slightly concave on one side and convex on the other, silvered like a looking glass on the convex side, would answer my purpose. I propose to mount that on bearings perfectly level, and have the sun's rays strike the concave side of the glass and throw an image of the sun on a black object (like rubber) with 5 parallel lines directly south of the lens. I propose to do away with the tube, and by increasing the focal distance, make a large disk diaphragm at the focal point. What do you think of the plan? A. Your proposed reflecting sundial would be cheap, but inferior to a home made transit.

E. E. asks: Is there any evidence of the horse being aboriginal on the North American continent? Have its fossil remains ever been found, and if so, where? A. Although it is certain that the horse was extinct when North America was discovered by Europeans, it is certain that the animal inhabited this country during the post-pliocene period, contemporaneously with the mastodon and megalonyx. Fossil remains, chiefly molar teeth, have been frequently found, especially in the Southern States.

A. M. Z. asks: Do you know of anything that will prevent the leaves of a scrap book from curling, after an article has been glued or pasted on. A. There should be no curling if the book is put under pressure immediately after the pasting.

E. H. S. asks: Do you know of any good composition, or liquid substance, for dipping or washing coiled steel springs, that will make a thin, dry surface, not sticky, and that will prevent rusting as long as the spring shall last? A. A wash of copper may answer.

W. J. D. asks: To run a Woodworth planer (to plane and match 12 inches wide) and a 12 inch saw, how large an engine will be required? A. These questions are rather indefinite; but for ordinary work, an engine capable of developing from four to five horse power of useful work will answer.

B. asks: Why is it that wood, well glued together, is stronger at the joints than at any other part? A. Because the glue is stronger than the wood.

L. C. M. asks: 1. At what part of a steam boiler is the pressure the greatest? On the bottom, owing to the weight of the water, or is it equal at every part of the boiler? A. Greatest at the bottom. 2. What is the rule for determining the length and breadth of the ports of the steam chest of a steam engine, when we know the area? A. Generally it is best to make the ports as long as possible. Having fixed upon the length, divide the area by the quantity, and the quotient will be the width.

H. C. says: In a 10 horse power threshing engine, the valve rod was bent by some accident which broke the outside part of the eccentric; a new piece was procured, and the new valve adjusted by a good mechanic of several years' experience. The engine is controlled by a steam rod raising and lowering the governor stem. When steam is shut off (in gassing back, rolling on logs, etc.), the engine runs spasmodically, alternately fast and slow, doing this most when steam is low, the spasms being at longer intervals and of greater violence. When a good head of steam is on, they are closer together, and the difference in speed is not so great. Can you account for it? A. We can seldom give anything but a guess about cases of this kind, as personal examination is generally necessary. We think the trouble may be in some of the connections of the governor, which stick at certain positions of the balls.

G. C. B. asks: 1. How can a cast iron kettle, badly cracked at bottom, be mended? Patching with boiler iron will not do, owing to unequal expansion. A. Castings are sometimes mended by burning the parts together. 2. Would the boiler of a 5 horse power horizontal portable engine, of the locomotive pattern, be large enough to bring 3 barrels water from 60° to 212° in 1 hour, the steam escaping into the water through perforated pipe? A. Yes, if the boiler can be worked up to the power stated. 3. Would it be consistent with economy, and quicker, in making soda crystals, to lead an electric current through the concentrated clear solution of soda ash? A. Probably not. 4. What is the lowest density of solution at which soda will crystallize at temperatures of 32° and 90°? A. From 30° to 32° Baumé. 5. In your No. 7, current volume, sulphide of cadmium is mentioned as a good material for coloring soap; what color would it give? A. Yellow. 6. Can I make a lighter colored soap by boiling in it a small quantity of oxalic acid, or would the causticly neutralize the bleaching effects of the acid? A. Try the experiment.

L. H. B. asks: 1. Will a round chimney, 25 inches in diameter inside, give as good draft as a square chimney 3 feet square? I am told that, in a square chimney, the corners are not utilized. A. Probably not. There does not seem to be much difference in the draft of chimneys having the same cross section, whether round or square. 2. I have an engine with two cylinders 2 inches in diameter x 3 inches stroke. What size shall I make a copper boiler to generate steam to run it to its full capacity, heated by spirit lamps? What is the proper thickness for the copper? A. Allow from 20 to 25 square feet of heating surface per horse power.

J. W. A. says: I have a spring distant from my house about 600 feet, and about 90 feet lower, on a gradual descent. The spring furnishes water to fill an inch pipe, with about 6 feet fall in 150 feet. Can any means be devised to carry the water to the house other than a ram, for which I think the flow of water is not sufficient? A. If a ram will not answer, you probably cannot employ any hydraulic motor.

C. O. W. asks: How much can air be compressed? If I take a body of air, say 10 cubic feet, to how small a body will this have to be compressed in order to get 100, 500, and 1,000 lbs. pressure to the square inch, respectively? A. If the temperature is kept constant during the compression, the pressure will vary inversely as the volume, so that the volumes at the pressures mentioned will be: At 100 lbs. pressure, 1/10 cubic feet; at 500 lbs., 1/50 of a cubic foot; at 1,000 lbs., 1/100 of a cubic foot.

R. L. M. asks: What are the relative heating powers of wood (oak, ash, and hickory) and bituminous coal? How many lbs. of coal will generate the same amount of heat as a cord of wood, in approximate figures? A. A ton of coal is equal to from 1 1/2 to 2 cords of wood.

W. L. B. & S. asks: How can we build a furnace for burning coal under a plain cylinder steam boiler, 30 inches diameter x 10 feet long? The stack is already built, and is about 30 feet high. Size inside, 14x 16 inches. A. Set it in brickwork, with the flue running the whole length underneath, the grate surface being from 7 to 10 square feet.

E. F. U. asks: What weight is there on the hangers of steam boilers in addition to the weight of cold water, when the gage indicates 75 lbs. per square inch steam pressure? For instance, boilers are two thirds filled with cold water, fires are kindled till 75 lbs. pressure is obtained; is the strain then any greater on the hangers by which the boilers are suspended than before? A. The contents of the boiler do not weigh any more when steam is raised than before.

S. L. M. asks: How many cubic feet of heating surface are there to a boiler of one horse power? A. An ordinary allowance is from 12 to 15 square (not cubic) feet per horse power.

J. A. S. asks: How much more back pressure is there in the rotary engine than in the ordinary reciprocating engine? In your opinion, would such an engine, with an adjustable cut-off (by the governor), be practicable, and would it use steam economically? A. We have seen no account of experiments that will enable us to answer these questions.

G. C. P. says: I. In a quartz mill, we run in the daytime only. Recently, when I stopped the engine, I opened the pet cocks at each end of the cylinder as usual. I saw a stream of electricity coming out of the pet cock with the steam. What was the cause of it? I have tried it over again with the same result. A. It is due to friction. 2. I have some gold that has a coating of sulphur on it; the gold is very fine dust. What chemical can I use to destroy the sulphur? A. Heat it in a retort. 3. Is there anything that I can add to water so as to cause a substance of the specific gravity of 4 to sink, and allow one of a specific gravity of 2.5 to swim? A. We do not know of any.

J. H. asks: 1. How can I tune up an E flat piccolo which is a little flat, the tuning cork being in all the way? A. Get a longer cork made, or put a piece of sole leather on the old one. 2. What can I pad the keys with? A. Chamol's leather.

J. H. L. asks: What is the difference between a relay magnet and a sounder magnet? How can I make a relay magnet? What size of wire shall I use? A. A relay is an instrument which receives the circuit current, and brings a local battery into play. You will find the needed information about different forms in Noad's "Text Book of Electricity."

E. says: 1. Will it add to the power of a cheap telescope (p. 7, vol. 30) to increase the diameter of the object glass, say to 2 inches? If so, of what focus ought it to be? A. A non-achromatic object glass of two inches aperture must be of over 10 feet focus; eyeglass, 1.88 inches focus; power 63. (Huyghens). Achromatic lenses are now made so cheaply that a five dollar spyglass should give a good view of the moon, planets, and wide double stars. 2. Would it do to use a compound eyepiece (one composed of 4 glasses) for the eyepiece of such a telescope? A. Yes; for star-gazing the two front lenses of the erecting eyepiece should be removed. 3. If used as a spyglass, of what power would it be? A. The magnifying power is found by dividing the focal distance of the object glass by that of the ocular. 4. Would it diminish the power to use a concave glass for the eyepiece, so as to show an object right side up? A. Yes.

J. asks: How can I put the wavy appearance on a nickel top plate for an American watch movement? A. By polishing with a fine oil stone. There are also machines for the purpose.

H. D. M. asks: 1. In canning maple sirup what shall I put in to prevent it from crystallizing? A. If properly prepared, it will contain sufficient water to prevent crystallization. 2. What solution shall I use for a bath in nickel plating? A. The double sulphate of nickel and ammonium. 3. How shall I clean surfaces for electroplating? A. In a weak solution of acid. 4. I have telegraph wires running from dwelling house to office. I use a very weak battery. The wires are well insulated. I oftentimes hear the instrument click when there is no one near to break the circuit. A. It is due to atmospheric disturbances, strong enough to overcome the power of your battery.

E. G. says: Suppose a fore bay to be 20 feet wide, 21 feet long, with any depth; the breast fronts on a pond extending back or up a creek; is there any difference between the pressure on the breast and side, or is the pressure equal on each side and the breast? A. The pressure per unit of surface is the same on breast and sides, and will be the same, whatever the size of the pond may be, provided the water level is maintained.

H. C. N. asks: 1. What causes the Indian summer? A. It would probably be difficult to assign any reason. 2. Is glycerin soap good for the complexion, and is there anything better? A. We suppose it is as good as any soap. 3. Is bathing the face in milk good to smooth the complexion? A. It is generally so considered. 4. What will remove black worms from the face? A. Purification of the blood. 5. What is the longest lived animal? A. Among fishes the whale, or reptiles the tortoise, and of quadrupeds the elephant. 6. How can I make good sand soap for the hands? A. Take old yellow soap 2 parts, silver sand 1 part, scent to taste. Melt the soap and mix in the sand, afterwards adding the scent, and make into balls.

G. B. asks: 1. What weight will a rope, 1 1/2 inches in diameter, bear, supposing one end to be fastened to a girder, and the weight hung on the other end? A. Between 9,000 and 10,000 lbs. 2. If we have a pulley block suspended to a girder above, with three sheaves in the block, and the lower block with two sheaves, which of course would require five spans of rope to reeve the blocks, should we have the strength of five ropes, or three only? A. Disregarding friction and the rigidity of cordage, the relation of power to weight in such a system is as 1 to 5, so that the tension of the rope will be 1/5 of the weight.

W. D. B. asks: 1. How is a belt laced with two rows of holes? A. A good plan is to commence at each side simultaneously, first lacing through the inner rows of holes, either singly or doubly, and then through the outer. 2. What is the cause of kerosene coming out on the outside of lamps when they are not full, and what will remedy it? A. We did not know that this ever happened.

H. W. H. asks: 1. How is artificial blood for stage use prepared? A. By mixing rouge and water. 2. What is the enclosed? It is used, combined with bisulphuret of carbon, as shoemaker's glue, for patching without stitches. A. The substance enclosed consists of gutta percha. 3. Is there any book on practical pharmaceutical manipulation? A. Consult the catalogue of a publisher of medical works. 4. Can a competent person pass an examination and receive a diploma as graduate in pharmacy without attending lectures? A. We hardly believe it possible, if the institution is first class.

G. & G. ask: 1. In there a steam crosscutting machine for crosscutting logs in the woods, light enough to draw from tree to tree? A. Yes. 2. What would be the necessary boiler room for a 4 inch cylinder with 12 inches stroke, 1/2 cut-off, working at 50 lbs. pressure, and 200 revolutions per minute. A. There is no settled rule, applicable to such small engines.

A. Y. M. asks: 1. What makes a good cement to stop water from running out between smoke stack and smoke arch? A. A strong hydraulic cement may answer. 2. What would be a good substitute for a safety plug in crown sheet? Could a wooden plug be used for a short time? A. It would not be very reliable. 3. Does the main pin on a locomotive wear round or flat? A. Generally the effect of wear is to give the pin an oval shape.

J. B. asks: Is there any way of finding the number of yards in a rolled piece of goods without unrolling it? A. It might be determined, approximately, by weighing a yard of the material used, and then the whole bundle.

J. C. S. asks: What is good to put in a boiler to keep the water from foaming? The water is hard. A. Tallow has been recommended.

J. C. asks: 1. What is required of a machine, to be a veritable perpetual motion? A. It must be one which works without the application of any external force. 2. I have a machine which runs constantly without stopping, has the power to drive a sewing machine, and is set in motion by cold (not running) water. What do you think of it? A. We cannot form any opinion from this description.

W. G. B. asks: 1. Is there any method by which lime can be burned with crude petroleum? A. We have not heard of any such process. 2. Would a barrel of petroleum equal a cord of wood if perfect combustion is kept up? Will it require a blower? A. The total heat of combustion of a pound of petroleum is equal to between two and three pounds of that of dry wood. We do not think that a blower would be necessary.

M. F. C. says: I have a fine pair of tweezers that by accident came in contact with a magnet and are unfit for use. What can I do to remove the magnetism from the tweezers? A. Apply to them a strong magnet in reverse of polarity.

H. J. M. replies to the many correspondents who ask for a paste that will fasten paper to bright tin: A. Take 2 lbs. flour, 1 quart water, 2 ozs. tartaric acid, 1 pint sirup molasses; boil together until stiff.

N. L. says, in reply to A. G. C., who asked how to temper taps: Polish the tap bright, and hold in the center of a red hot platen or other piece of iron with a hole in it, without touching. By this means you can obtain any desired color.

L. B. says, in reply to A. McR.: The press for copying letters by pressure between moist sheets was first used by Murdoch, assistant to James Watt and the first user of coal gas for illumination.

W. says, in reply to H. N. who enquires about teaching parrots to talk: Perhaps H. N. would be glad to know that bird fanciers teach birds to repeat various words and phrases by waking them up in the middle of the night and repeating to them the words they wish them to learn, two or three times over, and then leaving them perfectly quiet. I have been informed that this method is practiced by many bird fanciers.

J. O. S. says, in reply to C. H. F., who asks why, in his base burning stove, a substance continually drips from the horizontal pipe, and asks what it is: I have had the same trouble, but always in stoves that had no feeders. I have found the same results with both wood and soft coal; I have had no experience with hard coal. In each case the stoves burnt with slow combustion, and but little heat passed up the pipe. In some cases I have found the cause to be a weak draft, occasioned by other stoves leading to the same flue. In others, by the cold air of the room coming in contact with the exterior surface of the pipe, thereby cooling it and causing the moisture in the smoke to condense and form a watery substance, referred to above. I have overcome the difficulty in two ways; first, by putting the pipe in the reverse way, so that the drippings would continue to flow until they found their way on to the stove where the heated plates immediately dry the moisture. This I have done in churches and halls where long pipes were used. In other cases I have enclosed the smoke pipe with a tin jacket, thereby protecting it from cold air.

S. says, in answer to W. D., who asked: Which is the deepest artesian well in the world? We have an artesian well in St. Louis nearly or quite 2,600 feet deep, from which flows a clear stream of white sulphur water, at a temperature of 70° Fah.

C. L. F. says, in reply to W. P. S. P., who asked: If the foundation of the centennial tower should give way 1/2 of an inch on one side, how much would the top of the tower move? It would swing 6 inches from its original position.

C. L. F. says, in reply to W. H. D., who asked how much of the earth's surface could a person have in view from the top of a tower 400 feet high: 2,033-248 square miles. The distance from the outer edge of the field of view to the top of the tower in a straight line would be 24-437 miles.

C. A. N. asks: 1. What is the best mode of preparing and covering wooden wheels with emery? A. Cover them with glue. We think, however, that solid emery wheels will be quite as cheap, and far more satisfactory. 2. What kind or number of emery is best suited for grinding carving and similar knives, and for darning the same? A. You can obtain full information from a dealer.

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

J. P. G.—The rock is bituminous shale. F. C. S.—Your specimen is gypsum; on burning, it is converted into plaster of Paris.

E. D. L. asks: Is there any material that can be mixed with fire clay to prevent its cracking, when applied to an oven?—J. W. G. asks: What is the greatest depth below the earth's surface ever reached, and where is it?—H. C. R. asks: Can any one give me a plan for making an apron for a double-ended ferry boat?—R. J. asks: What are the ingredients and *modus operandi* of making candy of white sugar?—S. G. N. asks: Is there any plan, either by packing in dry sand or otherwise, by which lemons, oranges, and peaches may be kept for any length of time, especially in warm weather?—J. H. P. says: Astronomers tell us that the earth's ages past has been gradually cooling, but the glacial theory necessitates the belief that the earth was once much colder than it is at present. Has any attempt been made to reconcile the two theories?—R. H. F. asks: How can I test squares with the dividers, to tell whether the angles are 90° or not?

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 Crocheted Stick for Detecting Water and the Precious Metals. By J. H., and by H. B. M.

On Ventilation. By J. R. L.

Or Oiling Safe Locks. By J. S. G.

On Kepler's Third Law. By G. B. G.

On Canada Thistles. By P. E.

On a Theoretical Perpetual Motion. By L. L.

On Ventilation. By C. G. V. P., and by J.

On the Vital Principle, and on a Mathematical Formula. By J. B.

On a Rat Trap. By J. H. P.

On Wheat Growing in Minnesota, etc. By —.

On a Waterproof Dress. By J. P.

On an Improvement in Spectacles. By G. V.

On the Wear of Journal Boxes. By C. D. S.

On Nerve Force. By I. R.

On the Pons Asinorum. By F. S.

On the Beech Blight. By C. G. C.

Also enquiries and answers from the following:

C. W. P.—S.—B. D. L.—S. W.—O.—J. A. M.—X. Z.—

D. B. W.—F. W. S.—J. H. P.—J. T.—R. E. G.—E. P. L.—

E. W.—W. H. N.

Correspondents in different parts of the country ask who makes a mud digger, to be used in shallow water? Who makes garden seed sowers? Who makes pill box and match box machinery? Who sells small portable forges? Who furnishes feather renovators, and at what price? Who makes machines for cutting veneers from the round log? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

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WERE GRANTED IN THE WEEK ENDING

March 10, 1874,

AND EACH BEARING THAT DATE.

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Valve, direct acting engine, H. Jamieson.....	148,462
Valve, well tube check, M. B. Squires.....	148,387
Vat, fermenting, Sleeman & Steel.....	148,381
Vehicle axle lubricator, W. Jones.....	148,308
Vehicle axle wooden washer, C. W. Saladee.....	148,506
Vehicle hub, C. W. Saladee.....	148,507
Vehicle, pleasure, C. W. Saladee (r).....	5,787
Vehicle, pleasure, C. W. Saladee.....	148,501, 148,502
Vehicle running gear, C. W. Saladee.....	148,497
Vehicle, seat, A. B. Scheffer.....	148,329
Vehicle spring, C. W. Saladee.....	148,504
Vehicle wheel, C. W. Saladee.....	148,503, 148,505
Vehicle wheel, W. Carr.....	148,283
Vehicle wheel, E. W. & D. Davis.....	148,422
Vehicle wheel, S. D. Forbes.....	148,438
Vehicle metallic washer, C. W. Saladee.....	148,498
Vessels, raising sunken, A. Sowerbutts.....	148,333
Vessels, center board for, T. Hartley.....	148,454
Wagon body, N. B. Cooper.....	148,351
Warmer, nut, Price & Wade.....	148,434
Water cock, C. B. Zimmerman.....	148,542
Water wheel, C. Redfield.....	148,384
Water wheel, W. Whitney.....	148,311
Well tube check valve, M. B. Squires.....	148,387
Whiffletree, G. R. Edwards.....	148,453
Wood polishing machine, J. C. Fish.....	148,457
Yarn spool guide, Draper & Bancroft.....	148,287

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

- 28,644.—PUMP.—N. S. Bean. May 27.
- 28,670.—RAILROAD BRAKE.—N. Hodge. May 27.
- 28,851.—FOG ALARM.—C. L. Daboll. June 10.

EXTENSIONS GRANTED.
27,438.—BLACK WASHING MOLDS.—W. Ferguson et al.
27,438.—TIMBER BENDING CHAIN.—L. Heywood.
27,456.—COVERING SKIRT SPRINGS.—J. T. Loft.
27,473.—TURNING LATHE.—W. Sellers.
27,625.—LANTERN.—A. Tufts.

DESIGNS PATENTED.
7,233.—BURIAL CASE.—G. Albin et al., Cincinnati, Ohio.
7,234.—SLEIGH-BELL STRAP.—W. E. Barton, East Hampton, Conn.
7,235.—SOAP CAKE.—J. Burns, New York city, et al.
7,236.—SHUTTER FASTENER.—C. B. Clark, Buffalo, N. Y.
7,237.—BLIND HINGE.—C. B. Clark, Buffalo, N. Y.
7,238.—GATE HINGE.—C. B. Clark, Buffalo, N. Y.
7,239 & 7,240.—TYPES.—H. Henburg, New York city.
7,241.—TUMBLER.—S. McKee, Pittsburgh, Pa.
7,242.—TYPES.—E. C. Ruthven, Philadelphia, Pa.

TRADE MARKS REGISTERED.
1,561.—TOMATOES.—Anderson et al., Camden, N. J.
1,562.—FRUITS, ETC.—Anderson et al., Camden, N. J.
1,563.—GLASSWARE.—R. Douglas & Co., New York city.
1,564.—WHISKIES.—Friebery et al., Cincinnati, Ohio.
1,565.—CHINA, ETC.—W. Grange & Co., Philadelphia, Pa.
1,566.—SHIRTS.—Marley & Co., Newark, N. J.
1,567 & 1,568.—KID GLOVES.—E. Ridley & Son, N. Y. city.
1,569.—MEDICINE.—M. A. Simmons, Iuka, Miss.

SCHEDULE OF PATENT FEES.

On each Caveat.....	\$10
On each Trade Mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
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On appeal to Commissioner of Patents.....	\$20
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On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (3 1/2 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.
LIST OF PATENTS GRANTED IN CANADA, MARCH 12, 1874.

3,187.—I. M. Rose, Brookhaven, Suffolk county, N. Y. U. S. Improvements on embroidering attachments for sewing machines, called "Rose's Improved Embroidering Attachment." March 12, 1874.

3,188.—William Beeman, Selby, Lennox and Addington county, Ont. Improvements on farm and garden fences, called "Beeman's Portable Fence." March 12, 1874.

3,189.—J. H. Livingston, New York city, U. S. Improvements in the process of making cheese, called "Livingston's Cream Cheese." March 12, 1874.

3,190.—V. H. Felt, Brantford, Brant county, Ont. Improvements on self rakes attachable to reaping machines, called "Felt's Self Rake." March 12, 1874.

3,191.—A. Soper, New York city, U. S. Improvements on a machine for drying grain, called "Soper's Grain Dryer." March 12, 1874.

3,192.—P. Brotherhood, No. 15 Elgin Road, Notting Hill, Middlesex county, England. Improvements on triple cylinder engines and pumps, called "Brotherhood's Triple Cylinder Engine and pump." March 12, 1874.

3,193.—G. Booth, Toronto, Ont. Improvements on fire extinguishers, called "Booth's Improved Fire Extinguisher." March 12, 1874.

3,194.—R. M. Wanzer, Hamilton, Ont., assignee of T. Hall, Northampton, Hampshire county, Mass., U. S. Improvements on sewing machines, called "Hall & Wanzer's Improved Sewing Machine." March 12, 1874.

3,195.—J. S. Tibbets, Jeffersonville, Clarke county, Indiana, U. S. Improvements on fire extinguishers, called "Peerless Fire Extinguishers." March 12, 1874.

3,196.—P. D. Roddey, New York city, U. S., assignee of W. F. J. Tuters, same place. Improvements on system and apparatus for ventilating and pumping vessels, and sounding fog and other alarms, called "Thier's Automatic Ship Ventilator, Fog Alarm, and Bilge Pump." March 12, 1874.

3,197.—E. Dégagné, Quebec, P. Q., and P. Brousseau, same place. Manière nouvelle et utile de faire les moppes au lavettes, nommée "Lavettes Prosper." March 12, 1874. New and useful mode of making mops.

3,198.—N. A. Beack, T. N. Rider, and H. M. Rider, Standstead, Standstead county, P. Q. Improvement on tyre iron for wheels, called "Beach & Rider's Improved Tyre Iron." March 12, 1874.

3,199.—G. Macfarland, Toronto, Ont. Improvements in step ladder locks, called "Macfarland's Step Ladder Lock." March 12, 1874.

3,200.—T. Northey, Hamilton, Ont. Improvement in coal cooking stoves, called "Northey's Improved Dampers for Cooking Stoves." March 12, 1874.

3,201.—L. J. Mervesp, Dobbs Ferry, Westchester county, N. Y., U. S. Improvements on horse shoes, called "Mervesp's Improvement in Horse Shoes." March 12, 1874.

3,202.—I. Arnold and J. C. Bates, Scott Township, Ontario county, Ont. Improvement in the ball and socket joint, called "Arnold & Bates's Ball and Socket Joint." March 12, 1874.

3,203.—I. Y. Smith, Pittsburgh, Alleghany county, Pa. U. S. Improvements on air ejectors, called "The Steam Condensing Air Ejector." March 12, 1874.

3,204.—D. Bourgeois, Montreal, P. Q. "Nouvelles et utiles améliorations aux attachements de pompe pour pomper le sable, les graviers, etc., nommées 'Attachements de Pompe pour Pulser du Sable, de David Bourgeois.'" (New and useful improvements to pump attachments for pumping sand, gravel, etc. March 12, 1874.)

3,205.—T. Ruston, Montreal, P. Q. Improvements on paint oils, called "Ruston's Paint Oil." March 12, 1874.

PATENTS

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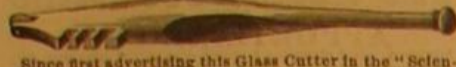
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THE MITCHELL SAFETY STEAM GENERATOR.

Among the many and varied forms of steam boilers which have appeared of late years, few, we think, will awaken more curiosity and interest among engineers and mechanics than the apparatus to the illustration and description of which we devote our initial page. It consists essentially of a rotating cylinder, disposed transversely over the fire, into which water is fed in a state of fine division, through a small pipe which runs through the axis, and through the length of the chamber. The revolution of the cylinder is effected by suitable mechanism in connection with the engine to which, with the other devices regulating water supply, etc., detailed reference is made below. Although the idea of generating steam in quantities by the direction of fine streams of water upon highly heated surfaces has been sought to be applied in various ways, experiments in that direction have met with little success, and certainly have not attained the practical results which the inventors of the present generator seem to secure by their system.

Referring to the engraving, the cylinder, A, which is constructed of ordinary boiler iron, riveted, rotates on friction rollers under the trunnions, P. Into this, water is injected by means of the steam pump, B, through the feed pipe, C. The latter passes through the axis of the cylinder, and is plugged at its extreme end where it rests upon the trunnion. At D a check valve is provided which prevents the return of the water to the pump. F is the pipe which conducts the steam to the pump, through the regulating valves, G and H, the latter of which is set to close at the required pressure of steam, and so stop the motion of the pump. The valve, G, serves a similar purpose whenever the steam is lowered twenty-five pounds below the desired pressure in the generator. The overflow valve, I, is set at the same pressure as the valve, H. The steam passes through the stationary steam pipe, K, in the packing box through pipes, L L, and is discharged at M, to the engine or wherever required. Bolted to the flange of one trunnion is a worm gear, O, which rotates the cylinder by means of a belt from the engine on the pulley. A steam damper regulator is attached to the damper in the smoke pipe at Q, the weight on the lever of which is so set that the damper will close on a required pressure of steam being obtained. Before the fire is started, three or four inches of water are admitted into the generator by working the pump by hand. After steam is up, the pump is actuated by the pressure and is subsequently self-regulating.

No further description is, we think, necessary to insure a comprehension of the mechanism of the invention, as the parts are quite simple and their uses easily apprehended from our illustration. It remains, therefore, to consider the merits and practical advantages which the inventors claim for their device.

We have already pointed out that the pressure of water entering the cylinder may be regulated at will. Let it be supposed that this is fixed at sixty pounds per square inch. It is clear that, as long as the pressure of steam within the generator is below this limit, the entering flow will continue, but the instant it arrives at or exceeds the same, then the supply must cease. The water seeking a vent will then re-

turn into a reservoir beneath the valve, until the steam pressure falls below sixty pounds, when it will again re-enter the cylinder. If, however, the full steam-producing capacity of the boiler is being used, the rapid withdrawal of steam will diminish the pressure to, say, thirty-five pounds; hence, again the water will continue flowing out at a pressure of twenty-five pounds—the difference between sixty and thirty-five—and feed in just sufficient quantity to maintain a steady supply. The inventors, therefore, claim that the generator is perfectly secure against explosion, because the supply of steam is constantly made equal to the demand, and because the pressure cannot exceed that of the limit set by adjusting the valve which admits the water; and this adjustment may be set at the highest pressure which it is safe for

dense, it is carried around by the rotation of the cylinder, and literally, before it has time to settle, is blown out of the trunnions by the force of the steam. The inventors inform us that new boilers clear themselves of dirt or chips left in them after manufacturing, and that the interior of a cylinder, after two years' continuous use, on examination, presented the appearance of perfectly new iron.

The saving of fuel effected is claimed to be one third. That a certain amount, whether greater or less than thus estimated, must be saved is evident, both from the non-formation of scale, and from the fact that there is no large body of water, or even a quantity of flues, etc., to heat to 212°, before a particle of useful steam is obtained. Only the iron itself has to be raised to a suitable temperature, and steam will at once be produced, an operation occupying hardly a minute of time after the water is turned on, or barely twenty minutes after starting fires. Moreover, the water is kept in constant agitation, and thus the formation of steam is again expedited. In a word, the force is made as it is required, and not stored up in a reservoir—a point which seems to us to set forth more clearly the advantages of the system than any other we have adduced. The apparatus is easily managed, occupies about two thirds of the space of the ordinary tubular boiler, and weighs one quarter as much.

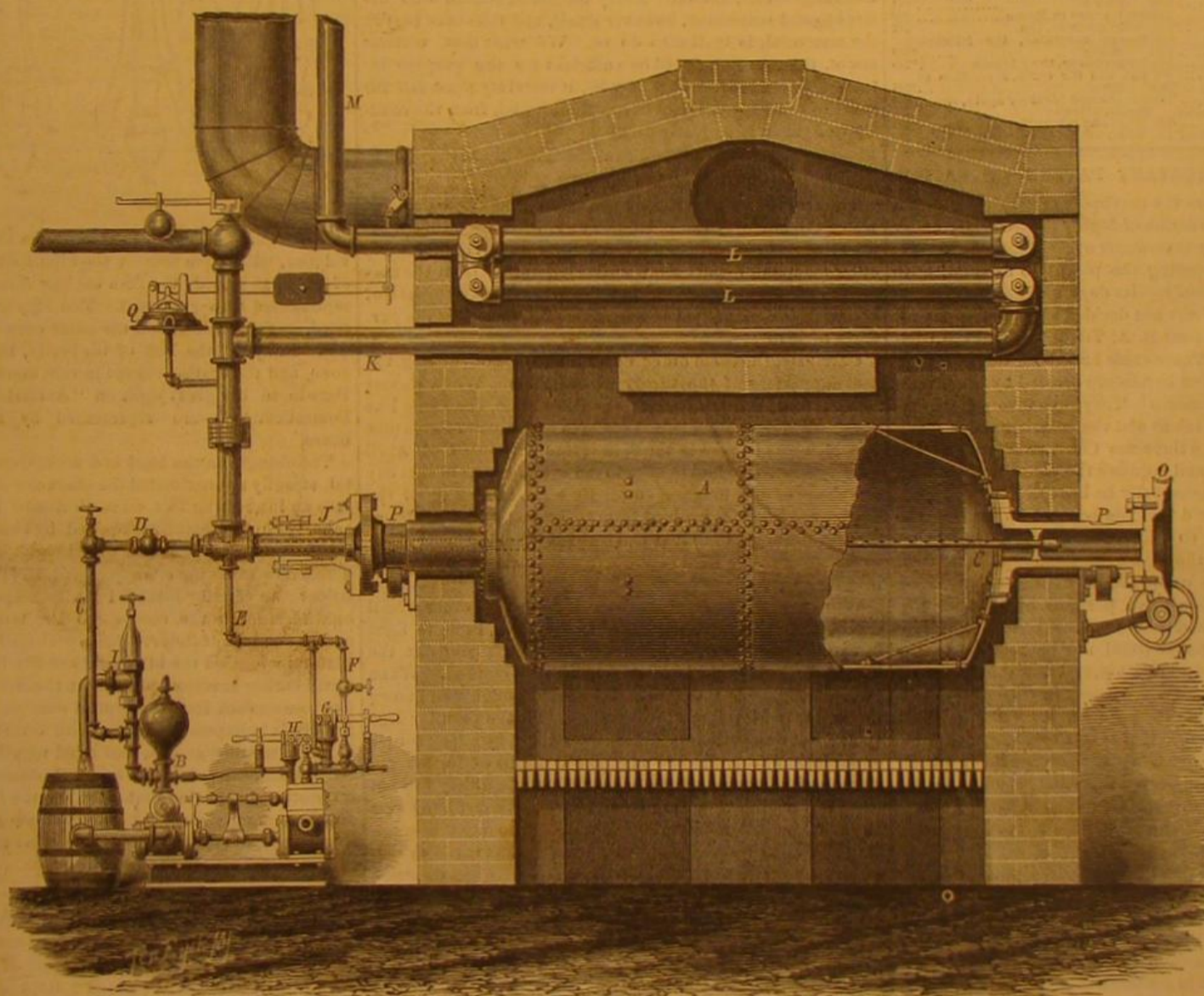
We recently had occasion to inspect one of these boilers in actual operation at the Empire Laundry, one of the largest establishments of its class in the world. The proprietors state that the generator, which is 6 feet 6 inches long by 3 feet 8 inches in diameter, has taken the place and does the work of two return flue boilers, each 2½ feet long by 4 feet in diameter, having two 14 inch flues in each.

It has also effected a saving of thirty per cent of fuel, although the capacity of the drying closets in the laundry has been doubled. With the old boilers 65 pounds of steam were needed to keep up 116 revolutions of the engine. With the Mitchell generator, 45 pounds pressure to the square inch in the boilers is found to be sufficient. The engine used is rated at 50 horse power.

For rights of territory, further information, etc., address the inventors, Messrs. T. & T. H. Mitchell, No. 329 East 53d street, New York city.

If You "Go West," Young Man.

To both single and married men in the East who have decided to go West, we would whisper in their ears one thing which, if heeded, will be of value to them. It is this: Avoid a too common error, that of puffing yourselves up with the notion that you are going West to show the natives how to work; that out there you will be looked up to as somebody unusually smart in your line. The Western people estimate a man by what he really is as a mechanic, and do not give him credit for what he is not. True, if you are heralded as a workman of superior skill, they await your coming anxiously, and will lay nothing in the way when you have stripped off your coat and are one among them. But the moment it is discovered that you have been overestimated, all your pleadings about "how they do it East" will avail nothing. Hundreds of instances have come under our observation wherein workmen from the East have gone West inflated with conceit, and, when they were put to the test, were found almost worthless.—*Carriage Monthly.*



THE MITCHELL SAFETY STEAM GENERATOR.

the boiler to undergo. There are two results which the entering water can produce; first, if the cylinder be highly heated, steam will be made as fast as the water is supplied. But, as we have already stated, the moment the fixed pressure is exceeded, the overflow valve opens, and the supply is stopped until the steam is worked off sufficiently. The other result is the reverse of this, and consists in flooding the cylinder, when the same is not hot enough to make the steam. This necessarily cannot produce explosion, while, to obviate the difficulties which might be caused by the overplus, the valve is so set that the superior pressure of water above it, exceeding that of the steam below, brings it to its seat, thus stopping the water supply. The water in the pipe, C, it will be observed, is continually surrounded by steam, and is also heated by the exhaust, so that it is, the inventors assert, always kept at the boiling point.

The generating cylinder rotates over the fire at a speed of about two revolutions a minute; thus, it is claimed, heating the iron of which it is composed to an equal temperature throughout, so that even expansion and contraction necessarily follows. The crown sheet and other metal around the fire box of ordinary boilers, as is well known, usually first deteriorate, owing to their being subject to unequal contraction and expansion, due both to the excess of heat there applied over other portions of the generator, and to the shifting of the water line. The form of the present apparatus, it is claimed, necessarily precludes this defect, and hence its durability is largely increased. The generator, in fact, has no water line, and is all steam space, so that scale cannot form therein. When the foreign matter in the water becomes

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NEW YORK, SATURDAY, APRIL 18, 1874.

Contents:

Table listing various articles such as 'Absorption of chemical rays by the sun's atmosphere', 'Agassiz in the laboratory with...', 'New books and publications', etc., with corresponding page numbers.

DECISION OF AN IMPORTANT PATENT LITIGATION.

For nearly twenty years the monopoly of making glycerin from fatty bodies by the action of highly heated water under pressure has been held by the owners of the Tilghman patent; and various parties, supposing the patent to be valid, have paid tribute to the monopoly.

The Supreme Court held that the scientific witnesses who were examined differed so widely in their testimony that they gave little aid to the Court in settling the question. The Court was therefore compelled to depend chiefly upon the comparison of the descriptive portions of the specifications, and came to the conclusion that the results and process claimed by the patentee could not be realized in the manner described in his specification.

The defendant only needed three hundred pounds to the inch to make his process successful.

In so simple a matter as the effects of hot water upon grease, it would seem as if scientific experts ought to be able to give intelligible information to the Court.

Chemical and mechanical experts were examined as witnesses on both sides in about equal numbers. Those called by the complainant expressed the opinion that the patented process may be applied, by the means and in the mode of operation described in the specification, so as to accomplish useful results, and of a character to give commercial value to the new product.

Most of the expert witnesses made experiments in applying the process, and in the course of their examination were required to state the results of the same as supporting their opinions; but experiments made, as most of these were, with small apparatus, admitting only a small charge of the fatty substance or mixture to be treated, are not entitled to much weight in determining such an issue.

Taken as a whole, the evidence convinces the Court that the patentee never did succeed in introducing his invention into practical use, by the means and in the mode of operation described in the specification, to such an extent as would warrant the Court in finding that issue in his favor.

In another column we give a brief resumé of the findings of the Court.

THE AGASSIZ MEMORIAL.

No more fitting monument of the great naturalist so lately passed away can, we think, be reared than that which already exists in the Museum of Comparative Zoology at Cambridge. Begun by him and for years the cherished work of his life, the collection has grown steadily in extent and value until at the present time its renown is worldwide.

Agassiz labored as a teacher, but not from books nor of the learning of others, but rather as one who, a preceptor in the truest sense of the term, points out to his pupils the means by which they may question Nature for themselves and obtain their knowledge from her infallible responses.

THE GENESIS OF THE HORSE.

The specialized structure of the small group of animals, of which the horse is the chief member, used to form one of the strongest supports to the theory of specific creation. No other mammals depart more characteristically from the average type, and none seemed to show more positive proofs of design in the adaptation of the modified parts to suit the purposes of man.

Curiously, the same order of animals is now among the best supporters of the theory of evolution. When Cuvier found, in the tertiary beds of the Paris basin, the horse like yet characteristically distinct remains of the palaootheria (one of which was figured in the SCIENTIFIC AMERICAN of April 4), they seemed to him to offer to the evolutionists of that day a problem of the toughest sort.

With the progress of geological discovery, other fossil forms, more or less closely allied to the horse, came to light in various parts of the world, and with each addition the line of descent seemed to be more clearly marked. When Darwin wrote his "Origin of Species," enough was known to justify, to his mind, the hypothesis that the peculiar legs and feet of those animals had been produced by a long course of variations from the less specialized forms of former periods; and he expressed the belief that, though they had not been, and might never be, discovered, the intermediate forms had made a continuous series.

In his annual address before the London Geological Society, in 1870, Huxley reviewed the case as it stood at that time, making out a tolerably complete lineage, connecting the horses of today with the fossil horses of the quarternary period, the hipparion of the later tertiary, and the anchitherium of the middle tertiary, or miocene period.

In his fourth lecture before the Lowell Institute, Boston, of which we print a resumé on another page, Dr. Brown-Séguard observes that the study of the facts relating to the brain has led him to believe that "each half of the brain—paradoxical as it may seem—is a whole brain," each lobe being normally competent to perform all the functions of both, not so vigorously, of course, as the two acting together, yet with apparent completeness.

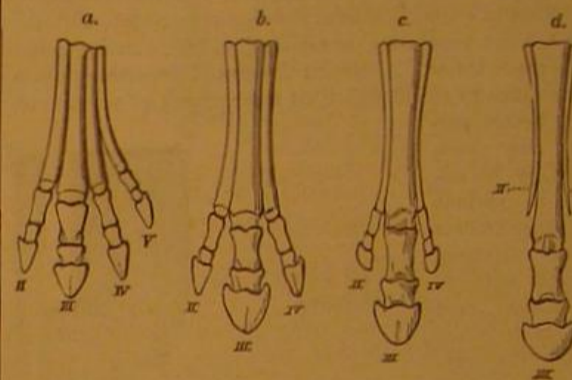
The intimation has been justified by the discoveries of later years, especially in our own country, where the line of descent appears to be more direct and the record more complete than has been found in the Old World. It reaches clearly to the eocene period; and the remains already known supply—

as pointed out by Professor Marsh in the current number of Silliman's Journal—every important intermediate form.

The natural line of descent would seem to be through the following genera: Orohippus of the eocene, miohippus and anchitherium of the miocene; anchippus, hipparion, protohippus, and pliohippus of the pliocene, and equus of the quarternary and recent.

The development in size, from the earliest form to the latest, was something remarkable. The orohippus was about the size of a fox. The miocene forms were as large as a sheep. Hipparion and pliohippus equalled the ass in height; while some of the quarternary equine forms rivaled the modern dray horse.

The nature of these changes is shown in the accompanying diagram, showing the forefeet of the typical genera of the series.



The orohippus had all four digits on the fore foot well developed, with three toes on the hind foot. In the miohippus of the next period, the fifth toe has disappeared, or is only represented by a rudiment. The hipparion, as already noticed, has three toes, but the outer ones have ceased to be of use.

The changes in the head and neck, though less fundamental, steadily approximated the character of the modern horse. It is an interesting fact, adds Professor Marsh, that the peculiarly equine features acquired by orohippus are retained persistently throughout the entire series of succeeding forms.

But how came the orohippus with its specialized characteristics? As Huxley looked for a less specialized form than anchitherium in the eocene, so Professor Marsh infers an earlier ancestor of the orohippus, perhaps in the lower eocene, with four toes on the hind foot and five in front, and to this a still earlier ancestor, possibly in the cretaceous period, with five toes on each foot, the typical number in mammals.

Since it is impossible to say with certainty through which of the three-toed genera, that lived together during the pliocene period, the succession came, Professor Marsh makes the interesting suggestion that possibly the later species, which appear generally identical, may be descendants of more distinct pliocene types, as the persistent tendency of all the earlier forms was in the same direction.

THE SUPPRESSED MEMBER AGAIN.

Not long since we noticed some of the manual evils resulting from the customary repression of the left hand, and advocated, on physical grounds, its culture equally with that of the right hand.

It is coming to be well known that mental development is the result of properly directed physical training: that the brain grows in size and power by the varied exercise of the senses and the will in mechanical employments quite as rapidly as by purely intellectual efforts in study or otherwise. It is equally well known to physiologists that most men are one-sided in their heads as in their bodies.

In his fourth lecture before the Lowell Institute, Boston, of which we print a resumé on another page, Dr. Brown-Séguard observes that the study of the facts relating to the brain has led him to believe that "each half of the brain—paradoxical as it may seem—is a whole brain," each lobe being normally competent to perform all the functions of both, not so vigorously, of course, as the two acting together, yet with apparent completeness.

the brain—the right side—the faculty of expressing ideas by speech. If we developed both sides of our body equally, not only would there be the benefit that we could write or work with the left hand as well as with the right, but we should have two brains instead of one, and would not be deprived of the power of speech through disease of one side of the brain."

HOW A GREAT DISCOVERY WAS MADE.

M. Claude Collas, a celebrated French chemist, communicates to *Les Mondes* an interesting paper on how discoveries are made. To M. Collas is due the honor of first recognizing nitro-benzol, or, as it is better known, essence of mirbane, a yellowish oil derived from coal tar, having a very sweet taste and an odor strongly resembling that of bitter almonds, which latter peculiarity has led to its extended use in perfumery. In telling the story of how he found this substance, he says that, during the year 1848, he was engaged in researches with a view of utilizing industrially the quantities of light oil which, having no employment and hence very small value, filled up the cisterns in gas houses. It was at that time worth about one cent a pound. After vainly endeavoring to solve the problem for some time, M. Collas was about to relinquish the task, when it occurred to him to treat the oil in the same manner as gun cotton, that is, with a mixture of monohydrated nitric acid and sulphuric acid. "After the operation, the acids being separated by water," he says, "I was astonished to find at the bottom of my vessel a yellow button. The oil, at first lighter than the water, had become heavier, and hence sunk. I touched it with my finger and rubbed it on my hand, when the strong characteristic odor at once became forcibly apparent. I had found an essence which, at the cheapest, could replace a substance in great demand, and which was worth, instead of five centimes (one cent), fifty francs (ten dollars), a pound."

This discovery of mirbane was, however, only the prelude of the greater one, subsequently made, of the magnificent colors which could be derived from the aniline obtained by its deoxidation by means of nascent hydrogen evolved from iron filings and acetic acid. In 1856 Perkin obtained from aniline the beautiful violet color known as mauve, and since then the dyes thus derived have been produced to such an extent that their value to industry is almost beyond calculation. The little button of mirbane, however, in the modest laboratory of a Parisian apothecary, was the germ from which the whole grand series sprang.

There seems to be a kind of fatality about great discoveries which brings them forth in its own time. Men stumble across valuable ideas, and learn important truths too soon, which lie dead during their life time, only to be appreciated by the world after their death. The history of arts and sciences abounds in examples. Faraday, in 1825, found benzol in the tarry residues of gas works, but that illustrious chemist obtained neither fame nor profit for his discovery, which would doubtless have remained buried in the archives of the British Royal Institution until the attention of the scientific and industrial world was drawn to the chemical properties of the substance, almost forty years later. Again, it often happens that discoveries escape those who are, by accident, placed in the very position to seize upon them. M. Collas cites, as evidence of this, the case of a French chemist who, in 1843, made a yellow dye for silk by the action of nitric acid on coal oil. The peculiar odor of the mirbane, which he must have produced, escaped him, and he failed to recognize the new substance which he had obtained.

THE ORIGINATION OF SCREW PROPULSION.

In our columns of correspondence this week is an interesting letter from Mr. C. H. Delamater, proprietor of the well known Delamater Iron Works in this city, relative to the subject of the first practical application of the screw propeller to marine propulsion. Mr. Delamater considers that the practical establishment of the art is due to Captain John Ericsson, and tacitly takes exception to the reference in our recent biographical notice of Sir Francis Pettit Smith, in which we ascribed a large share of the honor, of introducing the propeller, to that inventor. The subject is a very interesting one, and the issue raised renders a slight historical retrospect necessary to the formation of an intelligent opinion.

It is certain that, for many years previous to the date of either Smith's or Ericsson's patents (1836), experiments had been made proving that vessels could be propelled through the water by means of a screw. But the inventors were either deficient in persistency of effort, or they found that, as is very often the case, the times were not ripe for the introduction of so radical an innovation. It is, therefore, a fact that, when Smith and Ericsson took up the subject, no vessel of the kind was in actual employment; and so far as past experiments extended, the simple fact of their abandonment, or rather non-continuation, held out a prospect for future inventors far from encouraging.

As our correspondent states, Ericsson's patent was obtained about a month and a half subsequently to that of Smith, but while the first trial of Smith's boat was made in May, 1836, immediately on the granting of protection, Ericsson's experiment did not take place until April 30, 1837. The *Orden*, built by Ericsson in the latter year, was undoubtedly successful, but Smith's first vessel was equally so, for she made a voyage of 400 miles, and averaged a speed of 8 knots per hour. Hence, while both ships proved the value of the invention, Smith's was undoubtedly first in so doing, in point of time.

In 1838 Smith's successful operation of his plan before the Lords of the Admiralty resulted in the building of the

Archimedes, and the making of a long voyage around England and to various points of Europe. In 1840 and 1841 the *Rattler* was built for the navy, and in the same years merchant vessels were constructed at Newcastle, Londonderry, and Hull. These ships were fitted with double-threaded screws set in the dead wood. Ericsson's vessels, however, had the blade screw, similar to that now employed. It will be seen that the course of the two inventors was very nearly parallel up to 1839, when Ericsson built the *Stockton* and started her across the Atlantic. The successful completion of that voyage resulted in the purchase of the vessel by the Delaware and Raritan Canal Company, and her subsequent use as a steam tug in the Delaware and Schuylkill rivers. While Smith was comparatively successful at the outset in gaining the support of the British authorities, Ericsson was not so. In fact, however, of heavy odds, he was the first, as our correspondent states, to place a boat in actual commercial use in England, equally the first similarly to introduce screw propulsion in America, and also in France. Bourne, in his "History of Screw Propulsion," in summing up the respective merits of Smith and Ericsson, leans to the side of the former in ascribing the weight of praise. Ericsson, he says, had the advantage of being a skilled mechanical engineer, while Smith was merely an amateur; but in almost the following sentence he renders the effect of this assertion nugatory, by stating that Smith accepted expedients known to engineers as his starting point, and hence submitted to the use of gearing in bringing up the speed of his screw, while Ericsson "threw the dogmas of the engineers to the winds and coupled the engine immediately to the propeller." Smith, however, showed great genius and resolute perseverance, and, so far as simple priority of time is considered, it is true that he maintained the lead; but the credit for this, in our belief, falls far short of that due to Ericsson for his extended practical applications of the system. Both courses of the two inventors were remarkable for successful issues. It may even, says Bourne, be probable that the exertions of either would have sufficed to introduce the screw into practical operation, but their simultaneous prosecution of the same object was not nevertheless a waste of power. The progress of each, therefore, was stimulated by that of the other, and their united force acted more powerfully upon the public, and procured for the screw a readier and wider introduction than could otherwise have been expected. Neither invented the screw, but both revived it.

While, however, opinions may be and probably will be divided as to the question above discussed, so far as Ericsson and Smith are concerned, a careful search through various authorities reveals the fact that to neither is justly due the credit of first practically demonstrating the ability of screw-propelled vessels to make sea voyages, a merit which Mr. Delamater seems to claim for Ericsson. That honor is due to Robert L. Stevens, of Hoboken, one, says Mr. Scott Russell, to whom "America owes the greatest share of her present highly improved steam navigation. Mr. Stevens' father, Colonel John Stevens, was associated with Livingstone in his experiments, previous to the connection of the latter with Fulton, and had persevered in his experiments during Livingstone's absence in France.

Fulton's boat, however, was first ready, and obtained an exclusive privilege from the State of New York. Being excluded from the Hudson and all waters of the State, Stevens conceived the bold idea of taking his steamboat by sea to the Delaware. He did so, and thus not only demonstrated the possibility of screw propulsion, but he used a bladed screw in the open sea. The engines and screw used are still in existence. To Stevens, then, is due the credit of being first in the field to prove the practicability of the system; to Smith that of first, after a long period of years, reviving it and re-demonstrating its value; while to Ericsson, finally, is due not merely also its revivification, but in addition the first practical application of screw propulsion to the necessities and requirements of commerce in three great countries.

ARTESIAN WELLS.

A recent question which appeared in our column of answers to queries, regarding the greatest depth attained in the boring of artesian wells, has elicited some interesting letters from our correspondents. We find it necessary from the information given by one writer to revise the statement that the well in Louisville, Ky., 2,086 feet in depth, is the deepest in the country, as the bore sunk for Belcher's sugar refinery in St. Louis has penetrated 2,300 feet, while that excavated for the insane asylum in the same city has reached the enormous depth of 3,843 feet, or in that locality, 3,000 feet below the level of the sea. This would give a water pressure at the bottom of 1,293 pounds to the square inch. Another correspondent, however, tells us of a bore in the old world which is deeper than the one last mentioned by several hundred feet. It is situated in the village of Spenburg, some twenty miles from Berlin. The government, it seems, in order to obtain a supply of rock salt, began the sinking of a shaft 16 feet in diameter. At a depth of 280 feet salt was reached, but excavations were continued, the diameter being reduced to 13 inches for 4,194 feet, at which point work was discontinued, the bit still remaining in the salt deposit, which thus exhibits the prodigious thickness of 3,907 feet.

The supply of water from an artesian well is practically inexhaustible. At Aire, in Artois, France, a well, bored over a century ago, has since then flowed steadily, the water rising 11 feet above the surface at the rate of 250 gallons per minute; and at Lillers, in the same country, one well has yielded a continuous steam since the year 1126. This fact, coupled with that of the large amount of water deliv-

ered, renders the artesian well of the greatest value for the irrigation of desert plains. Up to the present time, some seventy-five shafts have been sunk in the Desert of Sahara, yielding an aggregate of 600,000 gallons per hour. The effect of this supply is said to be plainly apparent upon the once barren soil of the desert. Two new villages have been built and 150,000 palm trees have been planted in more than 1,000 new gardens. Water, it is stated, is reached at a very slight depth, in some cases hardly 200 feet.

The success attending the efforts of the French engineers in Africa has led to the excavation of numerous wells in the dry alkali plains along the line of the Union Pacific Railroad. There is a desolate and arid section, extending along the Bitter Creek valley for a length of about 120 miles, and varying in width from 20 to 50 miles. Since the building of the road, water trains have been running over the whole distance, supplies being obtained from the Green and other rivers. The cost of running these trains was about \$80,000 a year. It became therefore absolutely necessary to produce some other means for getting water for the locomotives, and to the miners working in the coal mines along the route. The only relief available was in boring artesian wells, and a correspondent of the *Tribune* says that, last year, six were begun. The subsequent success has been all that could be desired. The first well is at Separation, 724 miles from Omaha, and the last one is at Rock Springs, 832 miles. Another is in progress at Red Desert. The well at Rock Springs is 1,145 feet deep. There are layers of clay mixed with sandy loam, clear sand, and water-worn pebbles (in which the supply of water is usually found), layers of sandstone of varying degrees of density, and beds of sulphate of alumina and iron chemically combined, resembling the peculiar bluish clay of some of the surface soil. The Rock Springs well rises 26 feet above the surface, discharging at the latter 960 gallons per hour. The water in the various wells, it is said, sometimes holds in solution as much as 280 grains of mineral salts to the gallon, and hence produces undesirable effects on steam boilers. It is believed, however, that for agricultural purposes these salts could, with plenty of water, be washed out, when the result would be a remarkably productive soil, which would be as valuable as guano. A flowing well furnishing 1,000 gallons per hour will water a section of 640 acres.

An artesian well, we learn, is also in progress at Denver; it is already down 800 feet, and water has risen nearly to the surface. The government has appropriated \$10,000 to sink one at Fort D. A. Russell, and it is now nearly 900 feet deep. A well 1,000 feet deep costs about \$10,000; and out on the plains, this outlay would make a most productive farm and might be made the nucleus of a stock range of thousands of acres.

SCIENTIFIC AND PRACTICAL INFORMATION.

SOUTH AFRICAN DIAMONDS.

A note on the diamonds of South Africa was communicated to the geological section of the British Association, during its recent meeting at Bradford, by Professor Tennant. He said that the first diamond arrived in England from South Africa in 1867. It weighed 31 carats. Last year there was one of 110 carats, and this year one has been brought over which in its present rough state is larger than the Koh-I-Noor itself, and which when cut down will probably be not much smaller than that celebrated gem. He gave a history of the Koh-I-Noor, showing how it has been reduced from its original weight of 787 carats to 102 carats, its present weight. It is a great mistake, said the speaker, to suppose that, because the diamond is the hardest substance known, it is not easily fractured. He showed by means of a diagram the fractures that had been made in the Koh-I-Noor, and remarked that the diamond is in fact one of the most brittle stones we know of.

ACTION OF LIGHT ON THE ELECTRIC RESISTANCE OF SELENIUM.

M. Sale, in experimenting on the electric conducting power of selenium, which varies with the degree of light to which it is exposed, as described on page 193 of our volume XXVIII, says that, after careful experiments, he concludes that the effect of the light is not produced by the chemical rays, since the maximum of diminution is observed in the maximum point of the red rays. Neither is the change in the resistance due to an augmentation in the temperature. While the effect also of the light is sensibly instantaneous, the return of the selenium to its normal resistance after the light is cut off is not so rapid. Finally it appears that there exists in the red rays, which are the most intense in heating properties, a power which, without modifying the temperature, changes the molecular conditions of the particles.

A NEW SIGN OF DEATH.

At the moment of death, there become disengaged from venous blood certain gases which are normally confined therein, and which form a pneumatosis or swelling of the veins. This action in the veins of the retina, says M. Bonchut, is easily appreciable by the ophthalmoscope, and constitutes an immediate and certain sign of death. The pneumatosis is indicated by the interruption of the column of blood, and is comparable to that observed in an interrupted column of a colored alcohol thermometer.

T. W. Y. says: I recently witnessed the application of a known medical fact in an unusual way, namely: the vaccination of a dog to prevent distemper. The pus was inserted in the ear, when the pup was only a few days old, and the effect was about the same as when the operation is performed upon a child.

NEW ELECTRIC DISENGAGING GEAR FOR KNITTING MACHINES.

We present herewith diagrams of a novel and ingenious application of electro-magnetism to the knitting machine, the object being to stop the loom instantly and automatically whenever a thread breaks, is injured, or is of abnormal thickness, or when a needle becomes bent.

The wheel, A, in Fig. 1, receives motion and transmits it by friction to the pulley, B, which, in turn, communicates, by means of a belt, with the driving pulley, D, of the machine. Pulley, B, is journaled on the rod, W, and the latter may be moved from right to left, or *vice versa*, so as to throw said pulley into or out of gear with the wheel A. E E are jointed arms connecting with the rod, W, and also at their point of junction with another rod, F, G is a lever which oscillates about its center of figure, communicating, as shown, at one end with F, and at the other with a plate, Q. K is an electro-magnet, and L the armature. As represented by the dotted lines, the rock lever, G, is supported by the upper portion of the latter. If, therefore, a current be sent through the magnet, the armature is attracted and drawn away from under the lever. The latter, being overbalanced by the plate, falls so that the plate enters between the wheels, A and B. These, rotating in opposite directions, seize it and drag it violently between them, thus supplying, for an instant, sufficient power to draw the rod, W, to the left, through the intermediation of the lever, G, and rods, F and E, and thereby throw the wheel, B, out of gear.

In order to arrest the motion of the machine promptly, the last mentioned pulley takes against a block, shown to the left, which is cut out and lined with india rubber to form a brake shoe. The effect of the spring, represented at M, is to so hold the hinged piece, when the lever is located as shown in the dotted lines, that the contact of wheels, B and A, is close. When the lever is in the other position, the tendency of the spring is to force the wheel, B, against its shoe. The spring serves to regulate the pressure in both instances.

From the above we think the direct application of the current to the mechanism will be rendered clear. It now remains to examine how the action of the magnet is governed by the broken threads or bent needles. For the latter purpose there are two separate appliances, one relating to the needles, the other to the thread. The latter, Fig. 2, is extremely simple. Each of the four threads used in the knitting passes over a pair of little grooved pulleys, P, between which it is horizontally extended. Between the pulleys and riding the thread is a bit of bent wire, the ends of which enter cups containing mercury. To the latter the battery wires pass. So long as the thread is whole and even, the wire is held up above the mercury. If, however, it becomes broken or very thin, the wire is dropped into the quicksilver, establishes a circuit, and the operation already described takes place.

Fig. 3 shows the appliance which will stop the machine if a needle become bent. The needles are horizontal and radiate around the vertical axis of a circular frame. They pass between two small plates, V and V', placed in a vertical plane and pivoting around horizontal axes, b b, c c. If a needle gets out of line to the top or bottom, it catches against one of these plates, and, if the bottom one, swings it forward. In its movement the latter strikes an appendage, m, carried by the other plate, and thereby oscillates a hammer, M, attached to the upper of the pair which, falling between two mutually isolated springs, establishes a circuit.

In Fig. 4 is shown a side view of the same device, which is actuated in precisely the same manner by an abnormal thickness of the thread.

In a machine using four threads, there are, therefore, the mechanical disengaging apparatus shown in Fig. 1, four of the devices in Fig. 2 to show the breakage of a thread, one to show abnormal thickness, and one for bent or badly placed needles. Through this combination, the *Revue Industrielle* says, one man can easily attend to four looms. The apparatus, we learn, is in use in a large factory near Montargis, in France. A Gramme electric machine is here substituted for the battery, and supplies a current sufficient for 150 looms.

Phosphate of Ammonia for Purifying Sugar.

Kuhlmann's process of neutralizing the alkalinity of sugar juices by means of phosphate of ammonia, discovered some twenty-four years ago, is now being largely applied in France, and, to meet the demands, a large factory for the production of the phosphate has been established at Asnières.

The rich mineral phosphates are reduced to powder, and dissolved in very dilute sulphuric acid (5° Baumé). The acid liquor, clarified by repose and having the excess of sulphuric acid removed from it by carbonate of baryta, is concentrated at 20° Baumé, and then neutralized by caustic ammonia. Finally, the resulting alkaline solution of phosphate, separated from the insoluble deposits of sulphate of lime, etc., is mixed with a fresh quantity of ammonia in order to produce a tribasic phosphate, which has the advantage of

being little soluble. Water is removed by pressure, and the substance is immediately packed in barrels. The deposits of phosphates of lime, iron, aluminum, etc., dried, constitute an excellent fertilizer, readily assimilable.

The Absorption of Chemical Rays by the Sun's Atmosphere.

The absorption, by the solar atmosphere, of chemical rays of high refrangibility, has recently been studied by M. Vogel. The method employed is that devised and described by Bunsen and Roscoe, in their photo-chemical researches, and is based on the principle that, between sufficiently extended

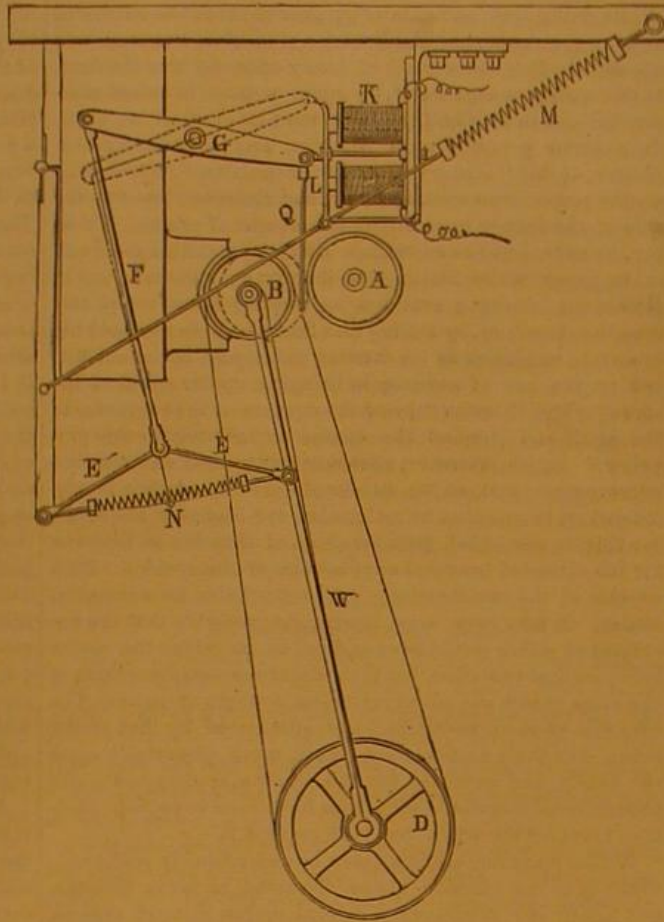


Fig. 1.—ELECTRIC KNITTING APPARATUS.

limits, the equal products of the luminous intensity by the duration of the insolation correspond to equal darkenings on chloride of silver paper. As applied by M. Vogel, the investigation consisted in obtaining a scale of photographic tints, due to the same intensity, with differing durations of insolation, and then comparing with these tints those of a photographic image of the sun on the same chloride of silver paper.

Designating by I_0 and I_1 the intensities of the two points of the sun, t the duration of insolation, i the intensity of light acting on the scale, t_1 and t_2 the duration of insulations

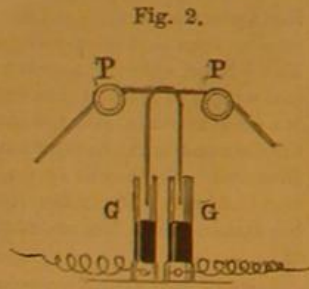


Fig. 2.

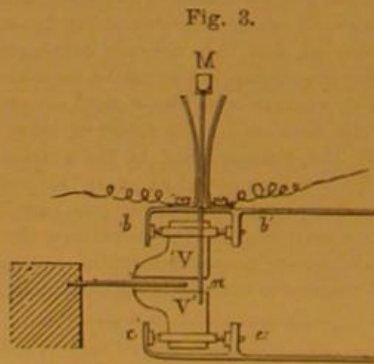


Fig. 3.

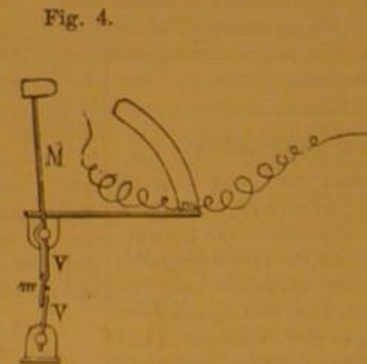
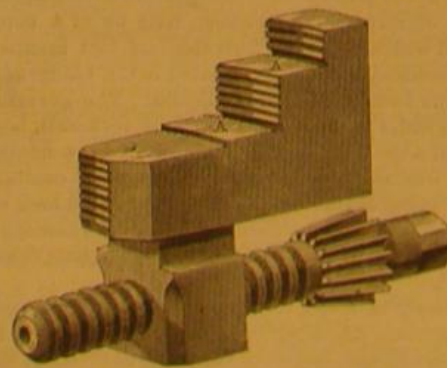


Fig. 4.

corresponding to the two tints on the scale found to be equal to those of the two points on the sun: according to the above principle, the formulas $I_0 t = it_1$, and $I_1 t = it_2$, are derived, whence the ratio of the intensities, I_0 and I_1 , is given by that of the duration, t_1 and t_2 . Numerically, from these it is found that the ray, being 12, and the intensity at the center 100, at the distances 4, 8, 10, and 12, the intensities are 96, 77, 51, and 13.

HORTON'S IMPROVED CHUCK JAW.

It is a well known experience, in case-hardening jaws, that



the relative positions of the metallic particles change more or less, so that it is almost impossible, without grinding, to hold work perfectly true. To overcome this difficulty, the new patent jaw, herewith illustrated, has been devised, the

principal peculiarity of which is a raised seat A, which is formed on the face of the jaw on which the work rests while turning. Grooves or recesses are cut at the corner of the bite and face of the jaw, rounding the said corner, and thus allowing of the use of a Tanite or other emery wheel, by which the raised seat may be accurately ground. The work, therefore, rests upon the seat, A, and the bite of the jaw only assumes, it is claimed, a perfectly true position thereon as an equal pressure is exerted on the same. Another advantage of the groove is that a grinding wheel without a perfect corner is enabled to work accurately, as the edge of the wheel projects beyond the raised part into the recess formed by the groove. The improved jaw is used in the Horton lathe chuck, and appears to be a useful and valuable device.

Patented August 20, 1873. For further particulars address the E. Horton & Son Company, Windsor Locks, Conn.

New Mode of Noting the Direction of the Wind at any Altitude.

M. Waldner, professor of mathematics at Osthofen, Germany, while engaged in examining the solar spots some years ago, had his attention attracted to an immense number of small white particles which suddenly came into view on a casual change in the position of his telescope. He at once began investigations, in order to discover their nature; and after continuing his researches for some three years, he found that the bodies appeared like snow flakes which floated, like the clouds, in aerial currents, and existed at differing altitudes. He finally determined them to be ice crystals which were driven by the winds at the same velocity as the cirrous clouds.

Mr. J. Francis Anderson has recently devoted his studies to this subject, and he explains the presence of the particles by the fact that the vapor of water tends to rise in the atmosphere. As it ascends it meets cold strata of air, condenses into water, and then freezes into solid bodies which are simply snow flakes. In the lower portions of our atmosphere, however, there are other luminous corpuscles which principally consist of organic material. These are easily observable by allowing a beam of sunlight to enter a darkened room, or may be seen out of doors by simply cutting off the disk of the sun with an opaque object. By means of these bodies in the inferior strata, and the snow crystals in the upper regions of air, Mr. Anderson considers that the direction of the wind may be determined at any altitude, even during a cloudless day. He proposes simply to adjust a telescope so as to give distinct vision at two, three, or more thousand feet, and to note the direction and rapidity of the particles, which will then be clearly seen as they cross the field of view. This will give the direction of the current which carries them along, and its approximate velocity for whatever altitude the instrument may be adjusted for.

Private Fish Culture.

A writer in the *New York Tribune* says that one of the principal causes why fish culture is not undertaken by persons of moderate means is the supposition that large ponds or rivers are necessary to a successful business. A farm, however, of fifteen or twenty acres, with a small pond or two, natural or artificial, supplied with water from a river or from perennial springs, would be all that could be desired. Many kinds of fish, and especially leeches, may be raised with considerable profit. Of leeches we now import nearly two millions annually from Europe, at a cost of about \$100-

000. One locality, especially well adapted by Nature for the business, is on the east side of the Passaic river, opposite the Newark water works, on land sloping to the river. Besides dwellings, outhouses, barns, orchards, etc., there are two ponds supplied with never-falling springs of sweet water, and the bottom is the right kind for trout, crayfish, or leeches. The Passaic river would furnish food in abundance for the young fish. A place having so many natural advantages will probably be utilized.

One reason for mentioning the subject of raising leeches is that the supply from all parts of Europe, except Brittany, is gradually falling because of the draining of the marshes of the Danube in Slavonia and European Turkey, all native places of the leech.

Muscarin.

Muscarin is a poisonous alkaloid, extracted by alcohol from a species of mushroom (*amanita muscaria*). The most interesting feature of muscarin is its antagonism to atropin. These alkaloids neutralize each other's action on the system so perfectly that each can be used as an antidote in case of poisoning by the other. The pupil of the eye, enlarged by atropin, is contracted by muscarin. The depression of temperature caused by muscarin, injected beneath the skin, is counteracted by a similar application of atropin; and the heart of a frog, that has ceased to beat from half an hour to an hour, under the influence of muscarin, has been restored to activity by atropin. Possibly quinine sustains a similar relation to the poison inducing intermittent fever that atropin does to muscarin.

THE AMMONIA ICE-MAKING PROCESS.

We present herewith an engraving of an apparatus for making ice and producing cold, exhibited by Messrs. Vaas and Littmann at the Vienna Exposition, in which, as in the well known system of Carré, the vapor of ammonia is the congealing agent. The normal volatility of ammonia, in both machines, is increased by removing the vapor as quickly as it forms. The apparatus consists of the boiler, *a*, condenser, *b*, gasholder, *c*, ice box, *d*, the absorption cylinder, *e*, the temperature exchanger, *f*, the cooler, *g*, and the pump, *h*. The boiler, *a*, is first half filled with solution of ammonia, which is caused to evaporate by the application of heat, and the gas thus formed is forced through the pipe, *i*, into the worm pipe of the condenser, *b*, and from there through the pipe, *2*, into the gasholder, *c*. From the gasholder the gas is conducted by the pipe, *3*, to the valve on the top of the ice box, *d*, which is in connection with the worm pipe inside the ice box.

At the commencement of the operation this valve is kept shut; but as soon as the gas has attained a pressure of eight to ten atmospheres, it is slightly opened. The gas, on its passage through the worm pipes of the condenser (which are always surrounded by cold water), is condensed, and the liquid passes through the valve to the worm pipes in the ice box, where it again commences to evaporate, taking up at the same time heat from the solution of chloride of calcium, in which the worm pipes in the ice box are submerged. This absorption of heat so lowers the temperature of the solution of chloride of calcium as to render it capable of turning the fresh water contained in the ice cases to ice.

The ammonia, which has been volatilized again in the pipes of the ice box, passes through the pipes, *4*, to the absorption cylinder, *E*, and, at the same time, the weak solution of ammonia, which has lost the gas by heat, passes out of the boiler by the pipe, *5*, into the exchanger *f*, through the cooler, *g*, into the absorption cylinder, *e*, where it absorbs the gas which comes from the ice box, and from there it is pumped back by the pump, *7*, into the boiler to be again heated. When the machine is working the valve on the ice box must be opened just sufficiently far to allow the gas to escape, but not to allow the pressure to fall, and the valve between the cooler and the absorption cylinder must be so regulated as to admit the proper quantity of the weak solution from the boiler as will absorb the gas from the ice box. A machine for making 200 lbs. of ice per hour requires a two horse engine to drive it.—Iron.

IMPROVED STEAM PUMP.

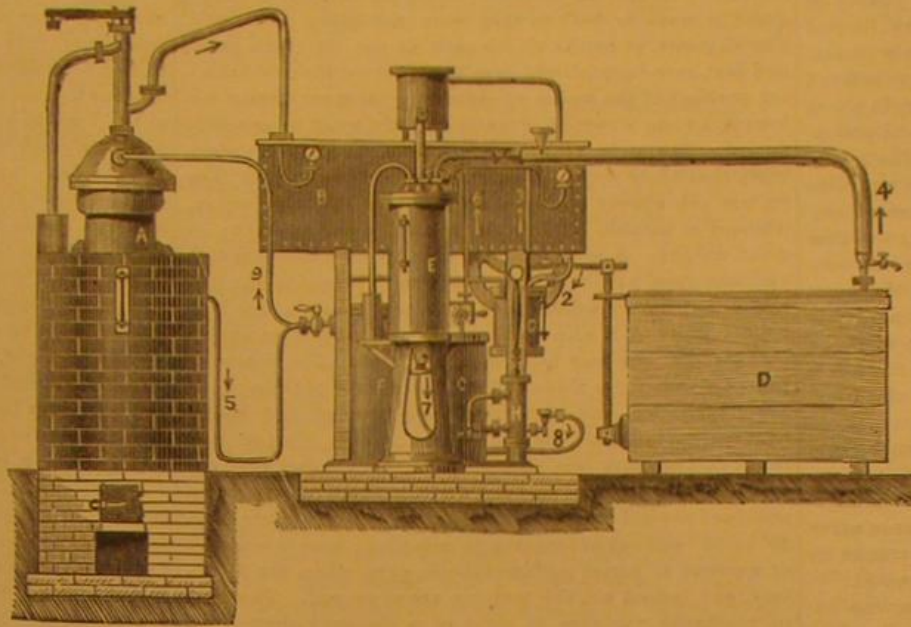
The many and diversified uses of the Niagara pump are so well known that it is hardly necessary to allude to them in any detail. Briefly, the machine will pump water—hot, cold, fresh, salt, clean, or muddy—sirups, beer, acids, molasses, or other heavy fluid. It is especially adapted to the feeding of steam boilers and supplying of tanks, and is useful in sugar refineries, tanneries, oil works, and manufactories generally. Finally, it is well suited for the drainage of mines, quarries, low lands, and for wrecking purposes.

The main feature of the improved form of the machine, as represented in our engraving, is the simple steam valve. This appliance, as formerly used in the pump, consisted of an auxiliary slide valve and steam cylinder, and a slide valve operated by the latter. At present this has been simplified so that only one circular balanced valve is employed, working on centers packed with rings, and operated directly from a tappet on the main piston rod. The apparatus can be run so slow that the motion of the piston rod will be hardly perceptible, and then again as swift as desired, without fear of having the piston strike the heads of the cylinder.

By a simple device, the steam operates the valve when running slow; and when working fast, the momentum of the piston opens and closes the valve; so that at any speed there will be invariably a full port of steam for the return stroke before the piston arrives at the end of its course, the connection between piston and valve being direct.

The parts are cast separate to provide for the replacing of breakages, which may occur by accident or frost, at small expense, and the makers add that the fewness of the various portions enables them to furnish a machine of excellent material and the best possible workmanship at a low figure.

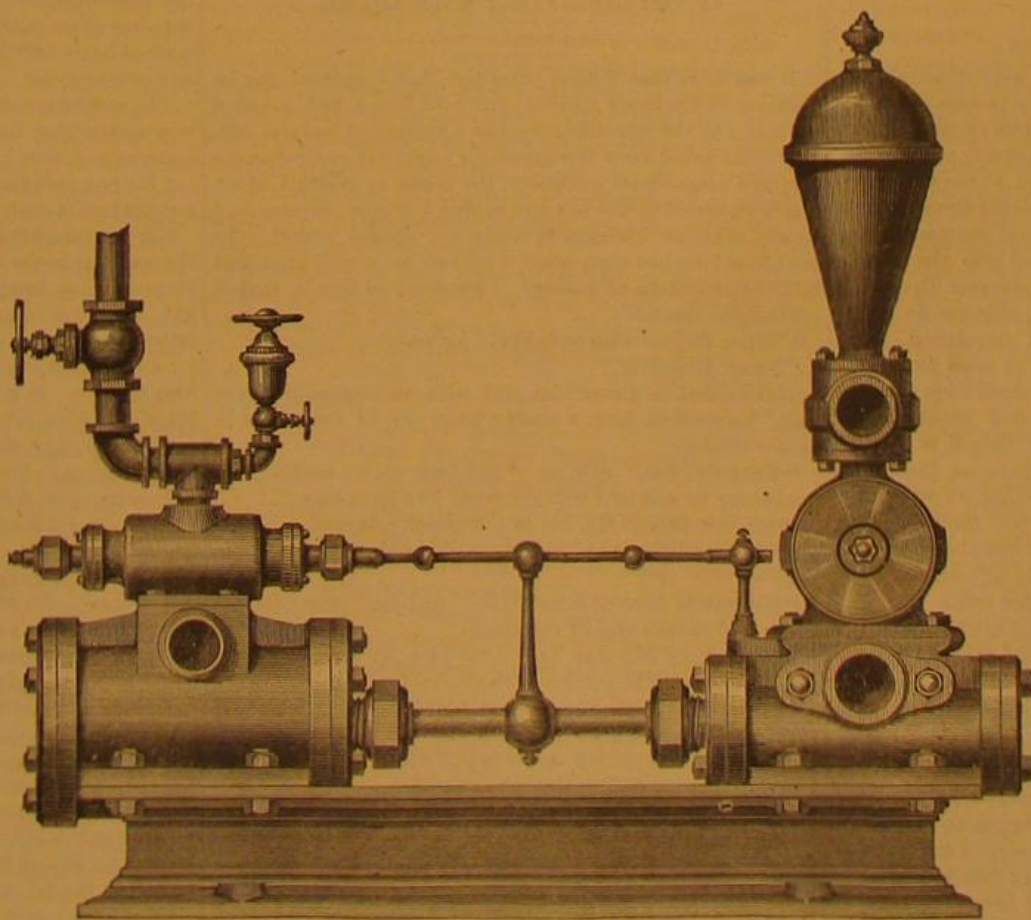
For further particulars address Messrs. Hubbard & Aller, 93 to 97 Pearl street, Brooklyn, N. Y.



IMPROVED AMMONIA ICE-MAKING MACHINE.

produced by strychnin, insufflating air into the lungs stops the convulsions; a similar result is caused by carbonic acid or a current of galvanism. In brief the mechanism of the arrest of convulsions in tetanus is just the same as the mechanism of the arrest of the heart in the case of galvanization of the *par vagum* of the neck. Similarly an irritation of almost any part of the skin may prevent epilepsy. In the case of anasura starting from a limb, a ligature around the latter (by irritating the nerves of the skin and sending a current toward the brain, changing the state of the cells there) serves to prevent an attack. There are many cases of epilepsy that have been cured by accidental injury.

Another kind of stoppage or arrest of the activity of cells consists in the arrest of the morbid activity of the brain. In cases of insanity, a large number of patients have been cured suddenly by means of irritation of the skin, that was either accidental or employed by a physician. A patient in a lunatic asylum met another one who struck his head and broke the cranium on the right side. The brain oozed out; a good



THE JOHN HARDICK NIAGARA STEAM PUMP.

deal of it was lost, and the patient was cured of his insanity and epilepsy. Other affections of the brain, such as amaurosis or paralysis, may be cured suddenly, sometimes without any cause that we can find, but with good ground certainly to believe that an irritation has acted which has produced a change in the cells of the brain and dismissed their

morbid activity. For there are clear cases in which those affections have been cured by such irritation. Those alterations of cells that were producing an arrest of the power of sight or paralysis have been submitted to an irritation of parts of the skin or of some viscus, and the irritation, going to the morbid part and producing a change in the activity of those cells, has cured the disease.

Referring to paralysis, the lecturer said that the malady is considered to result from a cessation of activity of a part of the brain from disease, destroying some particular portion. According to this view the destruction of the part of the *crura cerebri* or *pons varolii* necessarily should produce a paralysis in some muscles of one half of the body; but such is not the case, for the paralysis may exist in the same side of the body where the disease is or on the opposite side, or the *pons varolii* may be destroyed without any paralysis at all supervening. Paralysis really appears only from an irritation which starts from a place where the disease is and acts upon parts at a distance so as to modify them.

THE DOUBLE BRAIN.

One half of the brain is sufficient for all the functions of the two halves of the organ. There is no question that it is our habit of making use of only one side of the body that consigns to one half of the brain—the right side—the faculty of expressing ideas by speech. If we develop both sides of our body equally, not only would there be the benefit that we could write or work with the left hand as well as with the right, but we should have two brains instead of one, and would not be deprived of the power of speech through disease of one side of the brain.

The nervous system is not essential to the existence of muscular contraction or irritability. Professor Bernard, of Paris, has found that woorari poison affects the

motor nerves in muscles so that the conductors which unite the brain with the muscles become paralyzed while the muscles remain active. Dr. Séquard, however, doubts that the woorari acts upon the parts within the sheath of the muscular fibers, and hence nerve power may possibly remain therein.

SEPARATION OF A NERVE.

It is well known that, if a nerve has been divided, after four days it loses its power. The muscles, however, remain perfectly active, and we can produce contraction in them. Unfortunately, here, also, there is an element of nerve tissue which is inside of the nerve sheath, and it is not known whether it has lost its power or not. In the case of two decapitated men, the lecturer said that he had made an experiment of cutting off the arms. He found, after thirteen and a half hours in one case and fourteen hours in the other case, that all signs of life in the limbs had disappeared. Up to that time, either galvanism or a shock produced by a blow with his arm or a paper cutter caused the muscles to respond to the irritation. He then injected the blood of a man into one of those arms, and the blood of a dog into another. In both cases local life was restored in those arms. The muscles became irritable again, and the strength of contraction was extremely powerful. Indeed, in the arm in which the blood of the man had been injected, the power was immense. It was greater certainly than during life. There was therefore a return of muscular irritability after it had disappeared and nervous excitability had not come. The nerves remained quite dead. Therefore it seemed quite clear that the muscular irritability depended upon nutrition by blood and the oxygen in it. The blood injected was richly charged with oxygen and that was the reason why the muscular irritation became so great.

Long ago, said the speaker, I had discovered that light can affect the iris of the eye, even when it has been removed from the body. The eye of an eel had been removed from the body for sixteen days and kept at a temperature of about 36° to 40° Fah. But he found that, although the eye was in almost complete putrefaction, the light still acted as an irritant of muscular fibers. There it was impossible to admit that there was nervous action. The muscular fibers themselves were considerably altered. Still they acted.

THE HEART AND THE NERVOUS SYSTEM.

It has been questioned whether the thermal movements, such as that of the heart, depend upon the nervous system. It has been found that, 48 hours after the heart has been separated from the chest of a dog, it continued to beat. There is recorded the case of a man at Rouen in, whom the heart

was found to beat for thirty-six hours after the death of the body by decapitation. There is therefore a possibility of long persistence of life in those organs. And the great cause why we see those organs stop at death so quickly is that the phenomena of arrest of their activity have taken place at the time of death.

MOTION WITHOUT NERVE FORCE.

A very singular fact is that movements, voluntary in appearance, can exist without nerve force, and Dr. Séquard related the following remarkable case:

"I was called," he says, "to see a patient who was indeed no more a patient; he had died before I reached him. I was told that he was making certain movements, and his family and friends all thought him alive. I examined him and found that he was certainly dead without any chance of returning to life, at least according to our very limited knowledge. I found that he was performing slowly movements that he had been performing with great vigor before I came. He would lift up his two arms at full length above his face, knit the fingers together as in the attitude of prayer, then drop the arms again and separate them. The movements were repeated a good many times with less and less force, until at last they ceased. There was no trace of sensibility anywhere, no reaction to the operation of galvanism or burning anywhere, as I had to make use of these means to satisfy the family. A needle was pushed into the heart as there was no danger from this experiment, a certain physiologist having, for the mere sake of showing what the Japanese had done that way, introduced one many times into his heart. The needle introduced showed that the heart of my cholera patient did not beat."

Dr. Dowler of New Orleans has amputated limbs from cholera patients after death, and has found that the members amputated continued to move after having been separated from the nervous centers; so that, if there were nerve force acting, then it was nerve force existing in trunks or nerves and not the nerve force that comes from the will.

The lecturer then proceeded to give several curious instances of movements apparently voluntary but really without the control of the person. One case was of a young lady in Paris who every Sunday at ten o'clock ascended a bed, and, putting her back on the top of the edge or border of the bed, took an attitude of prayer and began to address prayers to the Virgin Mary. She continued in that attitude, fixed like a statue, except that her chest continued to move and her heart to beat: her lips were giving utterance to sounds. All the other parts of the body were absolutely motionless. This was a feat that you could not perform on level ground. Standing rigidly on tiptoe, even without shoes, is an utter impossibility, beyond a short time. Sometimes a movement forward is made, sometimes backward, and often rotary motions take place. Two cases of the last mentioned class happened in persons who exhibited their strange contortions standing on their heads. A girl who had received a severe blow on the head had a rotary movement on that account. She knew well what was the matter with her, and had come to be able to prevent any bad effect of it. If she wanted to go in a contrary direction, she turned herself in a direction almost at right angles to it, and the irregularity of her movement brought her to the right place.

Passing to another branch of his subject, Dr. Séquard proceeded to show that the

CENTRAL NERVOUS SYSTEM

has power to act on all regions of the body through the medium of the vaso-motor system, which is capable of diminishing the size of blood vessels and thus regulating circulation; also, that a suspension of the activity of the vaso-motor nerves produces a passive dilatation of the blood vessels with increased afflux of blood. Increased circulation in any part of the body may be due to chemical processes, going on in the tissues, which attract the blood into the vessels supplying the tissues in question. Professor Draper of New York has shown that these chemical changes do cause an increase in the rapidity and amount of circulation. And such chemical force the lecturer believes to arise from a direct transmutation of nervous force. The circulation depends more on the general tissues of the body, and much less on the heart, than is commonly supposed. Indeed it may be said that the heart is formed by the circulation instead of *vice versa*. The curious rapidity with which an engrafted organ will not only grow to its stock, but will show evidence of partaking in its circulation, should be remembered in estimating the causes of the latter. The lecturer told an anecdote of his engrafting a cat's tail on a cock's comb.

Another influence belongs to the nervous system, which is that it regulates the nutrition, secretion, and other functions. It is not essential to nutrition, though it is of great use.

THE POWER OF THE MIND OVER THE BODY

through the nerve force is infinitely greater than most of us can imagine, in extent and variety. Mesmerism, animal magnetism, the Od force, Perkins's tractors,—all these have some ground in Nature, that ground being simply the immense power of the imagination on the body. John Hunter made some curious experiments in willing pain into a part; he failed, however, to will the attacks of his gout into his great toe, though he tried to do it. Swedenborg, though subject to illusions and hallucinations, had an equally clear view of the way in which the brain can convey various kinds of sensation, etc., into any part of the body. Bennett of Edinburgh tells of a man whose sleeve was caught in a hook; the man, thinking his arm was pierced, suffered excruciating pain until he was extricated. As for mesmerism, the senses are exquisitely exalted; but the feat of reading a watch placed out of sight may be (perhaps) explained by the obscure faculty we possess of estimating the lapse of time, even

in sleep. The *convulsionnaires* of St. Médard suffered themselves to be trampled under foot in the most shocking way without feeling pain; this is one instance of the suppression of feeling by mental influence, of which the mesmeric anaesthesia is another example.

The secretions are arrested or made active by nerve influence. Nursing mothers who give way to anger or other emotions poison their own milk, whereby the infant's health is often injured for life, if he be not killed outright. The bowels are purged by bread pill (as was once proved on a large scale by the Emperor Nicholas) provided people are told they are to be purged; eighty out of one hundred hospital patients have been vomited by a neutral remedy, when told "there had been a mistake made and they had all taken emetics." Much sea sickness would be avoided if people could be made to believe they were not going to have it. The stigmata, or marks of the nails on the Saviour's hands and feet, have been plainly seen to appear on the corresponding portions of the bodies of certain of his more devout followers, among whom St. Francis of Assisi must be specially named. Yet ought we not to lose from our sight the possibility that these occurrences, however unquestionable they be, are yet simply owing to an action of the imagination, whereof a notable instance is related upon authority of great weight: A mother saw a window sash descend with violence upon her little child's fingers, whereupon she herself was instantly seized with extreme pains in her own fingers which did afterwards swell and inflame in such a manner that she was long in being cured. The fakirs of India are sometimes able to divest themselves of the signs of life—respiration and circulation being stopped and bodily temperature lowered—for months continually. This well attested fact becomes less strange in view of the fact, once observed by the lecturer in his own laboratory, where a dog remained several months after death in a temperature from 40° to 60° without undergoing putrefaction; here is evidence of a power to arrest metamorphosis, even when the voluntary, and indeed all, the motions are at an end. The pain of toothache vanishes at sight of a dentist's chair; neuralgia once disappeared as the lecturer was about to enter on an operation for its relief; most functional, and even some organic, affections (as dropsy) may be cured by giving a patient the idea that he is to be cured! and the well attested list of modern miracles is in the same category of facts.

Nervous force is generated through the blood; it results in this case from a transmutation of chemical force. It is accumulated by rest, but too prolonged rest stops its production, and an anæmic condition, with degeneration, occurs. Too prolonged action of a part or organ does the reverse, in producing congestion and the diseases incident to congestion. The principal rule of hygiene is deducible from these principles: It is, not to draw blood by exertion to one part of the nervous system alone, exclusive of the rest.

We may not despise the doctors, but must attend to certain cautions, which are summed up in one, as follows: We ought not to spend more than our means allow. We ought also to use all of our organs pretty equally. Regularity in the time of meals, sleep and exercise must be acquired; if it is not natural to us, it must be gained by habit.

IN THE LABORATORY WITH AGASSIZ.

BY A FORMER PUPIL.

It was more than fifteen years ago that I entered the laboratory of Professor Agassiz, and told him I had enrolled my name in the scientific school as a student of natural history. He asked me a few questions about my object in coming, my antecedents generally, the mode in which I afterwards proposed to use the knowledge I might acquire, and finally, whether I wished to study any special branch. To the latter I replied that, while I wished to be well grounded in all departments of zoology, I purposed to devote myself specially to insects.

"When do you wish to begin?" he asked.

"Now," I replied.

This seemed to please him, and with an energetic "very well," he reached from a shelf a huge jar of specimens in yellow alcohol.

"Take this fish," said he, "and look at it; we call it a *hæmulon*; by and by I will ask what you have seen."

With that he left me, but in a moment returned with explicit instructions as to the care of the object entrusted to me.

"No man is fit to be a naturalist," said he, "who does not know how to take care of specimens."

I was to keep the fish before me in a tin tray, and occasionally moisten the surface with alcohol from the jar, always taking care to replace the stopper tightly. Those were not the days of ground glass stoppers and elegantly shaped exhibition jars; all the old students will recall the huge neckless glass bottles with their leaky, wax-be-smearred corks, half eaten by insects and begrimed with cellar dust. Entomology was a cleaner science than ichthyology, but the example of the Professor, who had unhesitatingly plunged to the bottom of the jar to produce the fish, was infectious; and though this alcohol had "a very ancient and fishlike smell," I really dared not show any aversion within these sacred precincts, and treated the alcohol as though it were pure water. Still I was conscious of a passing feeling of disappointment, for gazing at a fish did not commend itself to an ardent entomologist. My friends at home, too, were annoyed, when they discovered that no amount of *eau de Cologne* would drown the perfume which haunted me like a shadow.

In ten minutes I had seen all that could be seen in that fish, and started in search of the Professor, who had how-

ever left the museum; and when I returned, after lingering over some of the odd animals stored in the upper apartment, my specimen was dry all over. I dashed the fluid over the fish as if to resuscitate the beast from a fainting fit, and looked with anxiety for a return of the normal sloppy appearance. This little excitement over, nothing was to be done but to return to a steadfast gaze at my mute companion. Half an hour passed,—an hour,—another hour; the fish began to look loathsome. I turned it over and around; looked it in the face,—ghastly; from behind, beneath above, sideways, at a three quarters' view, just as ghastly. I was in despair; at an early hour I concluded that lunch was necessary; so, with infinite relief, the fish was carefully replaced in the jar, and for an hour I was free.

On my return, I learned that Professor Agassiz had been at the museum, but had gone and would not return for several hours. My fellow students were too busy to be disturbed by continued conversation. Slowly I drew forth that hideous fish, and with a feeling of desperation again looked at it. I might not use a magnifying glass; instruments of all kinds were interdicted. My two hands, my two eyes, and the fish: it seemed a most limited field. I pushed my finger down its throat to feel how sharp the teeth were. I began to count the scales in the different rows, until I was convinced that that was nonsense. At last a happy thought struck me—I would draw the fish; and now with surprise I began to discover new features in the creature. Just then the Professor returned.

"That is right," said he "a pencil is one of the best of eyes. I am glad to notice, too, that you keep your specimen wet and your bottle corked."

With these encouraging words, he added:

"Well, what is it like?"

He listened attentively to my brief rehearsal of the structure of parts whose names were still unknown to me: the fringed gill arches and movable operculum; the pores of the head, fleshy lips and lidless eyes; the lateral line, the spinous fins and forked tail; the compressed and arched body. When I had finished, he waited as if expecting more, and then, with an air of disappointment:

"You have not looked very carefully; why," he continued more earnestly, "you haven't even seen one of the most conspicuous features of the animal, which is as plainly before your eyes as the fish itself; look again, look again!" and he left me to my misery.

I was piqued; I was mortified. Still more of that wretched fish! But now I set myself to my task with a will, and discovered one new thing after another, until I saw how just the Professor's criticism had been. The afternoon passed quickly; and when towards its close, the professor inquired:

"Do you see it yet?"

"No," I replied, "I am certain I do not, but I see how little I saw before."

"That is next best," said he, earnestly, "but I won't hear you now; put away your fish and go home; perhaps you will be ready with a better answer in the morning. I will examine you before you look at the fish."

This was disconcerting; not only must I think of my fish all night, studying, without the object before me, what this unknown but most visible feature might be: but also, without reviewing my new discoveries, I must give an exact account of them the next day. I had a bad memory; so I walked home by Charles River in a distracted state, with my two perplexities.

The cordial greeting from the Professor the next morning was reassuring; here was a man who seemed to be quite as anxious as I, that I should see for myself what he saw.

"Do you perhaps mean," I asked, "that the fish has symmetrical sides with paired organs?"

His thoroughly pleased "of course! of course!" repaid the wakeful hours of the previous night. After he had discoursed most happily and enthusiastically—as he always did—upon the importance of this point, I ventured to ask what I should do next.

"Oh, look at your fish!" he said, and left me again to my own devices. In a little more than an hour he returned and heard my new catalogue.

"That is good, that is good!" he repeated; "but that is not all; go on;" and so for three long days he placed that fish before my eyes, forbidding me to look at anything else, or to use any artificial aid. "Look, look, look," was his repeated injunction.

This was the best entomological lesson I ever had,—a lesson whose influence has extended to the details of every subsequent study; a legacy the Professor has left to me, as he has left it to many others, of inestimable value, which we could not buy, with which we cannot part.

A year afterward, some of us were amusing ourselves with chalking outlandish beasts on the museum blackboard. We drew prancing starfishes; frogs in mortal combat; hydr-headed worms, stately crawfishes, standing on their tails, bearing aloft umbrellas; and grotesque fishes with gaping mouths and staring eyes. The Professor came in shortly after, and was as amused as any at our experiments. He looked at the fishes.

"*Hæmulons*, every one of them," he said; "Mr. — drew them."

True; and to this day, if I attempt a fish, I can draw nothing but *hæmulons*.

The fourth day, a second fish of the same group was placed beside the first, and I was bidden to point out the resemblances and differences between the two; another and another followed, until the entire family lay before me, and a whole legion of jars covered the table and surrounding shelves; the odor had become a pleasant perfume; and even

now, the sight of an old, six inch, worm-eaten cork brings fragrant memories.

The whole group of haemulons was thus brought in review: and, whether engaged upon the dissection of the internal organs, the preparation and examination of the bony framework, or the description of the various parts, Agassiz' training in the method of observing facts and their orderly arrangement was ever accompanied by the urgent exhortation not to be content with them.

"Facts are stupid things," he would say, "until brought into connection with some general law."

At the end of eight months, it was almost with reluctance that I left these friends and turned to insects; but what I had gained by this outside experience has been of greater value than years of later investigation in my favorite groups.—*Every Saturday.*

Correspondence.

The Screw Propeller.

To the Editor of the Scientific American:

Having been intimately connected with the introduction of screw propulsion in the United States, the biographical notice of Sir Francis Pettit Smith, in your issue of March 7, 1874, induces me to present the following statement:

Francis P. Smith obtained a patent in England, dated May 31, 1836, for a propeller consisting of a continuous screw, formed and applied as shown by the engraving which accompanies your biographical sketch referred to. John Ericsson obtained a patent in England, dated July 13, 1836, for a propeller consisting of several blades or segments of a screw, the twist of which was determined in accordance with the principle now universally adopted in the construction of screw propellers.

That Ericsson carried his invention into practice immediately after having obtained a patent in England will be seen from the following notice in the London *Mechanics' Magazine*, June 3, 1837, vol. xxvii., p. 130, relating to the screw steamer Francis B. Ogden:

"Captain Ericsson's New Propeller.—The American packet ship Toronto, of 630 tons burden, and drawing 14 feet 6 inches water, was on Saturday last towed down the Thames at the rate of full 4½ knots an hour, against wind and tide, by an experimental steamboat called the Francis B. Ogden. We subjoin a copy, with which we were favored, of the certificate given by the pilot and mate of the Toronto, of the performance of the Francis B. Ogden on this occasion:

"Packet ship Toronto, in the Thames, May 28, 1837:

"We feel pleasure in certifying that your experimental steamboat, the Francis B. Ogden, has this morning towed our ship at the rate of 4½ knots an hour through the water, and against the tide.

(Signed)

"E. Nashby, Pilot.

"H. R. Hovey, Mate.

"To Captain Ericsson."

Bennett Woodcroft, in his celebrated work on steam navigation, published in London, 1848, thus notices the Robert F. Stockton, the second vessel built in England propelled by Ericsson's screw propeller:

"On the 7th of July, 1838, a new iron vessel, built by Messrs. Laird & Co., of Birkenhead, and fitted with a screw propeller, was launched into the Mersey. This vessel was constructed for Captain Stockton, of the American navy, who has been already mentioned, and consequently received the name of Robert F. Stockton. To the kindness of Mr. John Laird I am indebted for the drawing of this vessel, as she was rigged for her first voyage across the Atlantic; and from one of the scientific journals already quoted the following particulars: Several experiments have been made with her (the Robert F. Stockton), the results of which appear very satisfactory, both in relation to the application of the propellers to inland and to ocean navigation; and these experiments derive additional weight from the fact of their having been performed and approved of in Liverpool, the great emporium of shipping and commerce.

"The Robert F. Stockton left England for the United States in the beginning of April, 1839, under the command of Captain Crane, of the American merchant service, a most intrepid sailor. His crew consisted of four men and a boy.

"Captain Crane made a forty days' passage, under sail only; and for his daring in thus crossing the Atlantic in this small vessel, he was presented with the freedom of the city of New York.

"Prior to Captain Ericsson leaving this country for America, he had built, for Mr. John Thomas Woodhouse, an iron screw propeller vessel to run as a passenger boat on the Ashby de la Zouch canal.

"She was named the Enterprize; her length is about 70 feet, beam 7 feet, and her engines about 14 horse power; her speed, where the water is wide and deep, is from 9 to 10 miles an hour.

"She was delivered and commenced to run on that canal in the middle of the month of August, 1839; and having run during a season without being profitable, she was then used as a steam tug on the Trent and Mersey, for a certain coal traffic, with great success."

Mr. Woodcroft adds (see p. 102 of the work referred to): "It will thus be seen that Captain Ericsson accomplished for the screw propeller in America and in England what Fulton did for the paddle wheel in the former and Bell in the latter country, namely, its practical introduction."

The history of the introduction of steam navigation in the United States shows that, several years before screw propulsion had assumed any commercial importance in

England, the carrying trade on our lakes was, to a great extent, conducted by screw vessels. Already in 1843, the Ericsson line of screw steamers was in full operation between Philadelphia and Baltimore, running through the Delaware and Chesapeake canal, seriously damaging the freight business of the Philadelphia and Baltimore Railroad Company.

Permit me to add that the sum which you mention in your biographical notice, as having been awarded to Sir Francis P. Smith, was paid at a recent period, and divided, in various proportions, among several (I believe seven) patentees who had in the meantime obtained patents for modifications of detail which the Admiralty desired to avail itself of. It is scarcely necessary to mention that Captain Ericsson received a fraction of the sum paid by the British Government. C. H. DELAMATER.

New York city.

The Attraction of the Sun and the Earth.

To the Editor of the Scientific American:

It appears that some of your correspondents are still in doubt about the exactness of the data in regard to the size and density of the sun and earth, and their consequent relative attractions, as established by astronomy. I made some remarks on this subject in your issue of February 7 (page 84, current volume) wherein I pointed out the impracticability of the proposition of Mr. Slaughter, who wished to find by the balance how much a few tons weight would increase or diminish in gravity at certain hours, and I mentioned Herschel's method of illustrating the variation of terrestrial attraction from the equator to the poles by a spring balance. After this communication, a correspondent (Captain Ericsson) communicates that he has constructed an apparatus for measuring these changes, consisting of a heavy iron globe floating in mercury, and Mr. Slaughter now proposes a spring balance with a mirror attached. In regard to the first contrivance, I must remark that a floating object is identical with a lever scale, as the liquid balances the floating body, and any change in the gravitation will equally affect both; so that such an apparatus would show no change whatsoever, even when transported to the moon or to Jupiter. It is, therefore, not in the least surprising that Captain Ericsson, according to his own showing, had no results. In regard to a spring balance with a mirror, this might show differences of attraction, but could not possibly be delicate and reliable enough for purposes of measurement, being affected so strongly by other causes as to be unfit for such delicate measurements as the minute changes in gravitation in question.

The best method is with the pendulum, by watching the changes in the periods of its oscillations at different hours of the day and night; but with what standard can we compare it, as all pendulums will be equally affected? Fortunately we have an equivalent instrument, of which the oscillations are not affected by gravity, and which is thus independent of changes in the same. I refer to a good, well compensated chronometer, in which the mass of the balance wheel and the elasticity of the spiral spring are substituted for the weight of the pendulum and its gravitating tendency. If therefore a criterion of the solar and lunar attraction is judged desirable, all we have to do is to compare the oscillations of the pendulum of a regulator with those of the balance of a chronometer, at different hours of the day and night. At those hours when gravitation is less by solar or lunar attraction, that is, when the sun or the moon crosses the meridian, the pendulum clock must be found to move more slowly, making the seconds longer, going behind the chronometer, and indicating less than 3,600 seconds for the hour as recorded by the chronometer. When the sun or moon is in the meridian of the antipodes, the opposite effect must be observed. These results differ from the ocean tides, which rise equally at the two periods.

I intend making these observations shortly on an astronomical pendulum clock driven by electricity, of which the weight attached to the pendulum is unusually large. I will communicate the results, if any are obtained worthy of notice. P. H. VANDER WEYDE.

New York city.

Calming the Sea by Means of Oil.

To the Editor of the Scientific American:

The communication on page 212 of the current volume of your journal interested me very much. I have read of a whale ship in distress being lightened of a part of her cargo of oil by pouring it overboard, and the sea, for some distance around the vessel, became comparatively smooth. The writer when a boy, living on a farm in Vermont, remembers that, in making maple sugar (by boiling the sap in deep cast iron kettles, as the custom then was), we had a small piece of fat pork, held in the end of a stick; and whenever the sirup foamed and would be in danger of boiling over, we dipped the pork in the sirup, and the foaming would cease instantly. Some years ago we owned a small hoisting engine that we could do no work with on account of foaming in the boiler. By advice of a boiler maker we forced a small quantity of lard oil in it and the cure was complete. It was only necessary to force in about two tablespoonfuls once or twice a day to keep things perfectly quiet inside.

Hartford, Conn.

JOHN McCLOY.

The Electro-Capillary Machine.

To the Editor of the Scientific American:

La Nature erroneously describes this motor, illustrated on page 195 of your current volume, as a French invention. The original description of the machine may be found in *Puggendorff's Annalen*, 1873, vol. 149, pp. 546 to 561. The machine was invented by Gabriel Lippmann, student in the laborato-

ry at Heidelberg; and it was built by the instrument maker Jung, at Heidelberg.

This very interesting machine works economically with feeble currents. It ran once continuously five days and nights by the current of one single Daniell. The power of any electro-capillary motor is independent of its volume, being proportional to the variation of the surface of contact of the two liquids. If S be the variation of the surface (in square meters) of contact under one Daniell, then the work of the machine will be (S÷100) kilogrammeters for each stroke.

Iowa City, Iowa.

G. HINRICHS.

The Beech Blight.

To the Editor of the Scientific American:

In your issue of March 28, Mr. Jacob Stauffer calls attention to an article in the *Science Record* for 1874, on the blight recently observed on beech trees in Westphalia, and states that he had noticed the same thing as early as the summer of 1857. I can go farther back still. In the fall of 1838, I noticed the same white cotton-looking insect on beech trees in Lapeer county, Mich., presenting the wavy undulating motion mentioned by your correspondent. I asked one of the native Indians, who was present at the time, what they were; and he said that they were called "me mes."

New York city.

EDWIN LEACH.

The Emerald Mines of Muzo.

Within four days' journey from Bogota, a French company has been enjoying a monopoly for the last ten years of all the emeralds found in the neighboring mines, and indeed of all the emeralds found in Columbia. The lease expires shortly, and the government think they can get better terms in the open market for a fresh contract, than by granting a renewal to the present leaseholders. The annual payment now is 14,700 dollars, for which the government bound themselves to prohibit the working of any other mines, existing in the territory of the Union.

The mines were known and worked long before the discovery of America and the conquest of New Granada by the Spaniards. When an expedition arrived in that part of the country, about 1553, to reduce the tribe Los Muzos to the Spanish rule, these Indians were found to possess a large quantity of emeralds. It is, however, not easy to see how they worked the mines, as they had no tools of iron. It is supposed that they found the stones in the beds of the mountain torrents; for it sometimes occurs that the winter rains produce great land slides which lay bare large veins of emeralds, in which they are washed out by the waters. But report speaks unfavorably of the quality of these gems; they resemble those which are still found in the Indian burial places, or in the lakes into which the Indians used to throw their relics during their struggle with the Spaniards. Let, however, this be as it may, the mines of Muzo were worked soon after the arrival of the Spaniards on a large scale, both in the open air and by means of subterranean galleries; but about the middle of the eighteenth century, the mines were abandoned no one knows why. And it was not until the war of independence and the expulsion of the Spaniards that working operations were again resumed. The mines were naturally taken possession of by the Republic, and let out to individuals and companies.

The principal mine now in work is pierced in every direction by galleries made by the Spaniards. Since 1825 it has been worked in the open air. An immense number of gems have been found, many of them of great value. After this mine shall have been exhausted, which will not be for many years, not a thousandth part of the ground containing emeralds will have been touched.

About two days' journey from Muzo there is another mine called Laquez, which was just touched by the Spaniards, and is evidently very rich. All this ground, including Laquez, bears traces of the presence of the Spaniards; and as the geological formation is the same in the whole neighborhood, it is clear that the day is far distant before these mountains will be exhausted.

The mountains of Muzo belong to the lower formation of chalk. The emeralds are found in two distinct layers; the first or upper one composed of a calcareous bitumen, but hard and compact. These two layers are generally separated from each other by a distance of from seventeen to twenty-two yards. In the open layers are found the veins which yield the "nests" of emeralds—that is to say, a number of these gems massed together. But after one of these nests the vein disappears, being crossed by others of a different kind, which run in a different direction to those containing the emeralds. These latter veins are called "ceniceros" from their ashy color; they are generally horizontal, while the emerald veins are perpendicular. They all run from N.E. to S.W. The veins of the lower layer are more regular, and are followed for fifty or sixty yards, and even more. "Nests" of emeralds are seldom found in them, but they are more easy of extraction. When veins of fluor spar, well crystallized, are met with, the emerald is not far off; the presence of rock crystal is also a good sign, as likewise that of a pretty pyramidal shaped stone, of the color of honey.—*Iron.*

It is hardly possible to introduce successfully an improvement in machinery of any class without the aid of a good engraving. It not only serves to show at a glance the valuable features of the machine, more effectually than the longest verbal description can do, but it also constitutes the very best method of advertising an invention, its attractive appearance securing the attention of the reader, while a column of reading matter, without illustration, might be overlooked.—*National Car Builder.*

IMPROVED PLANE GUIDE.

The invention herewith illustrated is an improved plane guide, by which the plane is steadied in squaring or beveling to any desired angle without the use of either try square or bevel. It is claimed that, with the aid of the device, any beginner or inexperienced workman can do better work and in less time than the ablest hand in the ordinary way without the attachment. Our engravings represent the apparatus applied to the plane, Fig. 1, and also separately, Fig. 2.

The yoke, A, is attached to the plane by means of a clamp screw, B, at one side, and a flanged extension at the other, C is the guide strip, which is applied to a connecting piece, D, which, by its semicircular portion, is pivoted to the outward projecting end of the yoke, A. The semicircular and straight portion of D is cast in a single piece, and the former part is beveled along its circumference, and divided into degrees. It may be rigidly set at any angle to the plane by a curved wedge piece, E, which is tightly secured, by a set screw between D and a small beveled projection on the yoke, at the outer end of the latter. The piece, D, extending from its semicircular portion, is slotted, and slides in a recess of the guide strip, C, so that the latter may be carried up to the base of the plane and firmly secured by the set screw and washer, F. A small projection on the yoke serves as an index to the degrees marked on the semicircular portion of D.

When the plane is to be used with the guide, for squaring, beveling, or jointing boards, veneers, etc., the yoke is firmly arranged in such a position that the center of the semicircular part shall be slightly below the base of the plane. The set screw at the edge of the arc is then loosened, which allows the swinging of the guide strip to any desired angle. If the latter is oblique, the set screw, in the slotted part of D, is loosened to give greater play to the guide. When the guide is in position, the set screw and wedge at the arc are tightened, and the guide is raised up until it touches the base of the plane. The set screw of the guide is then tightened, and the apparatus is ready for work.

Fig. 1

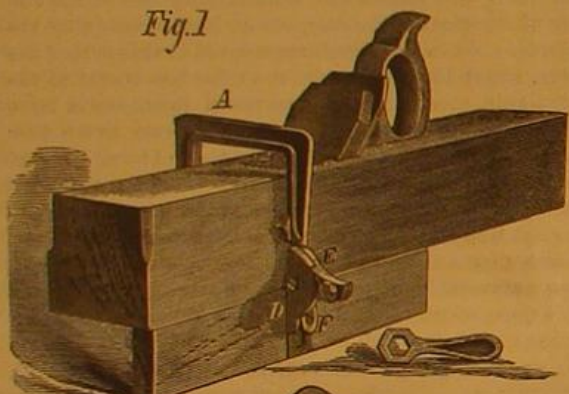
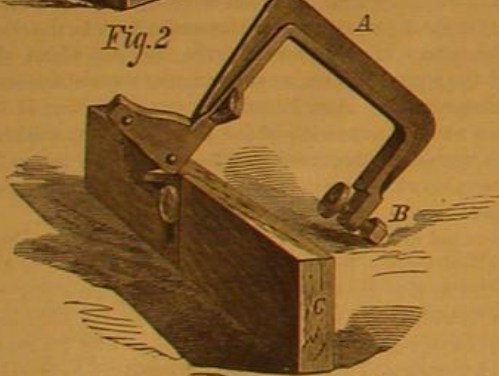


Fig. 2



By fixing the plane (with guide attached) in the vise, small work can, it is stated, be squared or beveled without the annoyance of frequently picking up and laying down a heavy plane, try square, or bevel, several times for each piece, and the trouble of fastening each piece in the vise. This work can be done perfectly, with the attachment, where the light would be insufficient for the ordinary mode of operation.

Having an equal pressure on both sides of the board, long and thin stuff, we are informed, can be beveled without the board springing from the bit and riding the ends of the plane.

Patented through the Scientific American Patent Agency, January 6, 1874. For further particulars address Walter S. Shipe, Minerva, Stark county, Ohio.

A Hill Full of Pyrites and a Widow Thrown In.

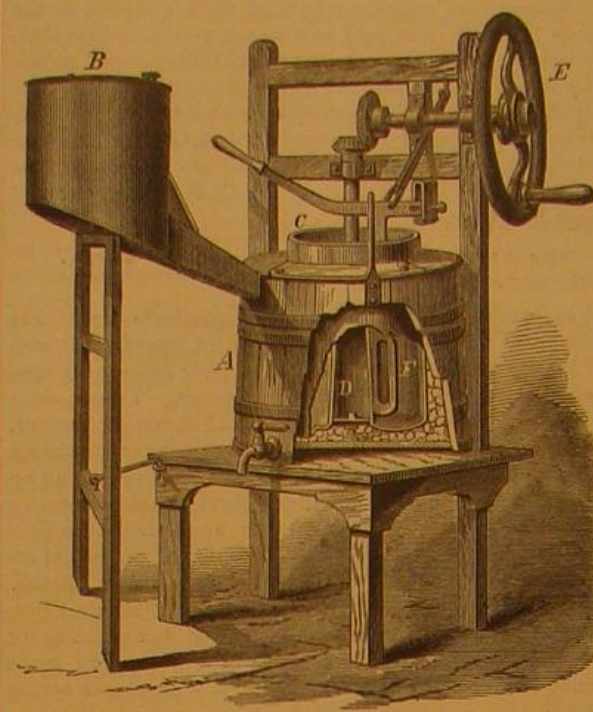
An extremely sharp and intelligent American gentleman from the West once walked into the office of Dr. C. T. Jackson, the chemist. "Dr. Jackson, I presume?" "Yes, sir." "May I lock the door?" And he did so. Then having looked behind the sofa, and satisfied himself that no one else was in the room, he placed a large bundle, done up in a yellow handkerchief, on the table, and opened it. "There, doctor, look at that!" "Well," said the doctor, "I see it." "What do you call that, doctor?" "I call it iron pyrites." "What!" said the man; "isn't that stuff gold?" "No," said the doctor, "it's good for nothing: it's pyrites." And putting some over the fire in a shovel, it soon evaporated up the chimney. "Well," said the gentlemanly man, with a woe-begone look, "there's a widow up in our town has a whole hill full of that, and I've been and married her."

[It is almost a daily occurrence at this office to receive specimens of the substance which was brought to Dr. Jackson. We have not heard that any of our correspondents have suffered to the degree of chagrin or from the cause as did the interviewer of the above distinguished chemist; but we have observed great disappointment upon the countenances of some persons,

who have brought their specimens to us from a long distance, on being told that their gold was worthless pyrites. —Eds.]

LUCETTI'S ITALIAN ICE CREAM FREEZER.

Confectioners, and others whose business includes the manufacture of large quantities of ice cream, water ice, and



similar delicacies, will doubtless find, in the device represented in our engraving, a convenient and timely apparatus for use during the coming summer months. It is said to freeze the cream with great rapidity, and to require much less labor in its manipulation than the machinery commonly employed. It is constructed as follows:

The tub, A, of the freezer, connects with a reservoir, B, which is kept filled with ice. A suitable gate is arranged in the spout, forming the two receptacles by which supply can be admitted to the former from the latter at will. The cream receiver, C, is constructed of such dimensions as to afford sufficient space for the freezing materials between its outer surface and the tub, A; and it incloses a tube, D, which is open at the bottom, and passes up through its center. The object of this last mentioned portion is to allow the cold air from the ice to pass to the middle part of the receiver so as to freeze the adjoining portion of the cream as quickly as the outer parts. Bars cross the lower end of the tube, D, and carry a pivot, which, setting in a socket in the tube, A, serves as a support for the receiver. The upper extremity of the same tube is secured to a vertical shaft which carries on its top a bevel pinion, forming a portion of a bevel gear by which motion is communicated to the shaft, and thence to the receiver by the crank wheel, E. The tub, A, is provided with a ring cover. The receiver has also a cover which has a hole in its center for the passage of the shaft, and a slot to receive a spatula, F. The construction of the lower part of the latter is clearly shown in the engraving, and it is operated so as to scrape against either the tube or the inner surface of the receiver by means of simple detachable mechanism, the operation of which needs no special explanation.

In using the freezer, the receiver is rotated by turning the crank, E, with the right hand, while the spatula is controlled by the left. The apparatus is also so arranged that the gate for admitting the ice is readily governed by the left hand of the operator.

Patented through the Scientific American Patent Agency, July 22, 1873. For further particulars regarding sale of rights, etc., address the inventor, Mr. Antonio Lucetti, at 125 White street, near Center, New York city, where the device may be seen.

MAGNIFYING INSECT CASE.

This is a simple device, by means of which living insects can be conveniently disposed under a lens, and thus kept for a lengthened period for purposes of examination. In entomological studies, the invention might be found quite a useful auxiliary, and would doubtless prove interesting and instructive considered merely as a source of amusement. It consists of a shallow tray of suitable dimensions, having its



longitudinal sides higher than its transverse ones, in order to receive a glass cover. The center of the latter is thickened into lenticular form at A, in order to afford the necessary magnifying power. B is a small platform, which is provided with a front piece set at right angles, and a knob, by which it may be pushed in and out of the box through a

square aperture at C, in the same manner as a drawer. On this the insect is placed. The glass is firmly held by two small set screws or bolts at D.

Patented through the Scientific American Patent Agency, February 17, 1874. The inventor desires to sell the patent to the highest bidder. Further particulars may be obtained by addressing G. N., Box 73, Station D, New York city.

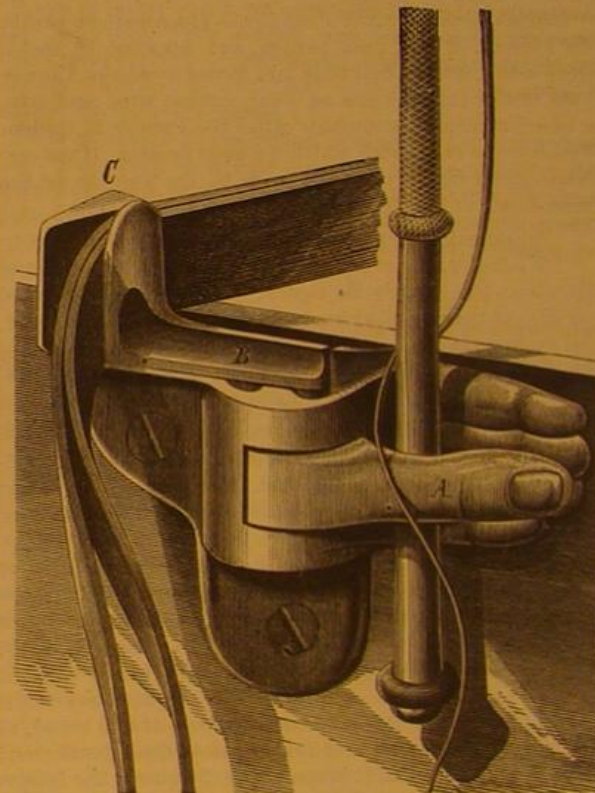
An Odd Use for Hammers.

"I remember," says a correspondent of the *Medical and Surgical Journal*, "that when I was very young, they used to raise blisters with boiled hammers. Old Dr. Twitchell of Keene (peace to his ashes!) once wanted to blister some one in a farm house, far from home. He had nothing with him to do it with. He asked the wife to find him a hammer. The article was brought out, put in a tea kettle over the fire, and, after the water steamed and bubbled well, he lifted it out and gently touched it to his patient, in half a dozen spots, over the seat of pain, with very positive effect. Boiled hammers were, for many years, used in that neighborhood for pleurisy; and every old lady knew nothing was equal to a hammer; and there was a long dispute whether it should be a claw hammer or not. I think the yeas finally conquered."

MATSON'S SAFETY COMBINED WHIP AND REIN HOLDER.

This is a useful device, simple in construction and readily applied to any carriage. Its object, as indicated by its title, is to hold the whip or the reins, and to this end it is attached to any convenient place on the dash board.

As shown in the annexed engraving, it consists of a metal box provided with flanges for the securing screws. In the enlarged circular portion, it carries the shafts of two arms, one of which, A, is made thumb-shaped, and grasps the whip, while the other, B, in connection with a projection, C, firmly holds the reins. Both arms are provided with strong springs inside the box, which cause them, after they are drawn back and the whip or reins inserted, to clutch the same tightly. In inserting the reins, the driver drops them between the jaws from above, and pulls them back as far as he chooses. They are immediately securely held, as any



dragging upon them by the horse only wedges the clutch tighter. The apparatus is made of malleable iron, is quite strong and durable, and, it is claimed, cannot become out of order.

Patented through the Scientific American Patent Agency, Messrs. Matson & Brothers, of Moline, Rock Island county Ill., are the inventors and manufacturers, of whom inquire for further particulars regarding sale of rights, etc.

Gain in Weight by Combustion.

At a recent lecture before the Franklin Institute, Mr. Theodore D. Rand showed a simple and satisfactory experiment to demonstrate the increase in weight of burning bodies, caused by their absorption of oxygen. About an ounce of fine turnings of zinc, produced in the spinning of that metal, were loosely wrapped with iron wire and suspended from the arm of a balance. The pan on the other arm having been weighed to counterbalance the zinc, the latter was ignited with a match. At first the combustion was rapid, and much oxide escaped in fumes, causing the zinc end of the balance to rise. Soon, however, the combustion became a mere glow, the absorption of oxygen taking place without fumes. In a minute the beam began to descend and soon very decidedly outweighed the counterbalance.

The only precaution necessary is to have the zinc moderately but not too compact. If too loose, it burns too rapidly; if too compact, it will not burn.

SOMEWHAT CONDENSED.—A French chemist is said to have condensed the body of his wife into the space of an ordinary seal, and had her highly polished and set in a ring. He made a nice income by betting, with lapidaries and others, that they could not tell the material of the set in three guesses, and, after pocketing the money, would burst into tears, and say: "It is my dear, dead wife. I wear her on my finger to keep alive pleasant remembrances of her."

CASTING A FIVE HUNDRED TON ANVIL.

At Perm, a town situated on the banks of the river Rama, in the northeastern part of Russia, there is a gun factory, belonging to the Russian government and erected for the purpose of manufacturing cast steel guns of large caliber. Owing to the increasing requirements of the work carried on, it was found necessary to substitute for the 15 ton hammer ordinarily employed, a large double-acting 50 ton machine, calculated, when using top steam, to be equal in effect to a single-acting 100 ton hammer. To form the anvil block, the molding of a solid mass of iron, 500 tons in weight, was necessitated, and the annexed engravings and following description, condensed from *Engineering*, explains how the operation was performed.

The geological characteristics of the ground selected for the erection of the hammer were first examined, and after passing through various strata of clay, sand, and boulders, a dense slate, capable of resisting a pressure of 680 lbs. to the inch, was reached. This was selected as a foundation, and the excavation was performed by the aid of a watertight caisson and compressed air. After the slate had been penetrated to a depth of 7 feet, two cross layers of heavy larch beams were laid and covered with tar and felt. Then came three courses of sandstone masonry laid in cement, *n n*, Fig. 1, each block weighing from 16 to 19 tons. This change of wood and masonry was repeated twice, and the whole ultimately covered with a double course of larch beams, upon which the anvil block was to be placed. The construction of the hammer building (a tower-like edifice, consisting of an iron roof supported by four iron pillars) and of the adjoining structures was next finished, and the preparation for the casting of the great block were begun.

The latter has the form of a prism with a base 16½ feet square and 5 feet high, joining a pyramid 9 feet high, with a top 9 feet 8 inches square. The cubical contents of the mass are, therefore, 2,700 feet. To compress the iron on the top of the anvil block, it was decided to cast the same upside down, and hence two trunnions, *g g*, were provided, upon which it could be turned to its proper place after having cooled, and which also served as inlets for the molten iron. The block was cast on the top of its definitive foundation; and after the casting pit had been well dried and warmed, the molding itself commenced. First a framework, *i i*, of vertical cast iron beams covered with iron plates, and strongly braced, was erected at the sides of the pit. The hollow space in this structure was filled with molding sand. Four layers of common brick, provided with flues for the escape of gases, were placed at the bottom of the mold, then four courses of fire brick, *p*, the three upper layers forming an inverted arch. A mixture of fire clay and quartz served as filling material. Lastly came three more courses of large fire brick, the space between the latter and the iron framing being rammed with molder's sand. The pinions and channels for the liquid iron were similarly molded.

While this operation was progressing, fourteen Mackenzie cupolas, *A'*, were erected around the mold and to supply them with the necessary blast of 4,000 cubic feet of air per minute, anthracite coal being mainly used, three blowing engines were used, of different construction, having, however, cylinders respectively 6½ feet, 6 feet, and 7½ feet in diameter, and making from 21 to 28 revolutions per minute; and 255,360 lbs. of fuel and 1,786,400 lbs. of pig iron were prepared. Within an hour after the cupolas were lighted, the three blasts being turned on during that period successively, the iron began to melt, and the first tapping took place. The work began at 3:45 A. M., and by 3 P. M. 880,000 lbs. of iron had entered the mold, reaching a height of 10 feet from the bottom. By 7:21 in the morning of the following day, the whole operation was over, the cupolas having been cleansed and filled three times, and only ten of them being used toward the end.

After a lapse of two days, a thin crust appeared on the surface, and the iron underneath was found to be under a state of compression by the contraction of the cooling surface, so that, instead of forming the well known phenomena of hollows, the iron came bubbling up through the pierced holes. After the lapse of two months, the mass was cool enough not to affect zinc, while it melted lead inserted in drilled holes. According to trials of temperature, it was found that the heat diminished at the rate of 72° Fah. per day at the outset, then

at the rate of 54°, and, toward the end of the cooling, at the rate of 32° per day.

The entire work cost about \$48,400, or some \$96 per ton.

The difficult operation of turning the anvil block was successfully accomplished in the month of October last by Mr. Woronzow, the engineer in charge of the factory. The great mass was revolved on its journals, by two steam engines, within two hours and a half.

To Make Paper Transparent.

* The best kind of paper is the class known as wove, not laid, paper. A varnish formed of Canadian balsam dissolved in turpentine supplies an excellent means of making paper transparent. The mode by which we succeeded best was to apply

former is elevated to a higher temperature than that in the latter; consequently the fluid travels through the lever from the first ball to the second, which, becoming heavier, overbalances the equilibrium, and in so doing sets free a weight attached to clockwork mechanism connected with a pendulum. When the sun is obscured, the liquid resumes its normal position, and the arms of the lever once more balance, arresting the fall of the weight.

In addition to the three dials above noted, there is a fourth, which is combined with mechanism which shows how many clouds pass before the sun, how frequently, and the exact time they take in making the transit. This consists of a narrow band of paper extended on a light circular frame established around the face of a clock. The latter is actuated by the ordinary machinery. Its single hour hand carries a pencil. When the sun shines, the paper, on its movable frame, is carried up to the pencil through mechanism connecting with the motor already described. The leaden point then traces a portion of the circumference corresponding to the divisions on the face of the clock passed over by the hand. If, however, a cloud passes before the sun, the movement of the lever, regaining its balance, withdraws the paper circle from the pencil, leaving a blank, the length of which shows the time during which the sun was screened. A single band of paper will last for a month or more, as the hour hand is made in two parts, screwed together, and so combined that, at every revolution, the outer portion passes under a fixed rack so that the screw head is slightly turned, thus elongating the arm and causing the pencil to begin its mark on a fresh portion of the paper.

In connection with the apparatus the inventor has established a sundial which strikes the hours, a paradoxical operation accomplished as follows: At every hour mark on the dial plate is fixed one of the ball and lever mechanisms that we have above described. When the shadow of the style arrives at any hour, one ball is shaded, the lever tilts, and clockwork mechanism, of simple construction, strikes the hour on a gong.

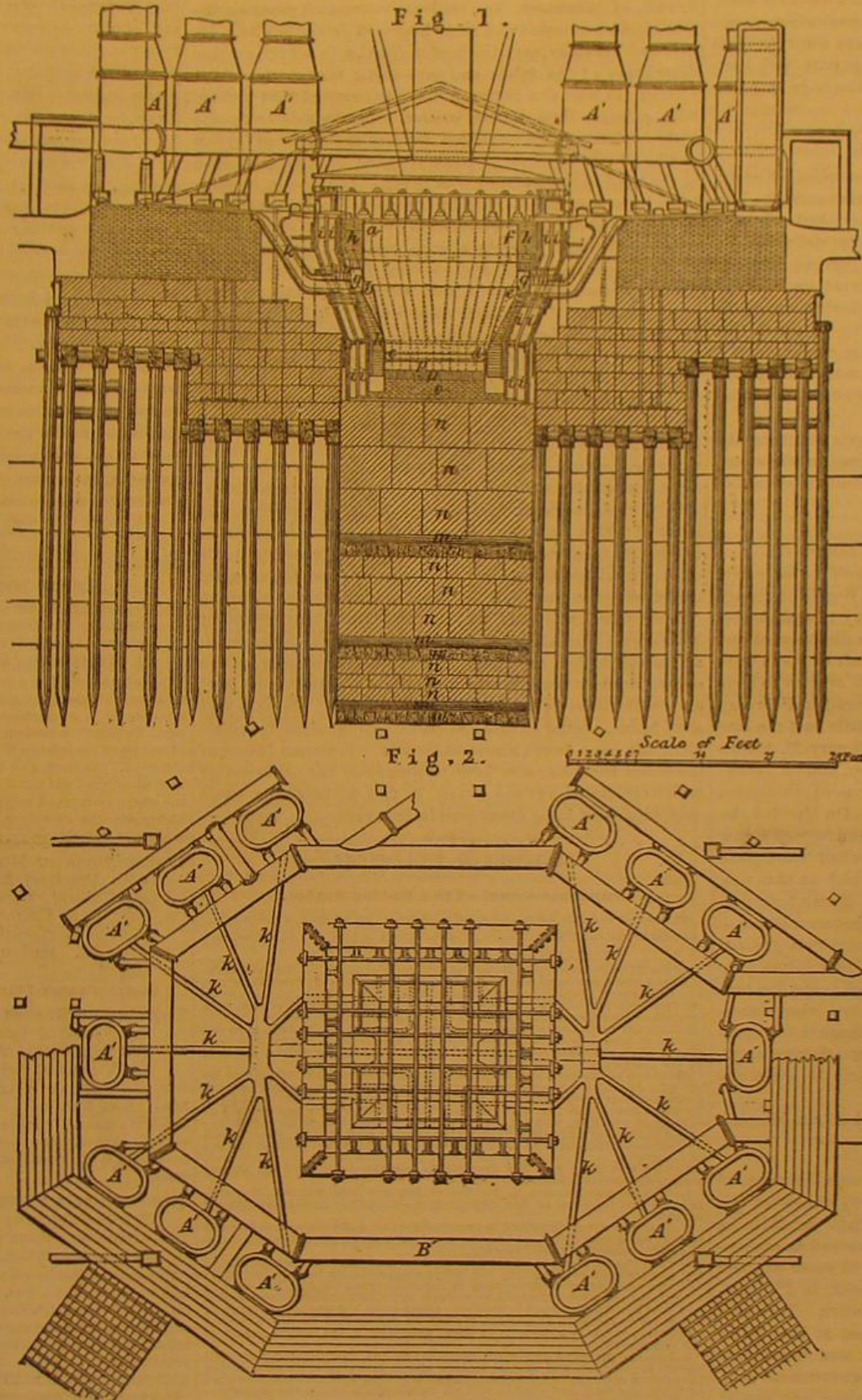
We should imagine that the solar counter might be of considerable use in extended meteorological observations. A large superficies of territory, for instance, might be provided with a number of these instruments distributed at equal distances apart, from which telegraphic communication might be established to a central station, and thus, say every twenty-four hours, the period of sunshine, for all the points of observation, might be known. From this could be ascertained the course of the atmospheric currents; and further, by noting the amount that the sun has warmed the soil and atmosphere of countries more or less temperate than our own, we might be able to predict either milder or colder weather, through the effect of the condensation or dilatation of the atmosphere in such regions, and the consequent effect of such upon that of our immediate territory. The knowledge of the direction and number of clouds (which exercise a notable influence upon the temperature), coupled with that of the direction of the wind currents, would also offer new elements of observation of considerable practical value.

Finally, as the autumn is warmer in proportion as the sun has shone more or less during the summer, transmitting more or less heat to the soil, the solar counter would serve to indicate approximately the yield of fruit and other crops to be expected.

An Hotel on Wheels.

The American carriage and wagon builders have a worldwide reputation for light work, says the *Carriage Monthly*; and as our cousins across the water have repeatedly stated that we carry this idea of lightness to extremes, we are now prepared to inform them that we can build also an occasional heavy vehicle. To Philadelphia, justly celebrated for light work, please remember to give the credit for building the heaviest heavy carriage on record. The following dimensions will be sufficiently startling, but we can vouch for their correctness, inasmuch as we have seen the drawing and copied the sizes.

DIMENSIONS OF BODY.—Length: 50 feet; width: 20 feet; height: 16 feet. The carriagebody is two stories high. The first story is 8 feet in the clear, and the second story 7 feet exclusive of the arch of the roof, which at the center gives 8 feet head room. Entrance is provided for at the front and back ends. The roof has ventilators similar to a street car. There



THE GREAT ANVIL AT PERM, RUSSIA—PLAN AND SECTION.

a pretty thin coating of this varnish to the paper, so as to permeate it thoroughly, and then give it a good coating on both sides with a much thicker sample. Keep the paper warm by performing the operation before a hot fire, and apply a third or even a fourth coating until the texture of the paper is seen to merge into a homogeneous translucency. Paper prepared in this way has come nearer than any other to our ideal of perfection in transparent paper.—*British Journal of Photography.*

THE SOLAR COUNTER.

A curious invention, the device of Abbé Allegret, has recently been introduced in the *Jardin d'Acclimation*, in Paris. It is an instrument which indicates how long the sun shines (months, days, hours, or minutes), during any given period. The machinery operates only when the sun is visible, and transmits its movement to three dials which, connected together in a simple manner, show months, days, hours, and fractions of the latter.

The essential part of the apparatus is two balls, one of which is black and the other yellow, fastened on opposite arms of a lever, which is sustained by a central pivot. When the sun shines the black ball absorbs more heat than the yellow one, and hence the vapor of the liquid contained in the

are 16 arch top windows, on each side, 8 below and 8 above. Those in the first story are 2 feet 6 inches wide, and 4 feet 9 inches high, and in the second story, 2 feet 6 inches wide, and 4 feet high. They have each two sashes, which are arranged to be raised and lowered. Those in the first story are divided into four lights each, and those above into two lights each. The upper windows are provided with shutters or blinds. The immense body or house, whichever you please to call it, will be hung upon platform springs, which will be of in all sufficient strength to support 25 tons weight. The wheels will be 3 feet 2 inches and 4 feet 4 inches in diameter respectively. Hub: 18 inches in diameter; felloes: 9 inches on the tread, and 6 inches deep. The Brobdignagian wagon is intended for hotel purposes during the Centennial Exhibition. The first story will be used as a dining saloon, and the second story will contain 16 state rooms, with 2 berths in each. It is proposed to place this portable hotel somewhere on the exhibition grounds, there to remain stationary until the close of the exhibition. The gearing or carriage part will have no other labor to perform than to support the body in going to and from the exhibition grounds.

ASTRONOMICAL NOTES.

At a recent meeting of the Royal Astronomical Society, Mr. Burton, who was for two years an assistant to the Earl of Rosse, stated that, during that period, there had only been three hours of what might be called excellent definition for the great six-foot reflecting telescope. In general, they had to use the three-foot reflector for their observations.

With this instrument, on one occasion, during exceptionally fine weather, he had been able distinctly to detect that the fine markings on the planet Mars were composed of a texture resembling the stippling of a mezzotint engraving. On no other evening had the definition been sufficiently good to recognize the same details.

We hope that our Washington astronomers will turn the great refractor towards the planet when occasion offers, and let us know how the markings which Mr. Burton speaks of appear in that instrument.

Spots on the Sun.

The students of Vassar College report as follows: Our record is from February 17 to March 14 inclusive. The period has been marked by an unusual degree of change in the spots. Between the noon of February 17 and that of February 18, two small ones near the center disappeared and a new one appeared. On February 20 a pair of spots were seen, a little to the east of the center, which seemed to have been formed by the division of one spot noticed on February 18. A new small one had also appeared, a little past the center. The next observation was made on February 26, when a good sized group was seen east of the center, and on February 28 the largest member of this group showed an umbra of peculiar shape, resembling a palm leaf. On March 2 the stem of the leaf had apparently separated and formed a new spot close to the first. Considerable changes had taken place since February 28. One circular spot, which on that day was on the eastern limb, had disappeared. March 3 showed a new spot to the west of the center, and between March 3 and 4 there was a still more decided change. Two groups, which on the 3rd were small, had resolved themselves into several spots, and a new group had appeared below the center. On the 4th two photographs were taken eleven minutes apart, and there were indications of change in the spots even in that short time. Owing to cloudy weather no observations were made after March 5 until March 14, when the spots were unusually large. Faculae were noticed February 17, 18, and 20, and March 5.

Joseph Harrison.

We hear, with regret, of the death of Joseph Harrison, of Philadelphia, Pa., well known in engineering circles as one of the greatest American mechanics. Born in 1810, he showed proficiency at a very early age, and served as apprentice, journeyman, and foreman till he was 25 years old, and was then in the employ of Garrett & Eastwick, in Philadelphia, where he designed and built a locomotive. This was in the year 1835, and the business increased so fast (after the then unworied achievement) that he was taken into partnership. Some agents of the Russian government soon afterwards suggested to Eastwick and Harrison that one of them should go to Russia, where the government was about to invite proposals for the whole of the rolling stock for the great railway, 400 miles in length, from St. Petersburg to Moscow. Mr. Harrison went to St. Petersburg, arriving there in 1843, with the remainder of \$500 in his pocket. Mr. Thomas Winans, of Baltimore, who had gone there to superintend the working of a locomotive, uniting with Mr. Harrison in making proposals. The contracts were ultimately awarded to them, under the firm of Harrison, Eastwick & Winans. They constructed 162 twenty-five ton locomotives; 2,000 eight-wheel cars; 500 eight-wheel platform cars; 70 eight-wheel passenger cars on the American plan; 6 eight-wheel post cars; the total of the contract amounting to \$3,000,000. All this work was constructed in government shops, at St. Petersburg, by Russian workmen, and was completed in five years. Mr. Harrison's high personal character obtained for him the means of carrying out this large contract on his very small capital; and after this great success and many others, he returned to Philadelphia in 1852, since when his greatest work has been the production of the Harrison boiler, one of the most highly esteemed of several inventions which defeat the danger by explosion of boilers by building them in sections. He also introduced into Europe the American drop bottom cupola, for iron smelting, the smelters having previously, at the end of the heat, pulled the slag, etc., from a small door

or the tap hole, instead of dropping the bottom as is now done. He patented the equalizing beam for distributing equally the weight of the locomotive on the drivers, and the Harrison stub end (without keys) for the connecting rods. He designed and first used the tool for boring both the crank pin holes at right angles at the same time, thus doing the work mechanically correct as well as much cheaper.

The integrity and moral courage of this eminent man laid the foundation of his success and his great fortune; and those who knew him, whether as a husband, father, son, friend, or citizen, will sincerely mourn his death.

Shell Heaps in Maine.

At a meeting of the New England Historic-Genealogical Society, held a few days ago in Boston, Professor Rufus K. Sewall, of Wiscasset, Me., read an interesting paper on the ethnological remains and shell heaps at Damariscotta. He prefaced his essay, says the Boston Globe, with a very graphic description of the inlets and bays along the coast in that vicinity, as well as a review of the discovery of that region, with extracts from letters written at various dates by the early explorers. He exhibited several specimens of oyster shells, as well as pieces of pottery, found in large quantities at the head of the Damariscotta River. The shells, he said, must have been piled there by a people who lived previous to any period of history referred to by documentary or traditional testimony. Skeletons were found at various points along the seaboard; but while several fragments of utensils for the performance of household work were found, no darts or spears seem to have been discovered. From the data at his disposal, the lecturer deduced the following conclusions: First, that there were oysters along the coast of Maine in the early ages of this country, and the shell heaps were piled up by human hands; secondly, the site of these huge deposits was the home of a primitive population; thirdly, these inhabitants were a domestic people, they cooked their food in a manner which bespoke civilization; fourthly, they had clear perceptions of the utility of mechanical appliances; fifthly, there were successive races in these localities, the latter of which were more nomadic than their predecessors, and lastly, these settlers came from eastern countries. He cited several additional facts in support of these theories, and closed with a summary of the proofs adduced, from which he claimed that it was clear that the aboriginal inhabitants of Maine came from the East, and brought with them the civilization which then prevailed. Mr. Kidder, a member of the society, made a few remarks in which he controverted several of the theories advanced by Mr. Sewall. He said that shell heaps, similar to those at Damariscotta, were found all along the coast from Canada to Florida. Professor Morse, of the Essex Institute, also bore testimony to the existence of such deposits at various points in this country, the exact counterparts of some discovered in Denmark.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

GLYCERIN PATENT.—ROLAND G. MITCHELL vs. RICHARD A. TILGHMAN. (Appeal from the Circuit Court of the United States for the Southern District of New York.—October Term, 1873.)

On the 2d of October, 1854, letters patent were granted to the complainant for a new and useful improvement in processes for purifying fatty and oily substances of animal and vegetable origin, and which contain glycerin (glyceryl) as an impurity. His invention, as the patentees state, consisted of a new and improved mode of treating such substances in order to produce fat acids and solution of glyceric acid, which, as he says, was not known or used before his application, and the recital of the patent is that it shall take effect from the 9th day of January preceding the date of the instrument.

By virtue of the said letters patent, as the complainant alleges in his bill of complaint, he acquired the exclusive right to make and use the described improvement, and to vend the same to others to be used; and he also alleges that the respondent, prior to the time when the bill of complaint was filed, without his license and in violation of his rights, engaged in making and using his patented process, and that he, the respondent, intends to continue to make and use the same, as set forth in the bill of complaint.

Service was made and the respondent appeared and filed an answer setting up several defenses, as follows:

1. That the complainant, on the 9th of January, 1854, was not the original and first inventor of the improvement described in the said letters patent.

2. That the result described in the specification and claims of the patent cannot be accomplished, so as to be practically useful, by the method and apparatus described in the specification.

3. That the respondent never practiced or used the patented process of the complainant as charged in the bill of complaint, or in any other manner. He admits that he is engaged in manufacturing candles, and that in manufacturing such articles he uses water and steam at high temperature, and that he also uses such pressure as arises from the expansive force of hot water or steam in a close vessel; but he denies that he uses any such method, process, or apparatus as those described in the letters patent of the complainant.

4. That the patented processes described in the specification were well known to chemists and men of science and to manufacturers long before the alleged invention of the complainant, and were also used and practiced by them, and were described in printed publications before the complainant filed his application for a patent.

5. That the use of a close vessel of sufficient strength to resist the pressure of water when heated, or any pressure incident when using water, to decompose other substances, was known to and practiced by men of science and manufacturers in this country and elsewhere long before the alleged invention; that highly heated water, when used as described, is an elementary principle open and free to all, and that such a principle is not one that is subject to a patent; that a prior knowledge of the alleged invention was possessed by many other persons, and that the same was described in many printed publications, as fully set forth in the answer.

On the 23d of November, 1867, the notice of the complaint was extended for seven years from the expiration of the fourteen years for which the original patent was granted. Subsequently, to wit, on the 6th of March, 1871, the complainant instituted a second suit against the respondent, founded upon the extended patent, which is No. 530 on the calendar. Both cases were heard at the same time. Suffice it to say, in respect to the latter, that the pleadings, issues, and proofs in the two cases are substantially the same, and that the latter must be disposed of in the same way as the preceding case.

Decrees were entered in these cases, respectively, in the circuit court in favor of the complainant, each of which must be reversed. The decree in each case is reversed, with costs, and the cases are, respectively, remanded, with direction to dismiss the respective bills of complaint.

The Court held substantially as follows: The claim in every patent must be construed to be limited to the method or process described in the specification.

A claim in these words, "The manufacturing of fat acids and glycerin from fatty bodies by the action of water at a high temperature and pressure, interpreted in reference to the specification to mean a process for decomposing fats, and converting them into oleate, margarate, and stearate, and a solution of glycerin, by, among other measures, mixing the fat thoroughly with one half or one third as much water by means of a perforated piston forced through the mixture back and forth, and by subjecting it for ten minutes to the temperature of from 510° to 515° Fah. in a close vessel capable of resisting the consequent pressure, and which is filled by the mixture, and into which nothing else is admitted."

Thus interpreted, the claim is not infringed by a process consisting of mixing melted fat and water by forcing the water up through the mixture, and spraying it over the top whence it settles through, and by subjecting the mixture for several hours in a close vessel to such a heat that the pressure equals that of from ten to twenty atmospheres. Diction. A newly discovered principle or property of matter may be patented provided a new and useful result has been obtained from the application of it, and the specification describes how the result is to be obtained. Diction. A patent is invalid if the result which is predicted cannot be obtained by the means described. Diction. Or, if the process cannot be performed without de to the operator.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the SCIENTIFIC AMERICAN. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs, drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees, and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN is obvious. Every issue now exceeds 42,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the SCIENTIFIC AMERICAN, the parties ordering having seen the article illustrated or advertised in these columns. Address

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NEW BOOKS AND PUBLICATIONS.

THE PRINCIPLES OF CHEMISTRY AND MOLECULAR MECHANICS. By Dr. Gustavus Hinrichs, Professor of Physical Science in the State University of Iowa, etc. New York: B. Westermann & Co.

It has been stated by a modern savant that the science of mechanics is universal, ultimate, and all-including, and that chemical action is as certainly a matter of mechanical arrangement as are light, heat, and electricity. To this view modern research is constantly tending, and the current literature of the schools is beginning to recognize recent progress in this direction. The book now before us is a compendium of what has already been discovered and laid down in the form of general laws according with the above mentioned theory, and is a most valuable contribution to our higher scientific literature, which we cordially commend to our readers as worthy of attentive study, and as a most excellent text book.

INSTRUCTIONS IN MODERN AMERICAN BRIDGE BUILDING, with Practical Applications and Examples, Estimates, and Tables. By G. B. N. Tower, formerly Chief Engineer in the United States Navy, and Chandler Instructor in Civil Engineering at Dartmouth College. Illustrated. Price \$2. Boston: A. Williams & Co., 135 Washington street.

A handy little book, full of information clearly and concisely expressed. THE UNITED STATES LAW DIRECTORY FOR 1874, containing the Names of One or More Reliable Law Firms, Banks, and Real Estate Agents in each of the Principal Cities and Towns of the United States and Canada.

We have here a portly volume, compiled with great care and considerable labor. Each State has a section of the work devoted to it, which is preceded by a digest of the laws and court calendar. The work is revised and reissued annually, and deserves the attention of the legal profession on account of the information it contains concerning all parts of the United States.

THE SECTORIAN SYSTEM OF RAIL RAILING, Elucidating the Whole Subject by Fifteen Plates. By William Forbes, Architect. Price \$5. New York: A. J. Bicknell & Co., 27 Warren street.

This work exemplifies a new method of laying out stair and other railings, by the use of a sector, which the author describes as "a mathematical instrument founded on Euclid I. 4, and adapted to this system." The tool can be readily made by any workman; and the system, admirably illustrated and described in the book before us, will, no doubt, soon be put to a practical test.

Inventions Patented in England by Americans.

- (Compiled from the Commissioners of Patents' Journal.) From March 10 to March 12, 1874, inclusive. BREACH LOADING FIRE ARMS.—R. Burton, Brooklyn, N. Y. DRYING BONE BLACK.—P. Farley, New York city. GAS MANUFACTURE.—D. Davison, New York city. GRIPPING TOOL, ETC.—D. L. Kennedy, New York city. HOISTING DOOR, ETC.—J. W. Meaker, Detroit, Mich. HOSE COUPLING, ETC.—D. Ashworth, Wappinger's Falls, N. Y. ICE MANUFACTURE, ETC.—S. B. Martind, San Francisco, Cal. METAL BOOT SOLE.—J. A. Punderford, New York city. ORDNANCE.—N. Ward, Washington, D. C. ORGAN STOP.—T. Winans, Baltimore, Md. PROPPELLING BOATS AND CARS.—T. J. O'Toole, Brooklyn, N. Y. PUMP.—W. J. Silver et al., Salt Lake City, Utah. STEAM GENERATOR.—W. E. Kelly, New Brunswick, N. J.

Recent American and Foreign Patents.

Improved Millstone Driver.

Moor Holden, Cincinnati, O.—This invention relates to an improved form of sockets and bushings in one piece or casting which are embedded permanently in the eye of the runner, and which operate to balance and drive the same, while serving as an inlet for the grain. The improvements are designed to combine in the most perfect manner the advantages of easy and certain feed with a firm yet delicate poise of the runner, whereby the latter is enabled to readily accommodate itself to the face of the bedstone without binding or raking, and, consequently, without loss of power or the liability to overgrind, scorch, or "kill" the flour.

Improved Fertilizer.

George J. Popplein, Baltimore, Md.—This invention consists in a fertilizer made of phosphate of lime and powdered tripoli in mechanical mixture.

Improved Machine for Canceling Stamps.

Charles J. Goff and Elmer B. Hurry, Clarksburg, West Va.—This invention relates to mechanical means whereby stamped letter envelopes and unstamped circular envelopes in the Post Office Department may be conveniently and rapidly canceled. The invention consists in a series of improvements by which a single person will, in a short space of time, do all the canceling required at any post office, thereby not only securing uniformity and thoroughness in the work, but great economy of time and cost.

Improved Volute Spring.

Charles T. Schoen, Wilmington, Del.—This improvement relates to that class of springs known as volute springs, and the object of the improvement is to render the action throughout the different coils more equable while under pressure, and at the same time to reduce the weight and cost of the spring by a saving of material. The spring is made from a plate or bar of steel which is of uniform thickness from end to end, but tapering in width from near the end which forms the base of the spring to the opposite end. This plate is coiled so that the width of spring increases with the diameter of the coils, whereby the elastic action of the spring is extended equably throughout all the coils except the coils which form the top and bottom.

Improved Horse Hay Rake.

Lyman Litchfield, Gouverneur, N. Y.—This invention relates particularly to the mode of placing the end tooth of a horse rake in a fixed relation to the one next adjacent, so as to prevent the lateral escape and waste of the hay or straw that is being raked up.

Improved Hay and Cotton Press.

John A. McBryde, Laurinburg, N. C.—This invention relates to and consists in means for hanging and operating the follower of a hay or cotton press, so that it will always center itself upon the hay or cotton to make a bale of rectangular shape easily moved off from the top of the press box to allow convenient access to the latter.

Improved Expanding Pulley.

William C. Margedant, Hamilton, O.—This invention consists in rendering a drive pulley expandible by making it of two disks and two semi-circular spaces, the former receiving the latter, and one disk being movable, so that one pair of spaces can be removed and a thicker or thinner pair substituted. By this means the speed of the pulley can be readily graduated to any required velocity.

Improved Horse Hay Fork.

Edger N. McKim and John R. Gearhart, Lathrop, Mo.—This invention consists in combining two sets of forks, one sliding within the other and the inner one provided with key catches, which enable the main fork to hold the hay until it is lifted to the desired elevation.

Improved Table.

Eli B. Francis, Windsor, Conn.—This invention pertains to a folding or hinged leaf table, and consists in the construction and manner of connecting two bars or cross pieces which form the fixed and movable portions of the table frame for the purpose of adapting the parts to fold together, and thus economizing space when the table is not in use.

Improved Steam Boiler.

James L. Spink and Albert L. Holland, Minneapolis, Minn.—This invention consists in a novel mode of combining, in a boiler, steam-generating sections composed of heating tubes and connecting coils connected by piping with the heating tube and bottom of boiler.

Portable Toy Race Track for Field and Parlor Amusement.
Jacob D. Spang, Dayton, O.—This invention consists in a mimic race course, inclosed, and having starting station, rows of transverse posts, cross hurdles, stables, and a final goal.

Improved Circular Swing.

Madison L. Reynolds, Flint, Ill.—There is a vertical revolving center post having radial arms. Seats are supported and revolved by said arms. The latter are jointed so they can swing up and down, and mounted, by a roller for each, on a circular undulating track, so that the seats will have an up-and-down motion, something like the motion of a galloping horse at the same time that they revolve.

Improved Paper Hanging Machine.

Russell H. Miner, Rouseville, Pa.—A box is made of tin, sufficiently long to receive a roll of paper, and of a depth and breadth sufficient to contain the paste roller and the desired quantity of paste, the case being nearly square. The paste roller revolves on pivots in the ends of the case. The paper, which is dropped into the case, rests on an inclined hinged flap, and bears on the paste roller. Before the paper is placed in the case a metal rod is inserted in the center to give the paper additional weight to keep it steady and in place. An adjustable head bears against the end of the roll of paper, to prevent longitudinal motion. The paste roller revolves in the paste, the friction against the paper being sufficient to cause it to revolve when the paper is drawn out. A pressure roller, which may be covered with felt, receives the face side of the paper. The paper is placed in the case, and its end is hooked into the bent. In hanging, the machine is raised to near the ceiling by means of a handle, and pressed against the wall. The paper releases itself from the hooks, and, as the machine is brought down, the roller presses the paper to the wall. The machine is used for papering overhead, and for putting on strips or bordering, in a similar manner. By this invention the tedious operations of unrolling, cutting up the paper, and spreading the paste are obviated, and the result is a very great saving of time.

Improved Windmill.

George A. Myers and Charles F. Myers, Schoolcraft, Mich.—The object of this invention is to produce for windmills a simple and effective regulating device, by which the main vane and wheel is turned sidewise when the wind is blowing too strongly, so that its effect on the wheel is reduced, and a uniform motion of the same obtained at the speed desired. When the force of the wind, bearing against the upright regulating vane is sufficient to overcome the weight, the vane will be pressed backward carrying at the same time the main vane around toward the wheel. When the main vane is thus brought round toward the wheel and receives a less force of wind than the wheel, the latter moves round with the socket to a corresponding position. Thus, however great and changeable the wind may be, the same force may be exerted, and a uniform velocity secured. The decreasing velocity of the wind allows the weight to carry the regulating vane into its upright position, drawing with it the main vane into its original place, keeping then the wheel to the wind in the usual manner.

Improved Spark Arrester.

Wesley Phillips, Morrisania, N. Y.—This is a spark arrester more especially designed for locomotive boilers, but adapted to stationary and marine boilers, and consists of a sectional flare pipe inside of a lower screen pipe formed of wire gauze or wire cloth, and in a wire gauze, or screen or pipe, which rests on the bottom of the smoke box, and in another tube or pipe of wire netting at or near the top of the smoke stack. By this construction a direct open exhaust is obtained. The smoke and gaseous products of combustion are separated at the base or in the smoke box, while the sparks are delivered at the base of the smoke stack, whence they are readily removed.

Improved Suspension Staple for Tanning Reels.

Alvin S. Riggs, Chesterville, Me.—This invention is an improved staple for suspending hides, skins, or leather from the slats of a tanning reel, and which is designed to take the place of the pins, brads, and tenter hooks now used for that purpose. It is made of iron, brass, or other composition. The wire is cut into pieces of suitable length, which are then bent in the middle, and the arms pressed nearly together. The ends of the bent wire may be left a little apart, so that the spring of the wire may prevent the staples from being drawn out of the holes into which they may be driven. The bend of the staple is then beveled off upon both sides, to form an edge to enable the staple to cut a hole for itself in the hide or skin to be suspended when it is pressed against the said staple. The advantage is that as it will be better retained as the reel revolves, and, also, that a workman can load and unload more readily and in less time than with the ordinary devices.

Preparation of Wool for Spinning and Apparatus Therefor.
Frederick Wilkinson, Manchester, England.—This invention relates to means of preparing wool for spinning purposes without the use of oil by mixing with the fiber a certain proportion of powdered French chalk or kaolin.

Improved Feather Renovator.

Charles Seaman, St. Joseph, Mo.—This invention relates to certain improvements in that class of feather renovators which are provided with a feather chamber, drying chamber, and steam supply chamber; and it consists in providing the steam supply chamber with a series of nozzles for admitting the steam into the feather chamber; said nozzles being combined with surrounding chambers or jackets to prevent the open ends of the steam nozzles from clogging. The invention further consists in the provision of waste passages for conducting liquid substances from the feather chamber, the upper ends of said passages being partially closed by hinges or movable covering plates, which, while permitting the escape of liquids, will prevent solid matter and feathers from entering the waste passages.

Improved Combined Blind and Sash Fastener.

This is a combined fastening for blinds or shutters and for window sashes, consisting of an adjustable fastening bar attached to the blind, a stationary hook in the casing, and a hinged hook attached to the sash. As the sash is lowered, the hook catches into the stationary hook automatically, and securely fastens the sash down.

Improved Detachable Shoe Tip and Sole Preserver.

Morris H. Lous, and A. H. Levett, New York city.—The edges of a plate are bent over so as to clasp the edges of the sole in the hollow, and the rear part of the plate is bent outward to lie along the breast of the heel, to which it is secured. The plate has an extension to cover the bottom of the heel and protect it from wear, and may be removed by slipping it forward to the narrower part of the sole. Another plate, which is so formed as to fit upon the forward part of the sole, has attached to it a tip to fit over the toe of the shoe. The rear part of the plate extends back over the forward part of the first plate, and has a short slot formed in it to receive a button. With this construction the second plate and tip can be readily detached when desired, so that they may be taken off when in the house, and put on when going out of doors.

Improved Paper Pulp Digester.

Hector J. Lahousse, Prague, Bohemia.—The boiler is mounted in its transverse axis upon hollow trunnions, with pipe connections for the admission of steam and water, and contains perforated plates and pipes for distributing the steam and water when applied. It also has one of its heads arranged so as to be readily removed, and is placed under the steep chest to receive the stock directly therefrom, and is provided at the lower end with a large cock for drawing off the stock. Besides the steep chest and the boiler there is also a tank above the steep chest for containing the alkaline solution, so arranged that the said solution can be let into the steep chest directly from it.

Improved Running Gear.

William H. Hathaway, East Claridon, O.—This is an improved draft attachment for platform wagons, which is so constructed that the line of draft may be in a straight line from the horses' collars to the axle. The forward ends of the draft rods meet and are securely welded to each other, and to a clevis to which a doubletree is pivoted when two horses are used, and the whiffletree when one horse is used. The doubletree and the forward ends of the draft rods are supported by a swing bar, the middle part of which passes beneath the upper arm of the clevis, and is secured to the said clevis and to the doubletree by the bolt that pivots said doubletree to the said clevis. The end parts of the swing rod curve upward and outward, and the ends rest against the under side of the front bar of the platform, and pass through eyebolts attached to said platform bar, forming a joint, to allow the double tree to move forward and back relatively to the front bar of the platform, as the said platform moves upon and down upon its springs. By means of other mechanism, should the wheels drop into a hole or rut, the tendency of the draft will be to lift, and not to draw downward.

Improved Tyre Bending Machine.

Samuel Hoobler, Minessville, Mo.—By this invention it is claimed that tyres of various degrees of thickness may be accurately bent without side twist, and easily detached from the rollers, which are also quickly and nicely set to the required degree of bending. The device consists of a central roller, placed in movable spring bearings, which are applied by strong stirrups and levers, and made detachable from the supporting frame. The tyre is placed below the central roller; after one end is bent by hand to the felly, the side rollers are firmly adjusted against it, the rims set to its width, and the tyre then passed through the rollers by turning the central roller and one of the side rollers by means of suitable cranks.

Improved Spoon Engraving Chuck.

John S. Fifield and Frank W. Brainard, Westerly, R. I.—In order to adapt the machine in common use for holding spoons, forks, etc., and for holding rings also, jaws are provided with a projection on the heads, and radial slots are made in the plate, also the short circular slots near the center, into which the jaws can be readily swung from slots to bring the heads sufficiently close together to hold rings, or can be shifted back readily to hold spoons, etc. At the center is arranged a little rest on which the ring is to be clamped. The said rest is removable, so that it will not interfere with the holding of the spoons. The screw is elevated sufficiently to cause the jaws to project as much as needed for holding the rings. As it is desirable that the rings be clamped at three points about equidistant from each other, the jaws are made to curve outward, so that they bear in the right proportion to cause the jaw heads to approach each other in the same measure that they are moved toward the rest when clamping the ring, and recede from each other in the same way when raised.

Improved Can for Cooling Milk during Transportation.

George W. Fluke, Mount Pleasant, Iowa.—This invention is a milk can by which the milk can be kept cool during its delivery, even in the hottest days. Connected with the side of a milk can is an ice vessel extending around the same to about one fourth its circumference. The bottom is inclined to the outside for collecting the melted water, and provided with a perforation, through which the water passes. A false movable bottom is placed in the ice receptacle, and forms, by a vertical segmental flange, a suitable downward inclination toward the wall of the milk can. The lumps of ice which are put into a receptacle are thereby continually carried toward the wall of the can, and produce an uninterrupted contact with the same, and thus the cooling off of the milk therein.

Improved Addressing Machine.

Lewis Bailey, Aurora, Ill.—This invention consists of a little hand instrument, intended especially for newspaper wrappers, in which a paper roll, pasting trough, pasting rollers, and shears are combined and arranged so that the operator can turn the pasting rollers and draw the printed slip of paper from which the slips are to be cut through the pasting apparatus to the shears by the thumb and finger, while the hand retains its hold on the handle of the shears. The shears are then worked to cut off the slip when the strip has been fed along sufficiently, without releasing the feeding or turning apparatus.

Improved Window Guard.

Christian F. Röschmann, Davenport, Iowa.—To the side posts of the window frames are pivoted a number of horizontal bars. With these are combined vertical pieces, so that two separate frames or gratings are formed, which meet in the middle of the sash. The horizontal bars turning on their pivots allow these frames to be swung upwards and to close together into small space. When the frames are down, suitable locks and catches are provided to secure them together and so form a barred grating to the window.

Improved Medical Compound or Hair Restorative.

Philippus Prass and Louis Prass, New York city.—This is a compound for restoring the hair, to produce a more vigorous growth of the same. It consists of a decoction of equal quantities of plantain and tansy, which is thoroughly mixed with glycerin, alcohol, and some odoriferous

Improved Guide Frame for Saws.

Darwin J. Parmelee, Chicago, Ill.—This invention is a simple and convenient guide frame for adjusting hand saws for cutting at various depths, and consists in a slotted frame with suitable handles, into which the saw blade is set, adjusted so as to project at the required depth below the bottom part, and firmly clamped by strong tightening screws.

Improved Derrick and Platform.

Charles A. Campbell, Chelsea, Mass.—The derrick is pivoted to shoes, and is connected by pulley and rope to a windlass, so that it may be let down into inclined position or be drawn back, resting in vertical position against a frame. It is also connected by ropes with the front part of a movable platform. The rear part of the platform may run by means of rollers in the top rails of the frame, so that the platform may be easily carried forward and backward simultaneously with the derrick. It projects at such suitable distance beyond the front part of the frame that a bucket, which is applied in the usual manner to the top piece of the derrick, is vertically above the place of unloading, and may, on hoisting, be discharged directly into the receptacle placed at the front part of the platform.

Improved Door Spring.

Ashbel A. Stimson, Montpelier, Vt.—This invention is a door spring pulley wheel having its groove formed of curved lugs, placed on one side thereof, so as not only to answer the ordinary purposes of a groove, but to allow the tension of the spring to be adjusted by passing the cord over a different number of lugs. There is a bent pin or catch, combined with a door spring wheel, having notches at or near the periphery to hold it while the tension of the spring is being adjusted.

Improved Machine for Dressing Slate Frames.

Thomas W. Parry, Slatington, Pa.—A common mode of finishing the frames of school and other slates is to round the corners or to cut them to a circle, and to dress the entire edge of the frame, so as to leave it either beaded or rounded in cross section. The present invention is a machine to be driven by steam or other motive power to facilitate this work, consisting of an adjustable table with a flange guide, and in a vibrating adjustable spider. The spider consists of a crooked arm, attached to an upright shaft, which arm is provided with lugs which enter curved openings of the table. The shaft and spider are raised, so that the lugs project above the table, when the slate frame is laid thereon for rounding the corner, by means of a foot lever. When the pressure of the foot is removed, the spider drops by its own gravity. To round the corners of the frame, the slate is laid upon the ends of the lugs, with the corner in contact with the cutter, and is carried round with the spider about one fourth of a revolution. The spider turns on a true circle, and a weight draws it back when it has described the quarter circle. When this has been done, the frame is moved laterally against a guide to dress the edges.

Improved Chain for Necklaces, etc.

Shubiel Cottle, New York city, assignor to Mulford, Hele and Cottle, of same place.—This is a chain for necklaces, etc., formed of the usual round closed links and open spiral links of peculiar construction, alternately arranged, each alternate link being polished or colored. It is so constructed that the links may all be finished separately, and then put together to form the chain, thus avoiding the necessity of coloring the whole chain, and then polishing the alternate links. The chain is formed from the finished links by springing the closed links into the open spiral ones until a necklace of the required length is made.

Improved Governor for Furnace Doors.

Alvin C. Norcross, Boston, Mass.—An expansible bar, which acts through a head and by means of an end-pointed rod on a pivoted lever, operates the furnace damper. The head is provided with a spring that acts on a different side of the fulcrum of the lever, and tends to open the damper to the prescribed limit. Inside the hollow expansible bar is placed a non-expansible bar, so as to bear directly upon the rod, and at the top is a base piece on which is a dial whereon is centered an adjusting screw having a pointer head. The expander, of course, acts in the usual way to close the damper more and more as the heat intensifies, while, by means of the device added thereto, the exact opening of the damper is adjusted at first, and before the furnace is heated up or afterward, the degree of adjustment being plainly visible on the dial plate.

Improved Rope Clamp.

Jonas P. Smith, Parker's City, Pa.—This invention relates to apparatus used in boring artesian and other wells, and consists of a self-acting hinged fastener for clamping and holding the rope. The device is composed of two parts, hinged on a pin, having handles and provided with a box apertured centrally. The operator bears down upon the handles, which throws up the central portion and enlarges the hole or throat to the size of the rope. When the cable is attached and the parts allowed to drop, the communication is complete.

Improved Wooden Scoop Shovel.

John N. Valley, North East, Pa.—This invention consists of a wooden scoop shovel, the bowl of which is composed of a bottom and two sides, of thin, tough wood, and a triangular stiffening block or head piece, to which and the bottom a socket for the handle is secured by an angle iron, the bottom being in concave form in the direction of its length and the sides flaring outwardly.

Improved Farm Gate.

George Van Riper, La Grange, Mich.—This gate may be thrown open in either direction, and adjusted in an elevated position, so that it will swing over snow drifts, or allow smaller stock, as pigs or sheep, to pass under it, without interfering with its working. The invention consists in hanging the gate to a pin or vertical rod which turns in rings of the gate post, and providing the rod with an adjustable cam wheel, with inverted V flanges, which flanges are grooved at their lower ends, so as to retain the gate, in connection with a friction roller of the gate post, in open or closed position.

Improved Gun Lock.

Abel Spaulding, Swanton, Ohio, assignor to himself and Benoni T. Geer, same place.—This invention consists in providing, in place of the feather spring in use, a second mainspring in the rear part of the lock, which is connected with the tumbler and sear. The two springs are alike in construction, and act jointly with greater precision and with less strain upon the latter.

Improved Lamp Chimney Holder.

Henry T. Sanford, Nicholville, N. Y.—This invention consists in an arrangement of springs and hooked wires to a lamp burner, for the purpose of holding glass chimneys securely. The wires are retained in position and set to the side of the chimney by screwing their lower ends through lugs of the burner, clasping thereby the chimney. A solid band, encircling the burner around the base of the chimney, secures a steady light, as no air can enter the chimney.

Improved Three Wheel Riding Plow.

William Snow, Waverly, Ill.—By suitable construction, the forward end of the tongue has a free up and down but no lateral movement, and thus relieves the horses' necks from having to support any more weight than the weight of the forward end of the tongue, and at the same time enables the plow to be accurately guided. When the fore wheels are inclined in turning, the rear wheel will be inclined to the same extent in the opposite direction, so that the machine may be turned in a very small space. The land wheel may be lowered, so that the machine may be level when moving from place to place, and raised when the machine is at work to run upon the unplowed land while the rear wheel runs in the furrow in the rear of the plow, and the other fore wheel runs in the furrow plowed in the previous round. By operating a lever, the plow may be raised away from the ground for convenience in passing from place to place, or lowered to work at any desired depth.

Improved Window Frame.

Samuel Hare, Martinsburg, W. Va.—This invention consists in making the box frame, with its dividing strips, of one piece. The sash guiding piece is also made laterally of one piece to cover the box frame, but divided into an upper and lower section, so that on detaching the lower section, and bringing the sashes down, they may be easily taken out for repairs.

Business and Personal.

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

Dry Steam, dries green lumber in 2 days, and warms houses. Circulars free. H. G. Bulkley, Cleveland, Ohio.

Air Compressors—Manufacturers will please send Circulars to National Mining and Exploring Co., Helena, M. T.

Marine Glue—Wanted by the National Mining and Exploring Co. S. J. Jones, Supt., Helena, M. T.

The most Perfect Power Hammer—Exclusive Right for sale, or built on Royalty. Particulars of Samuel Pennock, Kennett Square, Pa.

Cannon's Patent Dumb Waiter for Dining purposes is admirable. Will remain stationary at any point, loaded or empty, without being fastened. Can be operated from any floor with which it communicates. Price, \$45 to \$80. A. Cannon, Jr., Poughkeepsie, N. Y.

Wanted—A first class 2d hand Screw Cutting Lathe, 8 or 8 ft. bed, 16 or 18 in. swing. A. L. Bender and Co., Wilmington, Del.

A Sample of the Combined Whip and Rein Holder, illustrated in another page, will be mailed by the patentee on receipt of 75 cents.

The Fleetwood Scroll Saw for Amateurs, Wood Carvers, Jewelers, Model Makers, &c. See advertisement page 132. Tramp Bros., Wilmington, Del.

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

Wanted—A cheap, simple Boiler, 1/2 H.P., with fixtures complete, to carry from 20 to 30 lbs. of steam;—adapted for use in water mills for steaming wheat. Address P. B. Hunt, Council Bluffs, Iowa, Patentee and Manfr of Hunt's Pat. Wheat Steamer & Dryer.

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

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

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

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

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

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

Temples & Oilcans. Draper, Hopedale, Mass.

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

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

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

To Rent—46x146 feet in one room, easy of access and constant power for manufacturing. Within 19 rods R.R. Depot and Erie Canal. Penfield & Tarbox, Lockport, N. Y.

Wanted—Hand Stave Jointer. Address J. Stoney Porcher, Bonneau's Depot, S. C.

Newcastle Grindstones for Locomotive Work. J. E. Mitchell, Philadelphia, Pa.

"The Best Book on Elementary Mechanics," The Apprentice, or First Book for Mechanics, Machinists, and Engineers. By Oliver Byrne. 71 Engraving, 12mo., cloth. \$1.50. Sent post paid, by A. J. Fisher, 95 Nassau St., New York.

Stephoe, McFarlan & Co., No. 212 to 220 West 2d St., Cincinnati, Ohio, manufacturers of Woodworking Machinery and Machinists' Tools. Send for circulars.

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

A. P. Morris, Northfield, Minn., wishes the address of Geo. Kirchoffer, patentee of machine for Purifying Butter, which was recently illustrated in this paper.

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

Two 50 H. P. Tubular Boilers for Sale (Miller's patent) very low, if applied for soon. Will be so d separately or together. Complete connections and pump. Holake Machine Co., 479 Cherry Street, New York.

Lovell's Family Washing Machine, Price \$5. A perfect success. Warranted for five years. Agents wanted. Address M. S. Lovell, Erie, Pa.

To Capitalists—To be sold, one half of patent Steam Street Car. Will put a car on the road for the benefit of all concerned. For particulars, address W. W. Crane, Auburn, N. Y.

Braes Castings of superior quality. Send your patterns to Bailey, Farrell & Co., Pittsburgh, Pa.

Notice to Inventors—Our Guide Book for the sale of Patents explains new and improved methods for disposing of rights. Send stamp for circular and synopsis of contents. S. S. Mann & Co., cor. Linden Av. and Hoffman St., Baltimore, Md.

Buy Boul's Patenting, Moulding, and Dove-tailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 227.

Emerson's Patent Inserted Toothed Saws, and Saw Swage. See occasional advertisement on outside page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.

Spools, Button Molds, and all small turned goods made by H. H. Frary, Jonesville, Va.

Wanted—A first class Machine, known among Hinge Makers as a Sifting Machine. Address Wheeling Hinge Company, Wheeling, W. Va.

Steam Fire Engines—Philadelphia Hydraulic Works, Philadelphia, Pa.

Bone Mills and Portable Grist Mills.—Send for Catalogue to Tully & Wilde, 20 Platt St., New York.

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F. N. will find recipes for jeweler's white enamel on p. 107, vol. 30. This enamel can be colored to taste.—C. T. S. We have no information as to the marble floor of Girard College, Philadelphia, Pa.—F. L.'s queries are not sufficiently explicit.—D. W. can clean his coins by following the instructions on p. 217, vol. 26.—T. H. D.'s query as to the evaporation of ice is incomprehensible.

C. B. H. asks: How can I make imitation pearls? A. These are hollow spheres of very thin glass. A small portion of a pearly substance, found at the base of the scales of the bleak and other fishes, is introduced into each, and is spread over the surface. The sphere is then filled up with white wax or gum arabic.

C. H. G. asks: 1. What substance is most sensitive to atmospheric changes, and will, by expansion and contraction, most readily indicate damp or dry weather? A. A delicate human hair, properly cleaned and arranged. This is used in De Saussure's hygrometer, as improved by Régnault, for measuring atmospheric changes. Animal membranes, vegetable fibers, and pieces of whalebone are sometimes employed. 2. What material is most affected by actual contact with water? A. The chlorides of nickel and cobalt completely change their color.

J. K. asks: 1. In using steel bars instead of bells, how large and of what shape should a bar be to make as much sound as a bell weighing 1,000 lbs.? How should it be suspended? How large a hammer would it need? A. In a properly constructed bell, the cavity of the bell reinforces the fundamental note and greatly increases its sonority. Moreover, the material is so distributed as to get the largest possible sounding surface. For these reasons a bar should be of large size to give as great an amount of sound as a bell weighing 1,000 lbs. How large it and the hammer should be must be determined by experiment. The bar should be firmly secured at one end.

J. C. F. asks: What is the best preparation to preserve the skins of stuffed birds? Is any ng better than arsenic? A. Carbolic acid answers well for temporary purposes, but arsenic is the best permanent preservative. 2. What is the best treatise on the art of stuffing birds? A. The best treatise is in the form of instructions published by the Smithsonian Institution for the guidance of collectors on exploring expeditions. Apply to Professor Baird, at Washington, D. C.

Z. B. asks: Has the first link of a train of cars the whole pull or weight of cars on it? A. Yes. 3. If a link of 1 square inch section will pull 30 cars, will a link one hundredth part of an inch section pull 1 car? A. Yes.

A. T. says: 1. Please give me a recipe for transparent cement, not soluble by dampness? A. Use powdered mastic and heat. 2. What is the difference in the heat of a room heated by steam pipes, and one heated by a wood or coal fire? Is not the heat from steam pipes more searching and dry than heat from either a wood or a coal fire? If so, why is it? A. Steam pipes give a mild, diffused heat, but at the same time arrangements must be made to supply moisture to prevent dryness. This is sometimes effected by attaching small escape cocks to allow a little steam to enter the room. 3. What is the thermometric difference in heat radiating from a steam pipe with 70 lbs. pressure per square inch and one with 10 lbs. pressure per square inch? Will it be nearly the difference in the temperature of steam at 10 lbs. pressure and at 70 lbs. pressure? A. No. It would be proportional to the more rapid flow of steam through the pipes at the greater pressure.

G. W. E.—Write to John Casey, 24 Beek man street, New York city, for the article.

H. C. P. says: A belt traveling at a certain speed, size of both pulleys being given, how can I find the size of pulleys to cause the belt to run at any other specified speed, either faster or slower? A. The circumference of either pulley, multiplied by the number of revolutions per minute, gives the speed of the belt; and if the number of revolutions remains constant, the speed of the belt can readily be changed by changing the size of the pulley. For instance, if the pulley is to make 60 revolutions per minute, and the belt is to have a speed of 1,000 feet a minute, the circumference of the pulley is found by dividing 1,000 by 60, or it will be 16 2/3 feet.

F. E. C. says: I. We are making a steam engine, the size of the cylinder is 5/8 inch diameter, 2 1/2 inches stroke; about what power would it have? A. Multiply pressure on piston in pounds by speed of piston in feet per minute, and divide the product by 33,000. 2. We have an old fire extinguisher for a boiler; will it be safe? How can we test it? A. Fill the boiler with cold water, and heat it, until the expansion of the water produces the desired pressure. 3. Are there any small steam gages that would do for it? A. Yes.

J. M. asks: Where was the first railroad bridge built across the Mississippi river? How many railroad bridges are there now over it, and how many were there in the year 1859, and where are they situated? A. The first bridge was at Rock Island. There were no others erected previous to 1859. There are now 19 bridges over the Mississippi, at the following places: Winona, Dubuque, Clinton, Rock Island, Burlington, Keokuk, Quincy, Hannibal, Hastings, St. Louis.

H. C. D. asks: If a person should fasten a stick to a smooth board large enough, when placed at some convenient spot, for the light of the sun to make a shadow of the stick on said board for the space of one year, if pencil marks should be made on the board parallel with the shadows, once a month for one year, at the rising or setting of the sun; would not the earth in its orbital yearly motion produce shadows diverging from the center all around like the spokes to a wheel? A. The different shadows would diverge from the center, but not all around like the spokes of a wheel, but between the limits of earliest and latest sunrise on one side, and earliest and latest sunset on the other. In this latitude, there is a little more than 3 hours difference between earliest and latest sunrise, and the same difference between earliest and latest sunset.

B. asks: Do the winds always blow in an exact horizontal line? If not, what inclination do they assume? A. They do not. The direction varies, but in general follows the outline of the earth's surface.

W. W. W. asks: 1. What must be the diameter of a spherical balloon which, when filled with hydrogen, will have an ascensional force of 80 kilogrammes, the balloon itself weighing 30 kilogrammes? A. Make it so that the weight of the balloon and gas is 80 kilogrammes less than that of an equal volume of air. 2. How much zinc and sulphuric acid are required to produce hydrogen to fill a cylinder 2 feet long x 9 inches in diameter? A. A trifling amount. You can calculate from the reaction. H2SO4 + Zn = ZnSO4 + H2. 3. Please give me the prescription to make yellow, bronze, and golden ink. A. See p. 130, vol. 32.

N. J. asks: 1. How many pounds can a horse of average strength pull, I mean to lift by pulling? A. It is generally considered that a horse of average strength, moving at the rate of 2 1/2 miles an hour, can exert a tractive force of 100 pounds for 10 hours of a day. 2. Can you give a simple explanation of the question: Which runs faster, the top or bottom of a wheel of a wagon? A. You will find this explained, by means of a diagram, on p. 362, vol. 28.

R. M. asks: Can I melt iron in a crucible on a blacksmith's forge, to mold gold points in plaster of Paris? Will a crucible last any length of time, so that it would pay to melt iron in it? A. To both the questions, yes.

G. J. asks: What, in your extended experience, is the nearest approach to perpetual motion ever accomplished by an inventor? Is there anything on record in the Patent Office, that is, has any person yet manufactured or arranged a machine, or invented any mechanical object, that would operate from a propelling power inherent in itself, without springs, steam, or other motor known to mechanics, for a basis? If so, did it prove to be of any force or power, or did it promise anything useful? Please inform a reader of your paper and a well wisher to the American inventive faculty. A. The nearest approach to perpetual motion is the example of the man who placed himself within a tub and, by a steady upward pull on the handles, expected to rise in the air. But he found that the tub was pushed down by his feet just as much as it was pulled up by his hands, or, in other words, that action and reaction are equal, and therefore he failed to ascend. He has had many successors, who have aimed to overcome the difficulty by interposing levers or cogged wheels, arranged either to pull against each other, or placed between the hands of the operator and the handles of the tub. The principle is the same in all such cases, consequently the thing won't work. The simple tub is the nearest approach to success because it is attended with less friction. The interposition of wheels or levers wastes a portion of the force. The jet of a fountain, for example, will most nearly reach the level of its supply if allowed to rise in the air unobstructed. If the jet is compelled to turn a wheel or operate a lever, its height is of course diminished.

J. K. asks: 1. What is meant by a high pressure and a low pressure engine, and by a low pressure engine and boiler? A. Non-condensing and condensing. 2. What is meant by link motion, and what by valve motion? A. The mechanism for operating the valve. 3. If I boil away one cubic inch of water, in a box of one foot cube, will I have any pressure in the box? A. Yes. 4. Will I get any by further heating it? A. Yes. 5. Can I explode the box? A. It depends on the strength of the box.

E. M. C. asks: 1. Is plating with aluminum successfully practiced? Why would it not be, for many ornamental purposes, superior to nickel, and (as the metal may be derived direct from clay) possibly cheaper? A. The cost of extracting aluminum from clay is still too great. 2. Can you tell me of any way in which magnesium can be used (without too expensive apparatus) for making signals at sea? The wire or ribbon will not burn continuously, and requires the aid of an alcohol flame to insure continuous combustion, even where not exposed to drafts. If burnt in a lantern, the glass is soon coated with the condensed magnesium; and if not thus protected, the wind blows the whole thing out. Is there any way of using it (simple or combined with other materials) in torches to burn

from one to three minutes, and which would not blow out or drop sparks? A. There is a magnesium lamp which can be successfully used for illumination and lanterns, which is constructed to remedy these defects. 3. What would be the most convenient way of generating electricity for the electric light in a compact machine, easily portable? What amount of power is necessary for a light visible five miles? A. The most convenient way to obtain the effect desired would be to use 40 flat Bunsen cells and an electric lamp. 4. Would the electrical machines used for medical purposes have sufficient power? A. No.

D. Y. H. asks: Which is the most economical steam engine, (1) one in which the cut-off is at 1/2 or 3/4 of the stroke, and the momentum is obtained by the governor and throttle valve, or (2) one in which the cut-off is regulated by the governor, and the regular momentum is obtained by large and small expansion? Which is the most economical, (3) high pressure and large expansion, or (4) low pressure and small expansion, if all other things are equal, with well covered cylinders, pipes, etc.? A. As we understand your questions, the second and third cases will be more economical than the others.

D. M. asks: What is the material to use to prevent a hardened polished steel plow from rusting and allow it still to retain its luster? I have been using clear varnish, but it is not effectual. A. It will be necessary to keep it covered with oil, when not in use.

"Sufferer."—In reply to this correspondent, who asked how knock knees may be cured, Dr. Chapman, of New Haven, Conn., says: After growth has ceased, there is no remedy. The chances of recovery diminish in exact proportion to the age up to the period when full growth is reached, that is, the younger the patient, the better the chance of recovery. The cause is not, as generally supposed in the majority of cases, accident or natural deformity, but an impoverished state of the system in very early life, brought on by disease or improper food. The treatment varies according to the extent of the trouble. If the legs are too weak and the joints too loose to bear the weight of the body, the recumbent posture must be maintained for months; at the same time the legs may be bandaged in such a way as to keep them in the straight position; tonics, such as iron, quinia, and cod liver oil must be taken in one form or another, and electricity may be used to excite the weakened muscles. In cases not so severe as this, or in such cases after the preceding treatment has conditioned up the legs, a different method is followed. The tonics are given and the electricity used, but instead of lying in bed the patient must be up and about like other people; but the legs must still be bandaged in a peculiar way. A stiff and straight iron rod, fattened at each end and padded, of the length of the leg, is fastened to the outer side of the leg. It will touch at two points, on the hip and ankle, and a bandage is placed around the knee and rod, drawing them together or towards each other, and thus keeping the leg in a nearly straight position. For a few minutes every day the rod should be removed so as to allow the weight of the body to fall naturally on the knee. This is the best known treatment: but patience, skill, and good nursing are requisite, for the disease at best is a troublesome and long protracted one.

G. A. D. asks: 1. How can I make the cheapest and simplest battery? I have been trying to construct a galvanic battery, but have not succeeded. I constructed it on the Bunsen plan, but it would not work. A. Use pieces of zinc for one plate of the battery and pieces of gas coke for the other, and charge with dilute oil of vitriol. 2. What is the principle of the kaleidoscope? A. It depends on the repeated reflection of any object, placed between two small mirrors which are at an angle to one another. The pattern and the number of reflections depend upon the angle between the mirrors. 3. To what height can a balloon ascend? A. To such a height that its weight is just equal to the weight of that amount of air which it displaces.

P. and other correspondents ask what is put in starch to give the shirt bosoms a gloss. A. A piece of paraffin or white wax, about the size of a hickory nut, in each bowl of starch. The managers of one large shirt factory, however, assure us that they produce the polish by the skillful use of the sad iron only.

J. W. G. asks: How can melted glue be kept liquid when cold? A. Take best pale glue 2 lbs., soft water 1 quart, dissolve in a warm bath; after cooling add (alowsly) 7 oss. nitric acid. When cold, bottle off.

C. R. asks: Is there any way of removing from a steel engraving spots (both in the margin and on the print) caused by the gum in the back boards of the frame in which it is hung? A. No. Such engravings are printed on unsized paper, which absorbs moisture so intimately that its effects cannot be got rid of.

L. H. S. says: In your reply to the question of M. M. in regard to the advantage of raising himself by a rope over a fixed pulley, you say that you think that the friend of M. M. is right, when he says it has no advantage over a single rope. Are you not hasty in your conclusion, and ought not scientific men to be able to give definite answers to questions which admit of proof by experiment or mathematical calculations? I am inclined to believe that M. M. is right when he claims an advantage of nearly one half. And in the same number, in reply to the geometrical question of W. C. L., whose teacher claims that an infinite circle is coincident with a straight line, you show from their equations that this cannot be so; the straight line being of one order, and the circle of another, they cannot coincide. That is all well enough so far as the mathematical discussion is concerned, but do you consider the mind of man to be capable of conceiving of infinity? If an infinite straight line can be conceived of, may not a circle be conceived of also, of which the straight line shall be diameter or chord, and vice versa? When the difference between a straight line and a circle becomes infinitely small, do they coincide? I claim that the mind is incapable of conceiving of infinity, and just so soon as men begin to discuss a proposition which cannot be conceived of, they are over their heads, and utterly at a mental loss. Everything infinite coincides. A. Without going into the metaphysical question that you have raised, we may say that the mathematical demonstration has the advantage, in giving the results without requiring a vivid conception of infinity. The question about the rope is considered on p. 219 of our current volume.

J. T. W. asks: How can I clean silver plate? A. Use prepared chalk in cold water; apply with a plate brush, chamois leather, or soft woolen rag.

W. M. W.—You appear to have both legs of the siphon of the same length. The size of your pipe answers well enough, but it is necessary that the end of the siphon that discharges the liquid should be on a lower level than the end into which it is drawn.

W. H. H. asks: We have a steam engine rated at 15 horse power, and a muley saw. With 150 lbs. steam, we cannot run through a 30 inch log, the saw making 200 revolutions per minute. I would like to increase the heating surface. At present we have only got an inch and a quarter pipe running through a heater 30 inches long. Suppose I turn the exhaust through the tank, will it deduct anything from the power of the engine? A. It will increase the back pressure slightly. We do not answer questions of the character of your other queries for obvious reasons.

J. W. G. asks: How can I make bronze and blue writing inks? A. For blue, use 2 ozs. Chinese blue, boiling water 1 quart, acetic acid 1 oz. Dissolve the blue in the water, add the acid, and it is ready for use. For bronze, use the common blue ink of the shops in a steel pen; it will turn bronze by the action of the metal.

J. H. P. says: It is generally believed that a railroad bridge is less liable to give way when the passing train moves slowly than when under full speed. Is this correct? Boys sliding or skating over thin ice rightly judge their safety to depend in a great measure upon the celerity of their movement. Grant that a bridge has one weak place, one place weaker than any other of the same bridge; and that a train has one car or combination of cars heavier than any other car or combination of cars of the same train; and further that there is one point (center of gravity) in that heavy car or combination of cars where the strain or gravity is greater than at any other point. Now, as it is the last straw that breaks the camel's back, so by parity of reasoning it is that point of greatest strain or gravity that causes the bridge to give way at the weakest place. Again, grant that a bridge never falls to pieces all at once, but that in the order of time one part—pin, brace, or beam—breaks first, then another part, then another, till the final smash, each break occupying, succeeding, and being succeeded by an appreciable moment of time; and further, the more rapidly the train moves, the more evenly the greatest strain will be distributed over the bridge and the less time it will have to act upon the weak point; and it follows, other considerations being out of the question: That the more rapidly the train passes over the bridge, the less liable will be the bridge to fall. Is this correct? A. This theory would be correct, if a train passed over the track as a body glides over the ice on skates. But the train, on account of inequalities in the track and uneven speed, is continually striking blows as it moves along; and the faster moves, the more rapid and violent are the blows.

G. T. D. asks: How is the crystalline appearance of galvanized sheet iron produced? A. W. believes that it is produced by the crystallization which takes place in the cooling of the zinc surface on with, drawing the iron plate from the bath of molten metal.

J. K. R. asks: At what temperature will plumbago fuse, or what degree of heat will it sustain without fusing? A. It will not fuse at, and should sustain, the highest heat of a wind furnace.

W. C. K. asks: How can I prepare common cotton sheeting, so that it will be sufficiently close to use for a sail? Without some preparation it will not hold the wind. A. Try a thin solution of India rubber in bisulphide of carbon.

A. E. G. asks: Will you give me a test for the presence of alcohol in solutions? A. Pure alcohol must completely volatilize, and ought not to leave the least smell of fusel oil when rubbed between the hands nor should it redden litmus paper. When kindled, it must burn with a faint bluish, scarcely perceptible flame.

G. O. S. says: I am building a small pleasure steamer to draw 2 feet of water. What tonnage will she carry? Her length is 47 feet, beam 4 feet, with flat bottom? A. Calculate the displacement, in cubic feet, for any draft, and divide by the number of cubic feet in a ton of water.

G. H. asks: 1. What will rust iron the most and in the least time? A. A solution of sal ammoniac will answer. 2. What is the wax which the barbers use for blacking the moustache composed of? A. It generally contains a solution of nitrate of silver.

J. W. M. asks: 1. What is the rule for placing boiler rivets, and for the size of rivets to get the greatest strength in different thicknesses of iron? A. It is usual, in single riveted joints, to make the diameter of the rivets from twice to once and a half the thickness of the plate. The distance between the centers of rivet holes may be found by adding the diameter of the rivet to 0.754 times the quotient of the square of the diameter of the rivet divided by the thickness of the plate. 2. If we use a common horse power, run a lever 50 feet from center, and lay a 3 feet endless railroad 100 feet diameter, would it do for such heavy work as a 3 run flour mill? We should use a small locomotive for power. Would it be economical or not? A. We do not see anything of special merit in the plan. 3. What is the size of the largest locomotive driving wheels, and on what railroad are they used? A. The largest of which we have seen an account are on some locomotives in the Great Western Railway in England. They are 8 feet in diameter.

T. C. S.—The solution on p. 300, vol. 29, seems to be correct. The relation between the power and weight was required for a definite position of the machine; and though this relation is continually varying, it can be found, for any particular point very reliably. You will find the subject treated in any good work on mechanics, showing how to deduce general formulae, by which the relation between the power and weight at any point can be determined.

T. F. asks: 1. What work on logarithms explains them in the plainest way, without regard to cost? A. We can recommend Law's "Treatise on Logarithms," published in Weale's series. 2. Is there any work in which the shafting and pulleys for quarter twist belts are illustrated? A. You will find this illustrated in nearly any book on mill work. 3. Which French scientific periodical is most like the SCIENTIFIC AMERICAN? A. The *Revue Industrielle*. 4. Is there any one devoted to the four milling interests? A. We think not.

C. A. asks: 1. What is the best speed for a foot power circular saw, as proved by practice, the saw being 5 inches in diameter? A. As fast as possible. 2. Would it not require too much power to run the saw at 9,000 feet per minute, to saw one inch stuff? A. Yes. 3. Can you furnish the *Science Record* for the years 1873 and 1874? A. Yes.

B. H. asks: What is the greatest speed that has been attained by a locomotive? A. The fastest time that we know of from personal observation is 63 miles an hour. We have seen statements, on apparently good authority, that a speed of 90 miles an hour is often attained on many railroads in this country.

W. H. B. asks: 1. What is meant by the term sea level, and how can I determine the sea level of any city? A. The sea level is the height of the ocean, at mean low tide, in reference to any place whose elevation is to be determined. 2. What is the meaning and derivation of the term O. K.? A. We have been told that it originated from the endorsement put upon a package by a distinguished but illiterate personage. Being asked what he meant by "O. K.," he took a piece of chalk and wrote down "O. K. correct."

H. T. G. asks: Can air be so confined as to be used as a power? For instance, could it be applied to running a locomotive, provided a constant supply could be obtained? Has there ever been an air engine in operation? A. Air compressing machines, and the use of compressed air for motors, are quite common. You can get full particulars from the manufacturers.

S. asks: Can the best turbine water wheel, geared to the best pump made, raise the quantity of water used by the wheel to $\frac{1}{2}$ the height of the fall? A. According to some of the best results given in tests of turbine wheels and pumps, the quantity of water raised would be 95 the height of the fall with a centrifugal pump, and 0.45 with a direct acting pump.

M. A. V. asks: How much water ought to be evaporated into steam of 60 lbs. per square inch pressure, by 1 lb. of coke, using cold water to feed the boiler? A. About $7\frac{1}{2}$ lbs., if the boiler is well designed.

J. H. asks: 1. Does the power of the ram increase as the square of the fall increases? A. No. 2. Is the power the result of the impetus acquired by the discharge? A. Yes. 3. Would it be practicable to work a ram under a head of twenty feet? A. Yes.

C. S. A. asks: 1. If a pipe is forty feet high and filled with water, what will be the pressure to the square inch on the base? What is the rule for telling the pressure of water on the base, the tube being of a specified height? A. Multiply the height in feet by 0.433. In the example given, the pressure per square inch on the base is $40 \times 0.433 = 17.32$ pounds. 2. When the steam gage registers 60 lbs., does that mean that there is 60 lbs. pressure to the square inch of surface of the boiler? A. Yes. 3. How many gallons of water does an ordinary locomotive carry in its tender? A. From 1,500 to 2,000. 4. How is the expansion and contraction provided for in the bridge at St. Louis? Will wire rope work over six inch pulleys subjected to heavy pressure stand the pressure and wear as well as the ordinary cable? A. See answers to C. B. A., p. 34, vol. 90.

A. M. Y. asks: Can you recommend me any works on armored vessels? A. It will be necessary for you to look over periodical literature. You will find some matter of considerable value in "Our Iron-Clad Ships," by E. J. Reed.

M. asks: 1. Is there any difference between one square foot and one foot square? A. No. 2. Is it correct to say that one square foot is equal to four feet square? A. No. 3. A contends that one foot square and one square foot are equal, and that four feet square contains sixteen square feet. A. The statement is correct.

R. asks: How can I get at the exact latitude of a place in the vicinity of Lake Connecticut, N. H.? A. It is most readily calculated from observations of the meridian altitude of the sun or a star. It can be ascertained, with sufficient accuracy for many purposes, by the inspection of a good map.

C. V. H. asks: 1. Will nickel coating disturb the temper of steel wire? A. No. 2. Will coiling the wire for springs injure the nickel coating? A. Yes. 3. What is the expense of nickeling steel wire compared to the market value of the same? A. From 25 to 100 per cent, according to size and quality.

J. H. W. asks: What is the nature and amount of friction on a ship propelled through the water by steam or wind? A. You will find the subject treated in Bourne's "Handbook of the Steam Engine." Its discussion would occupy too much space for insertion in these columns.

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

T. J. M.—No salts of any kind, nor any sizing, have been used in the manufacture of this article. It appears to owe its character to the way in which vegetable fibers like hemp have been worked together.

H. H. H.—Your specimens are iron pyrites found in coal; one of them is pyrites submitted to heat, and sand from drilling.

J. F.—It would be necessary to have some of the black substance from the needle gun cartridge in order to pronounce what it is.

W. S. B.—It is limonite, and contains about 80 per cent of oxide of iron.

W. J. C.—The samples sent appear like good specimens of lithographic stone; but in order to determine its value, practically, a specimen about 12 inches long x 6 inches wide is necessary.

T. B. G.—The mineral sent is mica slate, composed essentially of mica and quartz. The folla of mica are sometimes so small that they are hardly discernible by the eye, as in this specimen. It can sometimes be split into tabular masses and employed for many common purposes. It is very difficult to fuse, and has been used in constructing the hearths and sides of furnaces for melting iron, etc.

P. J. K.—An analysis of the powder revealed the presence of oxide of iron, silica, clay, carbonate of lime, chloride of potassium, chloride of sodium, and some organic matters. But it is not possible to tell with certainty, from such residues, whether or not the drinking water is injurious. The water itself must be analyzed. We should, however, in this case suspect some contamination. The mode of remedying it could only be indicated after the complete examination spoken of above.

S. H.—Yellow calcite or carbonate of lime, of no particular value.

C. H. F.—Galena, sulphide of lead.

N. W. W.—Lenticular argillaceous oxide of iron. In this species, the oxide of iron is united by mixture or combination with clay. It ordinarily melts with ease, affording from 30 to 50 per cent of iron.

A. S. T.—Your specimen is neither isthglans nor silica. It is gypsum, and, by burning, will yield excellent plaster of Paris.

R. W. F.—The shining particles in the black rock are iron pyrites, and are of no value.

J. A. D.—1. Impure limestone. 2. Sulphide of zinc, containing 61 per cent zinc.

J. N. S.—Iron pyrites, of no value at present.

G. W. H.—Your specimens of ore contain iron. If you wish an analysis, it will cost \$10.

R. H. W.—The blue mineral in the rock is silicate of copper, and contains about 45 per cent of oxide of copper. The yellow is sulphide of copper, containing about 35 per cent of copper.

W. C. C. & Co.—The material sent seems to be of the nature of Portland cement. An analysis will cost \$10.

T. C. H.—The shining metallic looking substance is iron pyrites.

S. E. G. C.—These specimens consist of indurated clay or shale, and the action on the piece of iron shown was due to the free silica forming a slag with the oxide of iron and leaving a clean metallic surface.

R. W. F.—This is galena; but to determine the amount of silver in it, if any, will require an analysis, costing \$10.

F. A. B.—This specimen is hornblende, a compound of silica, alumina, lime, magnesia, oxide of iron, and sometimes manganese.

J. E. S.—In order to determine the value of lithographic stone, we require a sample about 12 inches long, 6 inches wide and 2 inches thick. Your specimens look promising. Send us, if possible, a sample of the size mentioned. Lithographic stone is a fine grained limestone; and when of good quality is of a yellowish gray color and uniform throughout. It is free from veins, fibers, and spots; a steel point makes an impression on it with difficulty, and the splinters broken off by a hammer show a conchoidal fracture.

H. L. C. asks: How can I paint tin so as to give it a fine glossy appearance? Can japanning be done without heat?—D. L. B. asks: How is wine made from cultivated grapes?—G. M. S. asks: What kind of paint will adhere best to articles of brass or copper? I want a bright vermilion color, and it is to be exposed to water.—W. V. asks for a recipe for plating gold without a battery.—J. F. J. G. asks: What substance is there which, combined with glycerin, will render leather perfectly waterproof?—V. E. Jr. asks: How many pianofortes are annually manufactured in the United States?—B. W. C. asks: How can I remove green beech and cherry stumps in the most speedy and effectual manner without digging them up? I have heard that oil of vitriol placed in them will rot them out in a short time. Will it do it? If so, how much should be used?—W. C. L. asks: Can any one give me a rule for setting iron axles?—J. H. P. asks for a cure for gapes in chickens. The disease generally makes its appearance about two or three weeks after the chickens are hatched, and continues for from four to six weeks. It is supposed that the parent insect lays its eggs upon the nostrils of the chick, which soon hatch into worms and crawl down into the trachea, make their way again into the open air and burrow in the earth to undergo transformation.

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 Use of Both Hands. By J. D. B.
- On the Torpedo. By —.
- On Kepler's Third Law. By G. E. W.
- On Cotton Planting. By W. D. H.
- On Light Steam Rams. By S. S.
- On Two Problems. By G. W. E.
- On the Attraction of the Sun and Earth.
- By D. E. G.
- On a New System of Telegraphy. By E. E. W. B.
- On Nerve Force. By I. R.
- On the Pons Asinorum. By F. S.
- On the Detroit Tunnel. By A. H.
- On the Transfusion of Blood. By X. Y. Z.

Also enquiries and answers from the following:

- O. G.—R. S.—F. McC.—I. M. W.—E. S.—E. N. K.—D. P. W.
- Correspondents in different parts of the country ask: Who makes small oscillating steam engines for running sewing machines? Who makes machinery for making paper pulp from wood? Who sells revolving bolts for dressing middlings? Who builds lime kilns of the most approved pattern? Who makes a hub boring and mortise machine, to go by hand power? Who sells the best clothes mangle? Who deals in old coins? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses. Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL]

Index of Inventions

FOR WHICH

Letters Patent of the United States WERE GRANTED IN THE WEEK ENDING

March 17, 1874,

AND EACH BEARING THAT DATE.

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Table listing various items and their prices, including Overskirt and mantle, Paper box machine, Paper making cylinders, etc.

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CANADIAN PATENTS. LIST OF PATENTS GRANTED IN CANADA.

Table listing Canadian patents with numbers and descriptions, such as 3,206—I. C. Wands, Nashville, Davidson county, Tenn.

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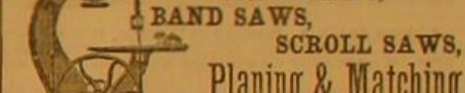
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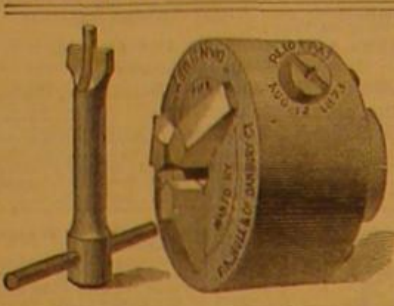
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