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THE DAYTON CAM PUMP.

Our engraving represents an improved direct and double acting steam piston pump, which, it is claimed, is absolutely positive in its action, simple in construction, and economical in the use of steam. The principal feature is the mode of working the steam valve by means of a cam bolted on the piston rod and moving with it. By the shape of this cam the stroke is rendered slower at each end, thereby giving time for the water cylinder to fill. A full stream is thus insured, and the pump is prevented from cushioning against the water when the cylinder is but half filled. The arrangement is such that the valve cannot be thrown into such a position as to shut off steam and stop the pump. The operation of the mechanism needs no further description, as the reader will readily understand the adaptation of the various parts to each other from an inspection of the annexed illustration. It will be seen that there are no dead centers and that the action is absolutely positive. The arrangement of the cam movement, in connection with the piston, causes the water valves to lift and to set easily and without jar, thereby saving the wear and tear of valves and seats. The maximum of speed is attained when the valves are lifted and the water is flowing.

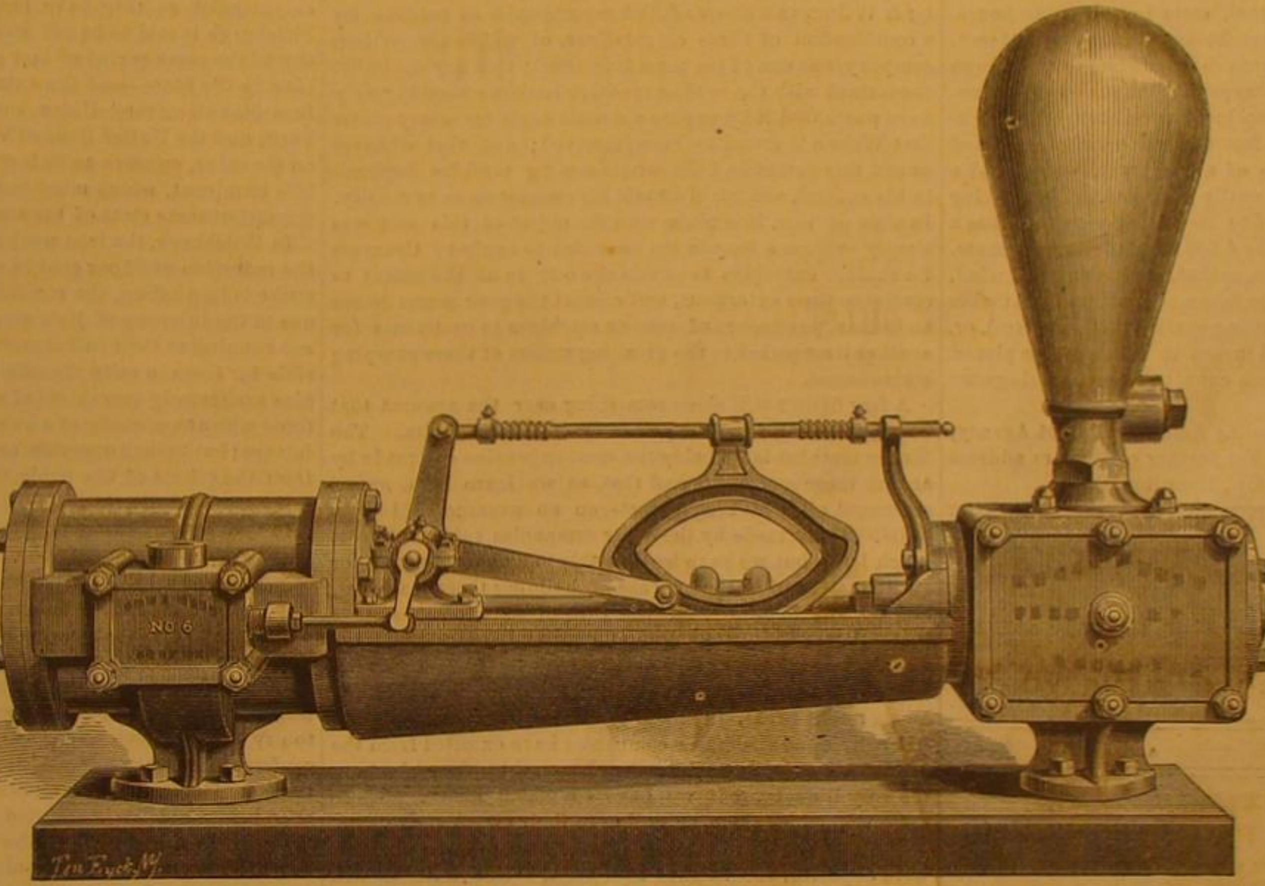
The manufacturers, in enumerating the various advantages of the apparatus, point out especially the simplicity of its construction, strong and durable material being used, and the various parts so constructed as to be readily accessible. There are no small intricate steam passages to fill up with dirt and grease, and the water valve chambers may be easily opened to reach the valves. The steam valve, being of the plain slide description, is also not liable to become out of order.

The pump, it is stated, will start at any part of the stroke, discharging the condensed water, and will lift either hot or cold water equally well, without change of valves. It can be used as a boiler feeder, or a fire and marine pump combined, and, it is claimed, will pump water at a temperature of 211°. Either water or steam pressure may be used as a motive power; a No. 2 boiler feeder, it is stated, has run at 25 double strokes per minute with only 20 lbs. water pressure. The steam cylinders are fitted with a patent metallic spring packing, and the water cylinders with a packing of linen rubber.

The boiler feeders are well adapted for forcing water under great pressure or to a high elevation. One pump of this description, the manufacturers state, fed water at 210°, from a heater, against 80 lbs. boiler pressure, and gained a medal over four competing pumps at the Cincinnati Industrial Exposition, 1873. For supplying tanks at railway stations, a compact steam boiler is furnished for driving the pump, the whole cost of the apparatus, it is stated, being less than that necessary to equip a station for pumping by horse power or caloric engine. The boiler is fed by means of a plunger pump attached to the piston rod of the main pump. The only difference, between the machines thus adapted and those above described as boiler feeders, is that the steam cylinders are much smaller, as it requires less pressure to do the work.

A class of low pressure pumps is also manufactured, which can be used in connection with a low pressure heating apparatus, thereby saving extra boiler and machinery. These are quite useful in case of fire, as the areas of the steam cylinders are as 9 to 1 of the water cylinders. The fire pumps constructed on the same general model are adapted for use in high buildings and for throwing water to great elevations.

The machine is well adapted for all the various uses to which steam pumps are applied, for employment in industrial establishments of all kinds, and for lifting oils, acids, and, in brief, any kind of liquid. It is manufactured by the Barney and Smith Manufacturing Company, car builders, Dayton, Ohio, an old and well known concern, whose excellent reputation is, perhaps, the best guarantee of the superiority of their productions.

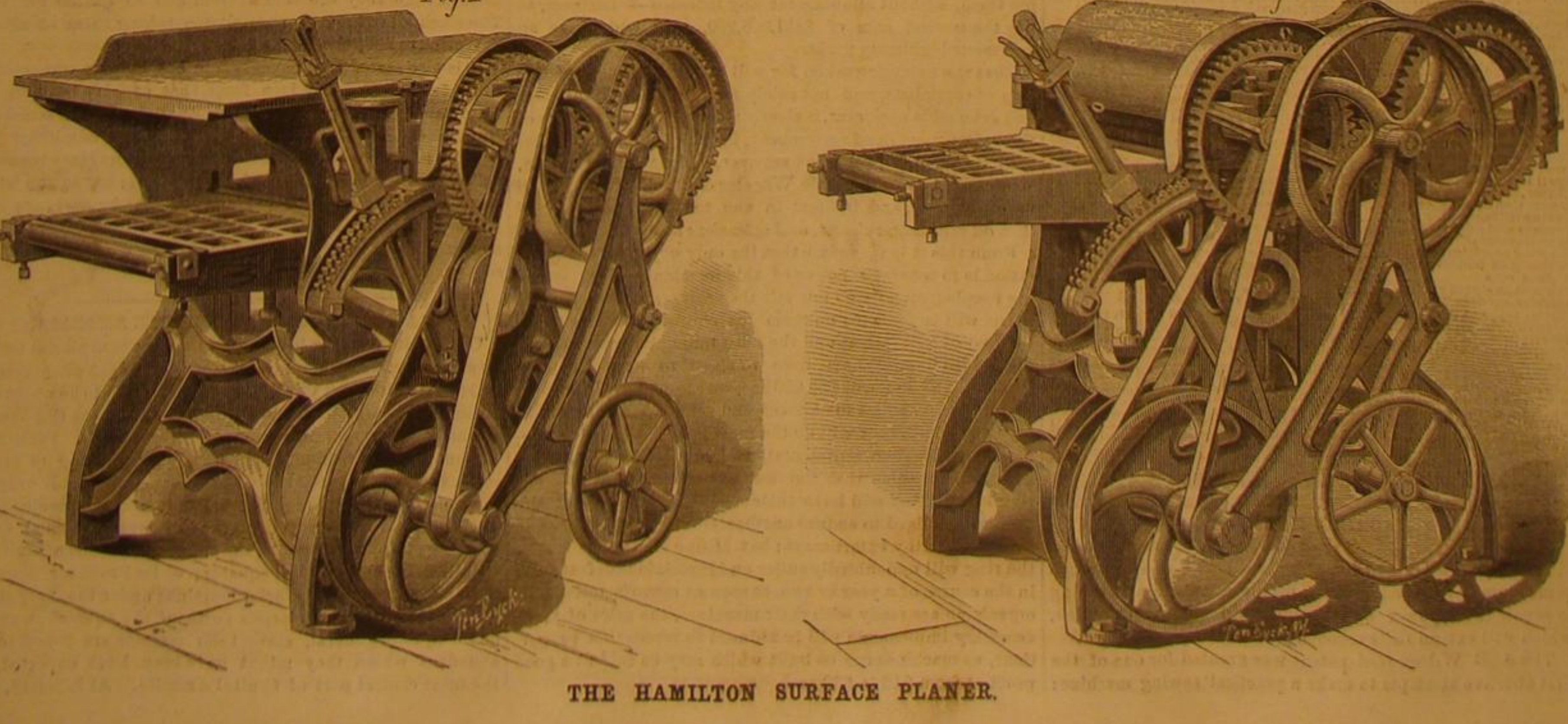


THE DAYTON CAM PUMP.

THE HAMILTON SURFACE PLANER.

The improved surface planer herewith illustrated combines several new features which are intended to increase its adaptability to a large extent, making it (although a pony planer in size) a very useful labor and time saving machine. It has adjustable tables above and below the cylinder, which enable the operator to smooth and plane material perfectly straight and out of wind above the cutter head. The material may be subsequently planed from five inches to one sixteenth inch thick below the cylinder, thereby insuring straight, smooth and even surfaces, or it may be simply planed out of wind, to a thickness, or smoothed off at the will of the operator. This improvement enables the machine to perform a large variety of work, and allows of the finishing of pieces after they are framed together, dispensing with bench finishing to a great extent.

Fig. 1 Fig. 2.



THE HAMILTON SURFACE PLANER.

Two different kinds of these surface planers are manufactured, with or without the attachment to plane out of wind above the cylinder. Referring to the accompanying engravings, Fig. 1 represents the surfacer, with attachment to plane above as well as below the cylinder. Fig. 2 represents the same planer without the attachment to plane above the cylinder, and only for planing below the cutter head. Three sizes of each of the two machines are made, to plane 24 inches, 20 inches, and 16 inches wide. The difference is only in the width, all working parts being the same. The frame of the machine is strong and heavy, the joints are carefully planed and then bolted together, and the table is cast in a solid piece, resting on two slides and screws, which are operated simultaneously by one hand wheel. An index attached to the table shows at a glance the different thicknesses to be planed, from five inches down to one sixteenth of an inch. There are six feed rollers, made of the best wrought iron, four resting in the solid table. The center feed rollers, of which one is fluted, are close to the cutter head, so that short as well as long material may be planed without clipping the ends. The gear wheels are very strong and are covered with a bonnet to keep them free from dust and shavings. An adjustable roller scraper is attached to the back feed roller to keep it free from gummy matter. The feed rollers are all adjustable, and the front and back pressure feed rollers are kept down by strong spiral brass springs, which can be easily adjusted and furnish an even yielding pressure. The pressure bar is also of a new construction and is held to its place and evenly forced down where the pressure is needed. The cutter head has a cast steel journal, rests in self oiling boxes, and is made with two or three knives, as may be ordered. The bonnet and feed roller apron can be swung to the side so as to enable the operator to sharpen the knives whenever necessary. The feed of the machine can be changed by a patent differential pulley, from fast to slow or *vice versa*, and started or stopped by means of a feed lever, which is of a new construction and very easily operated. The driving pulley on the cylinder is of five inches diameter and has a five inch face, and should make 4,000 revolutions per minute. The upper tables are adjustable, so that, in planing out of wind, a cut from 1-32 to ½ inch can be taken on stuff up to 24 inches in width (the width of the cutting surface of the knives), or, in other words, stuff up to 24 inches in width can be planed out of wind, from 1-32 to ½ inch cut at one time, passing over the cutter head.

Patented through the Scientific American Patent Agency, March 24 and April 7, 1874. For further particulars address Messrs. Bentel, Margedant & Co., Hamilton, Ohio.

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NEW YORK, SATURDAY, MAY 16, 1874.

Contents:

(Illustrated articles are marked with an asterisk.)

THE SEWING MACHINE MONOPOLISTS AGAIN AT WORK.

The sewing machine ring, not content with the enormous sums already extorted from the people, are again attempting to renew their power by lobbying a bill through Congress, which will extend their monopoly for seven years longer.

The A. B. Wilson feed patent was granted for one of the first abortive attempts to make a practical sewing machine; but so imperfect and crude was the model, filed with the application, that we doubt if any machine constructed like it was ever used, or was capable of being used practically. Yet as it happens that this is the first case in the Patent Office that shows an approximation to the modern feed motion, the patent has been construed by the courts to cover all styles of feeding devices in which the cloth can be turned around the needle, or in which the cloth is fed between two clamping surfaces. In view of these decisions of the courts, although the patent was granted for an impracticable machine, the Commissioner of Patents extended it for seven years; and Wilson, with an eye to the present application for an extension, immediately sold, for the comparatively insignificant sum of $50,000, all his rights to Messrs. Wheeler & Potter, as trustees for the Wheeler & Wilson, Grover & Baker, and Singer companies, and it has ever since been held and used in common by those companies as their most effectual instrument in monopolizing the sewing machine business, and in extorting millions yearly from the poorest and worst paid people in the land. On the strength of the small amount of money for which Wilson sold his patent, the combination now wants to have the privilege of plundering the people for seven years longer. In considering this sale of $50,000, it should be remembered that this valuable patent was not owned by a poor man who was obliged to sell his rights for a mess of pottage; the wealthy Wheeler & Wilson Manufacturing Company were doing business amounting to millions of dollars yearly, of which three fourths were clear profit; the patent was sold to the presidents of the Wheeler & Wilson and Grover & Baker companies as trustees for a combination of three corporations, of which the Wilson company was one of the most interested; that any capitalist conversant with the sewing machine business would gladly have purchased it by paying a double eagle for every dollar that Wilson is stated to have received; and that whoever owned this patent had the whole sewing machine business in his control, and could dictate his own terms as to royalty. In view of this, it is plain that the object of this sale was simply to form a foundation on which to apply to Congress for another extension to enable the owners of the patent to continue their extortions, and compel the poor seamstresses and other purchasers of sewing machines to contribute for another long period to the groaning coffers of these grasping corporations.

A few figures will show something near the amount that has been wrung from the people by these cormorants. The Singer machine is probably the most expensive one made by any of these companies, and that, as we learn by a sworn statement of I. M. Singer, costs, on an average, $11.83 to build. Those made by the other companies referred to cost much less; but we have been unable to find any reliable or sworn statement of the expense of building these machines, and we will therefore, for the sake of argument, estimate them at the same price. The plainest and cheapest of these machines are priced at $55 dollars each. If from this we deduct $25 as a fair selling price (which would be considered an enormous profit, in any other business, on a first cost of $11.83), we find that these companies have extorted from the people $30 on each machine they have sold, over and above the very liberal profit we have estimated above. These three companies alone, according to their sworn statements, sold, in 1872, 445,776 machines; and if one fourth of these were exported, the balance sold in the United States will amount to 334,332. Now multiply this by the $30 above the fair profit, and the product gives the enormous amount of $10,029,960. If, in addition to this, we deduct one fourth, for export, from the number of machines sold by the favored licensees of these companies, we have a balance of 289,788; and if we multiply this by the $30 as before, we have a product of $8,693,640, which, added to the above, will give us a grand total of $18,723,600 as the amount extorted, mainly from the poorest and neediest of the people of the United States, in one year alone, by the operations of this ring, who, not content with this wholesale robbery so far, want the privilege of continuing it seven years longer; which will enable them, without allowing for any increase of business, to bag the modest sum of $131,065,200, over and above an enormous legitimate profit.

That the extension asked for will be for the benefit of this ring of capitalists, and not solely for the poor (?) inventor and ostensible applicant, is clearly shown by an inspection of the before mentioned assignment, in which it is stated that "I have assigned, sold, and set over, and do hereby assign, sell, and set over unto said Wheeler & Potter * * * all my right, title, and interest in and to the same * * * *with all renewals, reissues, and extensions thereof.*"

From this it is very plain that the only object of this application is to renew the power of this formidable ring; and if the people generally do not stir themselves, this mighty incubus will be fastened on them for seven years longer, as the best of legal talent and the most influential members of the "third house" have been retained to work the case through. The sum of $50,000 has, we are credibly informed, been raised as a first instalment and sent to Washington to be "placed where it will do the most good;" and if the people do not let their representatives know their will on this point, it is possible that the weighty reasons of which the ring is so lavish will have their usual influence, and the people be obliged to endure another seven years' servitude to these wealthy extortioners; but if due efforts are made, the ring will undoubtedly suffer an ignominious defeat; and in the course of a year or two, as soon as manufactories now organizing are ready with their machines, the price of these necessary implements will be reduced to reasonable proportions, as machines can be built which may be sold at a good profit at from $15 to $20 each.

THE DEPRESSION IN THE IRON TRADE.

"The iron trade," says Mr. Samuel J. Reeves, President of the Iron and Steel Association, and also of the Phœnix Iron Works, the largest establishment in the country producing manufactured iron, "has not been so bad for fifteen years; and there is little prospect of improvement before the fall." Manufactured iron, according to the same authority, is a drug; the demand is less than that of three months since, and the delay of Congress to settle the vexed question of the currency, the late panic, and the strikes, past and impending, have, it appears, all contributed to produce a condition of affairs, in one of the most important branches of the national industry, which indicate widespread and alarming distress.

A brief review of the course of business during the past twelve months shows that, up to the summer of last year, trade was quite brisk and iron in demand at moderate rates. The year bid fair to be a prosperous one until the opening of autumn, when a falling off took place, followed by the financial crash which blocked business. Still trade dragged on until February of the present year, when, in the opinion of some, a very slight improvement took place, and has continued: others however, maintaining that such is not the case, and for a reason point to the fact that the demand for manufactured iron is far below the average. A correspondent of the *Tribune* says that new railroad improvements are at a comparative standstill; railroads in operation are doing only a limited carrying traffic; the coal market is dull and flat, and operations in improvements are not by any means as extended as they have been. The product of rails at Pittsburgh is said to be not more than one fourth the quantity of the same period of last year—630 furnaces are out of blast in the State—and the antagonism existing between the Iron Manufacturers' Union, composed of capitalists on one hand, and the United Sons of Vulcan, of puddlers and boilers on the other, appears to be increasing, rendering labor troubles imminent, which must tend still further to complicate the unfortunate state of the trade.

In Pittsburgh, the iron workers are becoming restive under the reduction of 20 per cent in wages since the panic, and a strike is impending, the result of which cannot but be ruinous to the interests of both sides. The leading houses are not running at their full capacity, and declare that is impossible for them to raise the rate of wages because their margins are scarcely two thirds of what they were last year. To those who are working at a loss, strikes are a matter of indifference; but to such operators as are striving to lift themselves from the effects of the panic, the closing of the works will bring renewed distress.

In the eastern section of Pennsylvania, the points of dispute between employers and employed are the sliding scale of wages and arbitration. The workmen, the vast majority of whom belong to the union, demand that their wages be so adjusted that when prices of iron advance they shall participate in the manufacturers' gains, and conversely share in the losses in times of depression. The employers are opposed to these conditions and assert their right and privilege to pay the men such wages as they choose. Arbitration is a conference between a committee for the Central Union and the manufacturers, which aims to settle difficulties which may arise before a strike is resorted to. Eastern operatives, it is said, dislike the unions and the established scale. West of the Alleghanies, both are quite widely recognized. Thus affairs now stand, and it is to be hoped that an amicable settlement may in the end be reached, though at the present time none seems clearly apparent.

The reports in the English journals show that the British iron trade is suffering severely from foreign competition, and that it is probable that the advantage of the increased imports to us, necessitated by the difficulties in our domestic productions, will be secured by continental manufacturers to a much greater extent than by those of England. The *Ironmonger* affirms that iron making in Great Britain is not only profitless but attended with loss. A ton of rails made in South Wales and delivered actually costs $70.25, while at the present time they are sold at from $45 to $47.50 per ton. The slackness of orders necessitates taking them at almost any price to keep the works going.

It is also stated that never before has Belgian competition proved so severe. Bar iron from that country is offered in England at $52.50 per ton, which English masters could not furnish at less than $62.50. *Iron*, while admitting the state of affairs to be bad, predicted some time since renewed activity, owing to the falling prices of fuel; but in the latest issues received, the trade summary of that journal says that business is in a state of suspense, and will probably remain so until the prices of fuel and the wages question are again settled.

GLACIAL REMAINS IN CENTRAL AMERICA.

Until quite recently it has been thought that glacial action on any extensive scale was altogether a northern phenomenon its southern limit on this continent appearing to be about the latitude of Washington and St. Louis, and in the Old World a line of corresponding temperature, that of Paris and Vienna. Lately evidence has been accumulating to prove the prevalence of glacial cold at the same time, not only in the southern hemisphere but practically over the greater part of the globe. Professor Hartt has discovered glacial drift all the way from Patagonia, its supposed northern limit, to within ten degrees of the equator; while Professor Agassiz claimed to have found glacial moraines under the very line. The development of glaciers north of the equator was no doubt equally general, since their remains are found to be abundant where they might have been least expected, in the most central part of Central America. At Libertad, the center of the mining region of Chontales, on the northeastern shore of Lake Nicaragua, the author of "The Naturalist in Nicaragua" observed transported boulders that gave unmistakable proofs of ice action, while in the adjoining district of Matagalpa the evidences were overwhelming. All along the eastern flank of the sierra are ranges of boulder clay, some of them exceeding a thousand or twelve hundred feet in hight, made up entirely of a brown clay mixed with angular and partly rounded blocks of stone derived from the higher mountains to the west. These ridges were particularly observed by Mr. Bell between San Rafael and Yales and northward to Ocotal, the capital of Segovia. A section of strata between Ocotal and Depilto, a small silver mining town nine miles nearer the boundary of Honduras, shows very clearly the depth and importance of the glacial deposits. At Depilto the rock appears to be Laurentian, great, bare, rounded masses of hard quartzite protruding through the scanty soil, while the river bed is filled with enormous boulders of granite-like gneiss. Descending the valley the massive beds of quartz and gneiss are soon succeeded by overlying, highly inclined and contorted schists, with veins of quartz running between the laminæ. About a mile below Depilto unstratified beds of gravel, enclosing boulders of quartz and schist, begin to be exposed in natural sections, which deepen as the river is descended, until at Ocotal they are from two to three hundred feet in depth. The undulating plain on which the town is built is composed of the same material. Near the town the formation is almost level, excepting where it is worn into deep gulches by the water courses. Across the river the same gravel beds extend two or three miles to where a deeper deposit of gravel, with boulders of trap and conglomerate, overlies the schists.

The evidence of glacial action along this valley seemed to Mr. Bell—with a single exception—as full and clear as could be found in any Welsh or Highland valley. There were the same rounded and smooth masses of rock, the same moraine like accumulations of unstratified sand and gravel, the same transported boulders that could be traced to their parent rock several miles distant. The exception was doubtless one of observation rather than of fact. His visit was a hurried one; and as he did not see any rock near Depilto that had been recently bared, his failure to see any glacial scratches is not surprising.

That the gravel and boulder clay formations were not due to floating icebergs is argued on zöological grounds. It is well known that the faunas of the two oceans have been distinct, certainly since the miocene period. Had icebergs floated in the neighborhood of Ocotal (now three hundred feet above the sea) during the glacial period, the low pass between the Atlantic and Pacific, through the valley of the San Juan and the lake of Nicaragua, must have been submerged something like twenty-eight hundred feet. That the faunas of the two coasts could have been kept separate under such circumstances it is impossible to believe.

DEAD SUBJECTS AND A LIVE DISCUSSION.

If the talk about cremation ever amounts to anything more than talk—and the present indications are that it must—it will afford a memorable illustration of the power of the press, if nothing more.

A gentleman not very widely known, and to most of those who have heard of him somewhat unfavorably remembered as the suggester of the "prayer test," publishes in a magazine of limited circulation a few more or less substantial reasons for radically changing a custom, more deeply rooted, perhaps, than any other in the prejudices, inherited sentiments, religious observances, and other conservative elements of Christian civilizations. The proposition is taken up and discussed in rapidly widening circles, and in half a year is a familiar topic wherever newspapers are read. Still more surprising: the reform is, in the main, not unfavorably considered, societies are organized for carrying it out; and in some cases, city corporations have made provisions for the exercise of the new rite by any so disposed.

As might have been expected in the general discussion by all sorts of people of a subject appealing to sentiment rather than reason, there has been a vast amount of nonsense uttered on both sides. Indeed, with the coolest headed, it is almost impossible to consider the subject dispassionately the moment we cease to think of the dead abstractly, or as belonging to some one else, and take ourselves and our own dead into account.

Burning has so long been associated with violence and accident, and burial with the undisturbable repose which we have learned to look forward to under grass and flowers, that few can compare them calmly. And though we may personally think with Laurens that our bodies are too good for the worms, and prefer that the elements of our cast-off frames may be quickly and surely dispersed by the purifying agency of fire, rather than slowly, uncertainly, and loathsomely by natural corruption, yet the most logical among us might shrink from the sight of a wife or child, parent or dear friend, thrust into the furnace seven times heated, and beg for the accustomed ministrations of earth and air in the quiet burial ground.

Unreasoning prejudice, it is true; but it is a power in the world none the less, and, like inertia in mechanics, it is an essential factor in all social calculations. A generation must grow up familiar with the thought from childhood before the practice of burning the dead can have a more than sporadic development among us.

The greatest difficulty, or rather danger, to the proposed reform is the wild and offensive extravagance of some of its advocates. The cessation of breath does not immediately convert the forms of our loved and lost into "loathsome carcasses," "carrion," or anything of that nature; and to demand their treatment as such is not likely to make converts to the new rite—hideous *wrong*, the sensitive may rather say—except to the limited extent of applying it to its proposers.

It is true that a lifeless body may be represented chemically by a few symbolic letters and signs, which also stand for plant foods and manures. It is true that the sequestration of the bodies of our dead withdraws annually some hundredweights of fertilizers from our fields. But there are other and higher values than those quoted in the guano markets—higher to us, if not to the rabid utilitarian. Besides, it is slightly absurd, to say the least, for him to declaim so earnestly against our burying, once for all, a hundred pounds or so of loved remains, when he deposits yearly in the sewers a vastly greater weight of more available fertilizing material, and thinks nothing of it.

We are not opposed to cremation. Indeed there is one aspect of the case in which it is all but imperative; only let it be done decently, and with due regard to sense and sensibility. From a sanitary point of view, our present mode of disposing of our dead is anything but commendable. The ordinary graveyard is demonstrably dangerous to the living, and a source of possible poison to generations that are to come. Especially where the burying is rapid or unwisely done, as is too commonly the case, the air is tainted, and the underground water courses are polluted: a double evil made increasingly noxious by the tendency of modern society to congregate in cities, and consequently to accumulate great numbers of dead bodies within limited areas near centers of population.

As for the alleged cheapness of cremation, that is a matter altogether doubtful and of small moment. It is true that a couple of dollars' worth of coal, properly burnt, will speedily convert a corpse of average weight into a few pounds of clean ashes and an indefinite amount of invisible and inoffensive elementary gases; but funerals will be a burden none the less. Fashion will invade the pyre and the urn as surely as it has the cemetery and the grave; and it can be as lavish in expenditure in the one case as in the other. To expect that funeral rites will be done away with, and the possibilities of ostentatious grief prevented, by burning the dead, is to overlook some of the strongest impulses of human nature. It is more likely that burning would simply add another item to the expense of funerals, since a few eccentrics only would have their ashes scattered to the winds, while the multitude would retain their decorated burial plots, and have their ashes interred as formally as now. Indeed, if made harmless by fire, we are disposed to think the cemetery, with its shady walks and well kept shrubbery and flowers would and should be retained. It is well to leave some spots sacred to bereavement and tender recollections of the dead.

OLEOMARGARIN.

We recently published an illustrated description of the mode of manufacture of the oleomargarin; and so far as our investigation of the process by which it is made extends, so long as pure caul fat is employed, the resulting product presents no qualities either in taste or smell at all offensive or even disagreeable. It is unquestionably, when thus made, superior to the detestably bad low grades of revamped butter which are sold to the poor from corner groceries in this city, and to a large extent shipped South; but if, as is asserted, it be produced from soap fat and butchers' waste, then a more revolting mass could hardly be placed upon our tables, and the resolution of the Exchange, condemning its sale, has not come too quickly.

It has also been alleged that it has been sold for genuine butter, and that it has been employed as an adulterant for the same; hence the Exchange "emphatically condemns any process of adulteration or mixture and the fraudulent attempt to sell such product for pure butter."

SCIENTIFIC AND PRACTICAL INFORMATION.

THE BAMBOO A DANGEROUS POISON.

The *Strait Times*, a Javanese journal, publishes some novel information on the poisonous properties of the bamboo, which heretofore has been considered one of the most inoffensive of vegetables. The natives of Java use the poison against their enemies, and obtain it by cutting the bamboo at a joint, and detaching from the saucer-shaped cavity, formed by the cane at such portions, some small black filaments, which are covered with almost imperceptible needles. The filaments constitute the venom, against which no remedy has been found to act. When swallowed, instead of passing to the stomach, they appear to catch in the throat and work their way to the respiratory organs, where they immediately produce a violent cough, followed by inflammation of the lungs. The poison, tried upon dogs, produces loss of appetite, severe cough, burning thirst, and gradual emaciation. The animal froths at the mouth, and finally dies by suffocation as if under the influence of a deleterious gas.

FLOATING PARTICLES IN THE AIR.

When a ray of sunlight crosses a shaded room, an immense number of fine particles will be noted, apparently in suspension therein. M. Tissandier has recently made some investigations into the quantity of this dust contained in 35·3 cubic feet of air, by causing that quantity of air to pass through a tube packed with gun cotton, which filtered out the particles. He afterwards dissolved the gun cotton in ether, and thus was enabled to obtain the particles in a separated condition. After a heavy rain, M. Tissandier has collected ·09 grains of dust in the above mentioned quantity of air, but during dry weather this proportion rose to ·3 of a grain. With regard to the nature of the material, he found that about one third was organic, another third silicious, and the rest composed of various substances and sulphate and oxide of iron.

AN ALCOHOL AND VINEGAR POLYPUS.

The Jardin d'Acclimatation of Paris was recently presented with a medusan polypus, which, on its reception, was placed in a tank of water with similar organisms. To the surprise of the curators of the aquaria, it was found that after the lapse of twenty-four hours the creature had killed every other occupant of the vessel, and remained alone in the midst of a quite large empty space. After some speculation over the apparent mystery, the analysis of the water was made, proving that the liquid was water no longer, but vinegar. The polypus, it appeared, was one of a very rare species of mollusk, which when placed in pure water, has the property of changing the same into a strongly characterized acetic solution. The animal, it is said, produces alcohol, which it transforms into vinegar.

EGYPTIAN BLUE.

A remarkable and very beautiful shade of blue is noticeable upon many of the ancient ornaments found in the tombs of Egypt. Analysis sometime since proved the color to be formed by a combination of soda, sand, and lime, with certain proportions of copper, from which substances the Egyptians managed to produce three different products: first, a peculiar kind of red, green, and blue glass; second, a brilliant enamel, and lastly the color to which reference is above made, and which was used for painting. By synthetical experiments, M. Peligot has succeeded in reproducing this peculiar shade of blue, by heating together 73 parts of silica with 16 of oxide of copper, 8 of lime, and 3 of soda. The temperature should not exceed 800° Fah., as, in such case, a valueless black product is the result.

THE AKKAS.

The Italian Geographical Society has recently received news of the death of the African explorer Miani, and also a number of interesting objects forwarded to them by that traveler just previous to his decease. Among the curiosities were two African dwarfs belonging to the tribe of Akkas. These individuals, aged respectively 18 and 19 years, are but 28 and 34 inches in hight, and belong to a peculiar race of people, the existence of which, first affirmed by Herodotus, has of late years been rediscovered by Du Chaillu and Schweinfurth. These strange beings are of a light copper color and noticeable for their extreme ventral prominence and very thin members. The lips are very long, the chin sharply recedes, and the hair, though tightly kinked, is very long and abundant. Their agility is said to be remarkable in view of their peculiar build.

ADULTERATION OF CHOCOLATE.

Chocolate is one of those articles of food which are rarely sold in an unadulterated condition. These adulterations are so considerable that frequently the spurious chocolate is a mere imitation, containing every ingredient except the principal one, the pure cocoa. Particularly is this the case with the imported material from France, a fact very evident considering that the poorest chocolate is sold in that country at wholesale for some three cents a pound, when the cocoa alone sells for 21 cents. The imitation chocolate is a mixture of cocoa shells finely pulverized, burnt flour, beef marrow, and a little spice, and such is the composition of much of the stuff for which medals have been awarded at fairs and expositions.

The purity of the chocolate can, however, be determined by very simple means. One part of the material to be tested is warmed with ten parts of water. The solution is allowed to cool; and on being thrown on a blotting paper filter, leaves a reddish brown deposit. The liquid should pass through promptly and be of a clear red, having an agreeable cocoa taste. The material on the filter should also on being dried yield a light powder of very little coherence. If, however, the chocolate is adulterated, the liquid passes through the filter slowly, and is of yellowish color, having a sweet taste. A viscous mass remains on the paper, which dries slowly into a solid form. The more viscid the residuum, the more burnt flour the chocolate contains. Glucose is frequently substituted in the spurious material for cane sugar.

A Fortunate Inventor.

Our readers will remember that not long since we devoted our first page to a description and illustration of Mr. E. F. Loiseau's machinery for the manufacture of artificial fuel from coal dust, and have since frequently alluded to the inventor's progress in introducing the invention. We have recently learned with much pleasure that Mr. Loiseau has disposed of the right to manufacture the fuel in Great Britain, under his English patents, for the sum of $60,000 gold and a royalty of twenty-five cents per tun when coal sells at from 15 to 25 shillings per tun in London, the royalty varying with the price above or below these figures. The purchasers agree to manufacture a minimum amount of 100,000 tuns the first year (!), and after that to keep the market supplied, on failure of which the inventor can manufacture for himself. This at the beginning, supposing coal to sell at the above figures, would give the inventor the neat income of $25,000 for the English market alone. Mr. Loiseau is organizing a company for the manufacture of the fuel in this country.

TO GIVE IRON A TEMPER FOR CUTTING PORPHYRY:—Make your iron red hot, and plunge it into water distilled from nettles, acanthus, and pilosella, or else in the juice pounded out from these plants.

AN INEXHAUSTIBLE INKSTAND.

Mr. Adolphe Teysonnière, of No. 18 King William street, Westminster, England, has recently patented in this country an ingenious inkstand, which, he says, is capable of yielding ink of a uniform color and quality, for a long period, by the simple application thereto, from time to time, of pure water.

The device, as shown in our engraving, consists of an inkstand divided into two compartments by a perforated partition. Access to both divisions is afforded by orifices above represented, covered with screw caps. In the smaller compartment a quantity of dry coloring matter, which may be aniline of any colors, ink powder, ordinary ink evaporated, evaporated extracts of dye woods, soluble dyes, indigo, Prussian blue, or any other similar material, is placed, after being enveloped in a porous bag or envelope of unsized paper. In the larger compartment is an inverted truncated cone, A, which forms the dipping cup, and the lower end of which rests against a sponge, which serves as a filter to keep back

any particles of undissolved coloring matter which may escape from the envelope containing the pigment. When the case is thus fitted, the cover is secured in place, and the inkstand is ready for the market. In order to use it, water is poured, through the opening for the purpose, into the smaller compartment. A portion of the coloring matter is then dissolved, as the water thus turned into ink flows readily through the perforated partition and sponge, and rises sufficiently in the cone, A, to be taken up by the pen. When all the liquid is used, more may be made by simply adding more water, and this may be repeated until all the pigment is dissolved.

The inventor also proposes several modifications of the form represented herewith, but all are constructed on essentially the same principle.

THE COLORADO POTATO BUG.

The Colorado potato bug, or *doryphora decemlineata*, a representation of which we herewith present, has for several years past made alarming ravages in the potato crops of the western section of the country. Some forty years ago, it was known in the Rocky Mountains, where it seemed to be indigenous, feeding upon the *solanum rostratum*, or wild potato. When the common tuber was introduced in that region, the beetle soon attacked it; and spreading from one field to another, in 1859 it had reached a point one hundred miles west of Omaha. In 1861 it invaded Iowa, and, crossing the Mississippi in 1864-5, it has since proceeded eastward at the rate of about sixty miles per year; so that it will probably reach the Atlantic, unless some means be found for its extermination, during 1878.

Professor Hall, of Chicago, states that the beetle lays its eggs on the under side of the potato leaf. These are speedily hatched. The larva, when full grown, is over half an inch long, very thick in the middle, and tapering towards head and tail. It is of a pale yellow color, often dusky or freckled on the back, with small blackish dots, and along each side are two rows of large black dots. The legs are black, and the head black and shining.

The mature insect, the beetle itself, is nearly half an inch long and a quarter of an inch wide. Its shape is oval, very convex above and flat beneath; of a hard crustaceous texture, smooth and shining, and of a bright straw color, the head and thorax being sometimes tawny yellow; head and thorax marked with black spots: the wing cases with black stripes arranged longitudinally, five on each case. The antennæ are twelve-jointed; the first five joints are pale or tawny yellow, the remaining joints black, the last joint being small, and sunk into the penultimate one. The legs are tawny yellow, the hips, knees, and feet being usually black. It requires less than a month to pass from the egg to the beetle state. The accompanying figure, for which we are indebted to the *Field*, is a representation of the insect on an enlarged scale, the line alongside showing its actual length.

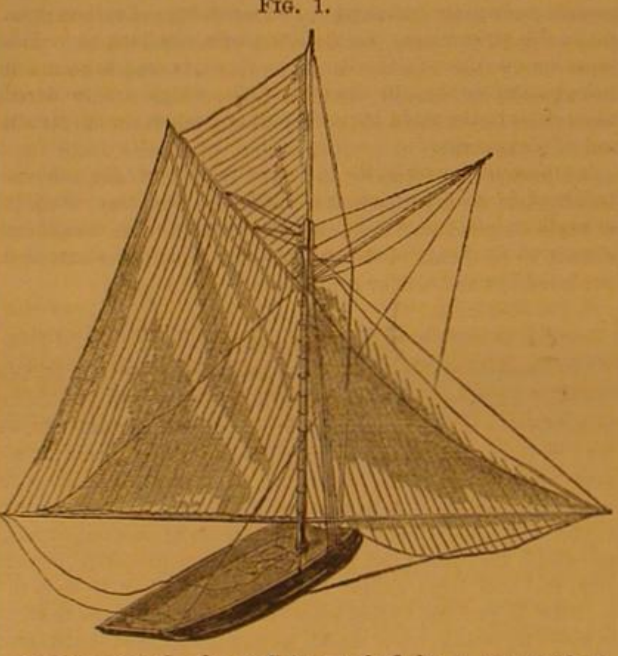
Where the bug once gets a footing, it speedily destroys the entire crop. It is believed to effect all its transformations in fifty days, so that a single pair would, if unmolested, produce sixty millions of progeny in a single season. Various modes of preventing its ravages have been suggested. Brushing or shaking the larvæ from the haulm into a vessel is sometimes tried, but this is a laborious and dangerous operation. Dusting the leaves with white hellebore powder is an effective remedy when it is well done; the powder must, however, be freshly ground, as it loses its efficacy when kept too long. Paris green is also recommended, but both powders are irritating to those applying them, while the latter is extremely poisonous. Birds, it is said, will not destroy the bugs, as the emanations from their crushed bodies are noxious even to human beings, and, it is said, have caused several deaths. The symptoms resemble those caused by the bite of the rattlesnake. The beetle has several insect enemies, especially some varieties of ladybird, which prey upon its eggs and larvæ.

There has been considerable alarm in England, lately, lest the pest should be imported thither in American potatoes, and official investigations have been made in order to determine the advisability of prohibiting importations of the vegetables. The report, however, points out that the larvæ of the parasite are not deposited in the tubers or conveyed by them, and that with the exercise of proper care no danger need be apprehended from bringing American potatoes into the country.

THE SHADOW SAIL.

We extract from *Land and Water* the accompanying engravings of a new sail recently patented in England, and called the Shadow. It seems well adapted for racing yachts, as it allows of a remarkably large spread of canvas. The fitting is, however, not American fashion; and although when once distended, the sail would be of considerable assistance, we think that the extra quantity of gear required, and the cumbering of the masthead rigging with an extra gaff, will hardly secure for it much favor from American yachtsmen. We should imagine that the plan might be so modified as to get rid of much of the clumsiness, particularly if the gaff, as our contemporary suggests, could be arranged so as to be easily and quickly shipped and unshipped in any kind of weather.

FIG. 1.



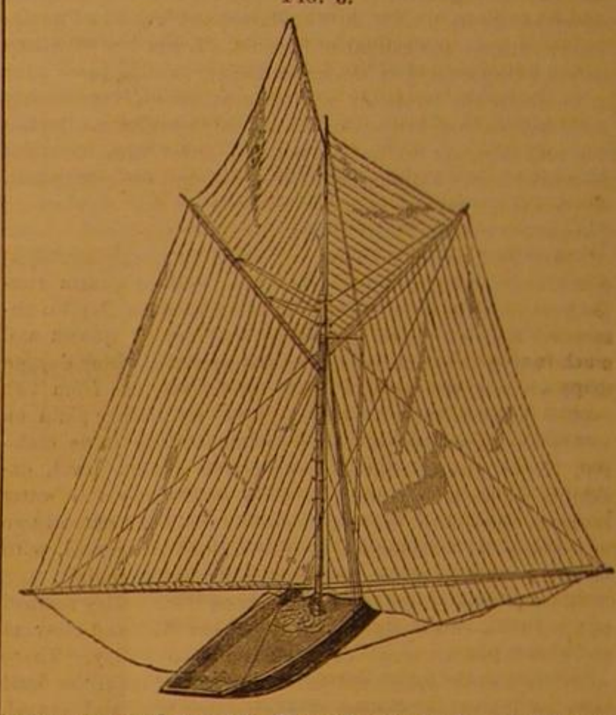
As represented, the gaff is attached by a gooseneck to iron work fitted on the foreside of the mast. This iron work projects from the mast in such a manner as to allow the topmast to pass through it when requiring to be housed, and is fixed about two feet six inches below the hounds of the rigging, just above where the jaws of the mainsail rest. The length of the gaff is regulated by the hoist of the mainsail, but should, when hanging down from the gooseneck and in use, reach within about four feet of the deck. In cutters, and for the foremasts of schooners, two halliards are necessary, one on each side of the forestay; but on the mainmasts of schooners, one will be found sufficient. When the

FIG. 2.

sail is not set, the gaff can be stowed either alongside the mast or lashed to the rigging as most convenient. The sail has hoops seized on it; and when being set, these hoops are slipped over the gaff before hooking on the peak halliards. As the hoops are passed over the gaff, the throat of the sail is hauled up; and when all are on, the head of the sail is brailed close to the mast. The gaff is then peaked up on the proper side of the forestay, and the boom, which is exactly similar to a spinnaker boom, is rigged out, and the foot of the sail set on it exactly in the same manner as a spinnaker.

Fig. 1 represents the sail as it now is, or when close reefed. Fig. 2 shows the sail when half reefed, or while being set. When the sail is half reefed, the gaff will re-

FIG. 3.



quire more peak to set it. The sail, when fully set, is shown in Fig. 3, which also explains how a topsail can be set over the Shadow in light winds.

From the gaff end are fore and after guys, with which to brace the gaff to its proper position. When gybing, all that is necessary is to brail up the sail, lower the peak of the gaff, unhook the halliards and guys, pass it under the forestay, hook on again, and hoist away, of course having first shifted the boom.

IMPROVED LARD AND BUTTER CUTTER.

We illustrate herewith a new form of spatula adapted for removing lard, tallow, butter, or similar material from the tub, which provides an easy mode of freeing the ladle portion from the clinging material. The device is made of wood, and its lower end is broadened, beveled to a sharp edge, and passes through an opening in the sliding piece, A. To the latter is secured a bar, B, which is slotted and through the opening in which passes a confining stop, C. A button on the upper extremity of the bar allows it to be conveniently moved.

After the material is cut and lifted up upon the broad end, as shown in Fig. 1, the piece, A, is slid down to the extremity, as represented in section in Fig. 2, thus pushing the lard off upon the receptacle placed for it, leaving it in a smooth, attractive shape.

The device is simply constructed and easily operated, and will doubtless form a convenient arrangement for the use of grocers, dairymen, and others.

Patented July 30, 1872. For further particulars, address the inventor, Mr. W. M. Bleakley, Verplanck, N. Y.

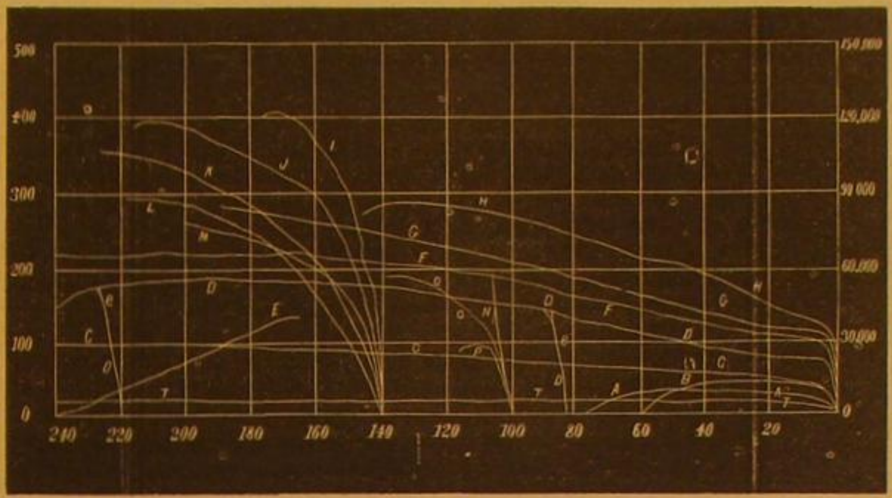
MOTTO FOR THE TEMPERANCE CRUSADE. "H_2O! every one that thirsteth!"

STRAIN DIAGRAMS AND THEIR REVELATIONS.

BY PROFESSOR R. H. THURSTON.

In the preceding article, a brief account was given of the method of formation of strain diagrams, whether made by plotting the results of experiments (made as described in the illustrated article published in the SCIENTIFIC AMERICAN of January 17, 1874) or by an autographic testing machine; and an explanation was given of the method of obtaining valuable and interesting information by the interpretation of the initial portion of the diagram.

In the figure here given are rough copies of several complete strain diagrams, produced by the autographic torsion machine at the Stevens Institute of Technology, by which this novel internal examination of materials, and its revelations, can be more completely exhibited.



The curves here shown do not exhibit the effect of peculiarities in the material as perfectly as the originals, because it is necessary to reduce the horizontal scale very much in order to bring the figure into proper shape and size to enter the columns of this paper. The original strain diagrams of iron occupy a space nearly a yard long and but two and a half inches high. Those of steel are five or six inches high. The column of figures at the right of the engraving represents the maximum stress per square inch of section exerted upon the fibers of the metal by tension, when the product of the weight on the end of the lever by its leverage is equal to the figure at the opposite end of the plate.

Referring to the figure, the curve, A, is that of zinc. Its form at the commencement, concave toward the base, shows its inelastic nature. Its gradual rise shows that it may take a set under the action of the smallest forces. Its maximum hight is small in comparison with its companion curves, and this shows its weakness; it actually has a strength, in tension, of but about 10,000 lbs. per square inch, and this was an unusually good specimen. Breaking off at about 65°, we learn that its ductility is slight, the metal only stretching about four per cent. Tin, T, is still weaker but vastly more ductile, and its strain diagram runs quite off the sheet, the metal twisting completely around before breaking; but its maximum resistance only reaches about 5,500 lbs. per square inch. B is the curve of cast copper, and C, that of forged copper. Could we follow the latter to the end, we would find that the specimen had yielded through more than 500°, its fibers stretching to three times their original length. It exhibited a resistance equal to over 28,000 lbs. per square inch. Its limit of elasticity, that is the point at which it begins to take a set nearly proportional to its distortion, is at a very low strain, less than 10,000 lbs., and it yields very considerably before it offers its maximum resistance. Its ductility is its most remarkable quality. Cast copper contrasts strikingly with the forged metal. Its limit of elasticity occurred at about 5,000 lbs. per square inch, its ultimate strength was between 12,000 and 13,000 lbs. per square inch, and its elongation was but two and a half per cent. This piece was from carefully selected ingot copper, cast in dry sand at the Stevens Institute of Technology. It, like the majority of the specimens here described, is therefore an unusually good example of cast copper; and were it of impure scrap, or had it been cast in green sand, its inferiority to forged copper would have been still more marked. Green sand seriously injures the metal by the production of porous castings, rendered spongy by vapors from the damp mold.

Good wrought iron gives the line, D. The beginning of the diagram, a line nearly straight but slightly curved in a direction the reverse of the preceding, and inclined toward the left, shows plainly that this is a somewhat elastic material, having a little internal strain. The short stretch of nearly horizontal lines, which appears far more distinctly in the original diagram, indicated that it is a fibrous iron, well worked and rather hard. It takes a set at very nearly 20,000 lbs. per square inch, and its maximum resistance is nearly 60,000 lbs. It finally breaks at some point beyond 240°; its maximum elongation is about one half, on some lines of fiber.

On this strain diagram will be noticed two of the lines exhibiting elasticity. They are apparently perfectly parallel, a fact which proves, what had already been suspected and almost proved by more than one distinguished philosopher, that elasticity remains unimpaired until fracture actually commences. Comparing the inclination of these lines, *e e*, with that of the initial part of the diagram, we find all very nearly of the same inclination; and the deduction, already made from the slight curvature of the beginning of the diagram, that this iron is very slightly weakened by internal strain, is thus confirmed. The line, E E, shows the form of the terminal portion of the diagram when the metal is very tough and ductile, like Swedish iron, for example. With ordinary irons and with steel, the curve ends abruptly, as shown in all those here given. The diagram, F F, is that of the excellent iron, referred to in the previous article as having given a curve of such beautiful regularity. The line exhibits perfection in quality by its great symmetry and smoothness. Were it shown *in extenso*, it would be seen that the specimen only broke after a complete revolution, and that the metal is as remarkable for its strength and ductility as for its homogeneousness and purity. This is the specimen illustrated and described as No. 22 in the article of January 17, 1874.

The effect of the presence of carbon upon the properties of iron is shown by the succeeding diagrams. A low steel, containing 0 4 per cent carbon, and produced by the Bessemer process, tells its story at G. The line H, is that of a Siemens Martin steel, containing one half per cent or a trifle more of carbon, while I and J are tool steels; K and L are medium and spring steels, and M is the strain diagram of double shear steel. It is seen, at a glance, that the introduction of carbon lessens the ductility of the metal, while increasing its strength and raising the elastic limit. The least ductile are the tool steels containing one per cent and upward of carbon. The most ductile is pure iron, containing no measurable quantity of that element. Intermediate degrees of ductility are produced by intermediate proportions of carbon. Their strengths vary in the opposite direction, increasing with the dose of carbon, in a pretty regular proportion, which is expressed quite accurately, for unhardened steel, by a formula, constructed by the writer: $T = 60{,}000 + 70{,}000\,C$, in which T represents the tenacity in pounds per square inch, and C, the percentage of carbon present in the given steel. In the low steels, the lack of homogeneousness, due to porosity in the ingot, is seen to be much more noticeable than in the tool steels, which are rendered more quiet in the mold by their higher proportion of carbon and of manganese.

In these high steels, the limit of elasticity, for the unhardened, is seen to rise to 60,000 lbs. and the ultimate strength to over 120,000 lbs. per square inch. The elongation is reduced by the maximum dose of carbon to about one and a half per cent.

N and P are the strain diagrams of white and of gray cast iron. The one is stiff, hard, strong and brittle, its line rising steadily upward without a sign of curvature or ductility until it suddenly snaps, after sustaining a very heavy stress. The other offers barely a half as much resistance; the curve bends sharply and runs a little way to the left, and breaks after the piece has twisted less than 20°, indicating a strength of but a half of one per cent. It has, however, five times the ductility of the white iron.

Malleableizing the white iron, a material is obtained of which the line, O, represents the characteristics. It is very homogeneous, has lost no strength, and has gained immensely in ductility. For many purposes it is better than average wrought iron; and the readiness with which irregular forms may be made of it, if of small size, makes malleableized cast iron a very useful material. "Steel" castings are usually made of an exceptionally good quality of this metal.

Glancing over the collection of strain diagrams, it is easy to select the proper kind of iron for any specified purpose. If mere strength is required, it is evident that the tool steels are the best materials. If ductility is desired, something resembling Swedish iron is the proper metal. Comparing the qualities of several metals experimented upon with the price lists, we may readily determine which is cheapest for the specified work. When shocks are to be resisted, or blows sustained, strength alone is not sufficient. Tool steel is too brittle a material to be used in such situations, and even moderately hard steels were long ago found to be less valuable than moderately good iron for such purposes. That metal which is at once strong and ductile is the proper one to choose. The power of a substance to sustain live loads—its resilience—is measured by the product of its mean resistance into the distance through which it stretches before breaking. A close approximation may be obtained by multiplying two thirds the ultimate strength by the distance through which elongation takes place. The metal giving the highest product is the safest against rupture by blows. Of two metals giving equal products, choose that which is strongest.

An area of the strain diagram measures precisely the value of a material to meet shocks. It is exactly proportional to the product just referred to, and its construction affords the only means, yet discovered, of determining resilience with precision. Examining the diagrams, it is seen that, except the very purest and most expensive wrought iron, the low steels excel all other materials in this respect, while they are stronger than any iron; and we perceive a very excellent reason for the wonderfully rapid introduction of Bessemer and Siemens steels, in rail and machinery making, which has recently taken place. A steel containing less than one half per cent carbon is not affected injuriously by changes of temperature, cannot be hardened, has at once great strength and considerable ductility, and is the best known metal, all things considered, to be placed wherever a structure is liable to severe blows and heavy strains, and therefore must be both light and strong.

Much more could be learned by the study of our strain diagrams, but space will not permit further examination of this method of molecular inspection, which physicians might probably term a stethoscopic examination of materials used in construction. Should the opportunity offer, we may, at some future time, be able to discuss some of the more novel facts which have been learned by the application of this new method and apparatus to research in a field in which much has been done, but in which there still remains much to be discovered.

STEVENS INSTITUTE OF TECHNOLOGY.

A Six Acre Rolling Mill.

The Phœnix Iron Company, whose great works are at Phœnixville, Pa., about an hour's railway ride up the Schuylkill from Philadelphia, have nearly completed a new rolling mill building, which is noteworthy in several respects. The *Ledger* says it is believed to be the largest single mill building, under one roof, in this country. The ground plan covers about six and a quarter acres of ground. Its longest dimension is nine hundred and thirty-eight feet, and its breadth is two hundred and ninety feet. The principal material of the building is wrought iron, the roof being slate. The building rests upon about two hundred and fifty wrought iron flange columns of three eighths thickness of iron, of the well known Phœnixville pattern. These rise about thirty feet to the eaves of the roof, and are but eight and a half inches in diameter through the cylinder, and about twelve inches in diameter from the tip of one flange to the tip of the flange on the opposite side of the column. At a short distance they look very slender, considering the great expanse and weight of the superstructure they have to support, but they have been proved to be capable of sustaining many times the greatest weight or force they are ever likely to have to resist. The roof rises to the hight of sixty feet at the ridge, the framework being exclusively of wrought iron, firmly braced and tied with rods and links. The furnaces, engines, and machinery will cost nearly a million of dollars. The cost of the building will be about $280,000.

Elongation of Conductors by Electricity.

Various physicists have from time to time studied the modifications in the molecular state of conducting wires, due to the passage of the electric current. Wertheim arrived at the conclusion that the transmission of the current modified the elasticity of the conductor, but Edlund, on the contrary, by a long series of careful experiments, has determined such not to be the case. This latter investigator has found, however, that the elongation of the wire under the influence of the current is sensibly greater than the dilatation due to the elevation of temperature resulting from the passage of the electricity. Two calculations were made of the temperature of the wire, one deduced from the relation previously established between the galvanic resistance of the conductor and its temperature, the other from the elongation of the wire directly measured and of its coefficient of dilatation, equally known. The second mode of determining the temperature constantly gave higher figures than the first, and M. Edlund therefore concluded that the current produced a special elongation in the conducting wire which is added to the expansion resulting from the accession of heat.

Quite recently M. Streintz has taken up this subject, and, by further investigation, has sought to measure accurately the galvanic elongation for different metals.

The observations were made on wires 0 019 inch in diameter and 21 inches in length, the ends of which just touched two levers which carried mirrors placed in the prolongation of their axes of rotation. The divisions of a graduated scale were reflected in the mirrors, and thus the displacement of the extremities of the wires could be accurately read. All the wires except those of hard tempered steel showed a marked excess of expansion under the action of the current, which varied, according to the different metals, from 11 to 27 per cent of the dilatation of the wire under the action of heat alone when brought from the normal temperature, 68° Fah., to that fixed as a limit, 131·4°.

M. Streintz sums up his results as follows: 1. The galvanic current causes no other modification of the elasticity of a conducting wire than such as results from the elevation of the temperature produced.

2. Under the action of the current, the conductor expands more than when it is carried to the same temperature without the current; tempered steel alone does not present this excess of dilatation.

3. Galvanic dilatation does not manifest itself immediately on the closing of the current, but gradually, as does calorific expansion.

4. Galvanic dilatation is not the consequence of an electrodynamic repulsion, but probably results from a calorific polarization or an orientation of the calorific vibrations.

THE superior effect of kindness over brutality, in the management of balky or restive animals, is forcibly illustrated in the following incident, related of one Sam Jones, who lived up in Orange county, N. Y. Now Sam was an enormous eater, and it happened that he was one day hauling a load to the nearest village, when his team was stuck in a sand hill. Well, did Sam fret and scold his oxen or unload his team? Not he. He very coolly took down his dinner from the load and sat down and ate it, when his oxen started off with the rest of the load without further trouble.

PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCE.

We continue our abstracts of the papers read before the National Academy of Science at its recent session in Washington. Dr. E. Bessels gave some further scientific

RESULTS OF THE POLARIS EXPEDITION.

It is probable, he thinks, that Smith's Sound must be regarded as the best of the three gateways to the pole. A channel, of almost 300 nautical miles in length and in some places scarcely twenty-five miles in width, separates Greenland from Grinnell Land and the archipelago south of it. This separation, as the nature of the land between 81° and 82° latitude demonstrates, took place in a south-north direction. The speaker then proceeded to explain various phenomena which tend to confirm this view, and pointed out the truth that the southern end of the strait is the older as is apparent from the fact that the southern portion of it is evidently broader than the northern; and also the fiords on the southwest coast of Greenland are by far more numerous and deeper than further north. According to the theory, a warm current must have moved along the east coast of America, and must have entered Baffin's Bay, having the full strength of an unweakened current in washing the end of that bay. Thereby considerable atmospheric precipitation as rain was occasioned, accelerating the growth of the glaciers, which moved on toward the valleys, and then formed spurs. The fiords we must consider as the former beds of these spurs.

What was the agency which caused the separation, we can only surmise. There are two probabilities: either the channel is a fissure which gradually widened because of the influence of the current, or it has been eroded by the action of a glacier, the south end of which gradually melted down. The latter hypothesis seems the more probable of the two, and we may regard the channel itself as formerly an immense fiord. But we know that the soundings of fiords are usually shallower at the mouth than at the head, while with Davis's Strait and its continuation exactly the reverse is true: the greatest depths are found at its entrance.

In reality, nothing else could be expected. We know that the bottom of the North Atlantic is slowly but continually sinking, and has been ever since the miocene period. Among other evidences is the fact that the Bermudas rest on a coral foundation. This motion reaches far north and includes a part of Greenland.

Professor Wm. Ferrel of the United States Coast Survey spoke upon

THE TIDES OF TAHITI,

the peculiarity of which is that the solar tide is for the most part greater than the lunar tide, although the force producing the latter is more than double that producing the former. There is only one other case of the sort in the world—at Courtown, Ireland. It is not, however, due to any exception in the general theory of the tides. Certain constants in the tidal expressions, which have to be determined by observations, are unusually large in this case. It is yet impossible to specify, however, what are the irregularities of ocean bottom and of coast outline which occasion the phenomena in this particular instance.

In a paper on

METAMERISM IN ORGANIC CHEMISTRY,

Professor Wolcott Gibbs, of Harvard, presented a novel and valuable discovery regarding metamerism, which has never before been observed in organic substances. Bodies are said to be metameric when they are of the same composition and atomic weight, but differ entirely in their properties in consequence of different molecular constitution. Professor Gibbs has discovered six such bodies, bearing such a relation to one another and to a seventh. The substance with which the series begins was discovered by Dr. Eidmann and is an exceedingly stable compound denoted by the formula: $CO_2(NH_3)_6, (NO_2)_6$, or two equivalents of cobalt, six of ammonia, and six of nitric oxide. In the following formula, the ammonia is represented by A and the nitric oxide by X, for the sake of abridgement:

First series—Eidmann's discovery:

$$\ldots\ldots\ldots\ldots Co_2A_6X_6$$

Second series—Dr. Gibbs' discovery:

$$\overset{II}{(Co_2A_4X_8)}\quad \overset{II}{(Co_2A_8X_4)} = 2.\ Co_2A_6X_6$$

$$\overset{II}{(Co_2A_4X_8)}\ 2\ \overset{IV}{(Co_2A_{10}X_2)} = 3.\ Co_2A_6X_6$$

$$\overset{II}{(Co_2A_4X_8)}\ 3\ \overset{IV}{(Co_2A_{12})} = 4.\ Co_2A_6X_6$$

Third series—Dr. Gibbs' discovery:

$$\overset{VI}{(Co_2X_{12})}\quad \overset{VI}{(Co_2A_{12})} = 2.\ Co_2A_6X_6$$

$$\overset{VI}{(Co_2X_{12})}\quad (Co_2A_8X_4)_3 = 4.\ Co_2A_6X_6$$

$$(Co_2X_{12})\ 2\ (Co_2A_{10}X_2)_3 = 5.\ Co_2A_6X_6$$

As each of the salts thus obtained is beautifully crystaline and perfectly well defined, and each salt of the second and third groups gives the reactions of each constituent with perfect distinctness, no doubt can exist as to their real chemical structure.

Professor Alexander, of Princeton, gave some brief remarks on the

COMPARATIVE VELOCITY OF LIGHT IN AIR AND IN VACUO,

relating to a small correction of the velocity of light as deduced from experiment. This, according to the undulatory theory, must be less in atmospheric air than in vacuo, in the inverse ratio of the index of refraction of atmospheric air to 1, that is, as 1 to 1·000294. The velocity then, as ascertained by experiment, under the air should be increased by just about 0·000294 of itself to be equal to that in vacuo; that is, to the extent, almost exactly of 55 miles per second, a very small quantity indeed in comparison with the whole velocity of 185,000 miles per second; and yet, small as it is—and so small as to be below the limits of error of the experiments in question,—it is yet very closely equal to three times the velocity of the earth in its orbit.

Professor Hayden presented a general account of scientific explorations in the west and gave a brief summary of the forthcoming seventh annual report of the expedition under his charge. Professor Silliman described the

TELLURIC ORES OF COLORADO.

The mineral is found on the side of a dyke some fifty feet in thickness, and was introduced by a plutonic invasion of this formation. The speaker had found that, in many instances, telluric ores were associated with gold, and the association was very unfortunate for the gold miner, as in one instance $3,000 worth of gold thus associated was thrown away (through ignorance), while the yield of the rest of the ore was only $40 or $50 to the tun. Professor Silliman asked Professor Endlich to perform an experiment, showing the presence of tellurium by using concentrated sulphuric acid. A bright purple color was rapidly obtained when the ore was thus treated with heat in a test tube. In one specimen of these telluric ores, there was $55,000 extracted from a tun.

With reference to

THE LAWS OF CYCLONES,

Professor Ferrel reviewed the theories of Espy and of Redfield, Reid and others, and re-enunciated his own views published several years since.

Concerning

THE GREAT TELESCOPE AT WASHINGTON,

Professor Newcomb gave some interesting facts. The question is frequently asked, how does the new instrument compare with other telescopes? This is difficult to answer, since there are no refracting telescopes in this country of comparable dimensions. The question as to the comparative efficiency of refracting and reflecting telescopes is frequently raised. It must be admitted that great reflecting telescopes give very variable results and are very apt to prove unsatisfactory. As an instance of this, if we examine the record of Herschel's work, we find that nearly the whole of it was done with his two foot reflector; we shall almost arrive at the conclusion that all the work accomplished with the four foot reflector might have been done with the smaller instrument. The same comparison of results leads us to a similar conclusion with regard to the four foot reflector of Lassell—probably the largest ever constructed. He had under the clear skies of Malta made many important observations; but when he took his four foot reflector there, hoping with it to verify his discoveries, it does not distinctly appear that he succeeded. Struve, after looking through the four foot telescope, wrote that it was not in any remarkable degree more powerful than his 15 inch instrument at Poltava. The only exception to this generalization is the fact that the four foot instrument of Lassell did really discover the two inner satellites of Uranus. Professor Newcomb having rediscovered these with the new instrument, and thus verified Lassell's discovery, thinks that they could never be seen with a 15 inch refractor. In the new telescope the outer satellites of Uranus look as if of about the size that *Ursa Minoris* appears to the naked eye. The smaller satellites, strange to say, have been best seen when the moon was shining, and its light was plainly apparent in the telescope; the first of these appears about half as bright, and the second about one third as bright, as Titania.

Our friends have asked whether there is difficulty in the Washington telescope on account of spherical aberration. This proves to be a very small factor; its total amount is less than that produced in the lens by ordinary atmospheric variations of temperature—an effect which is noticed when work is first begun with the instrument of an evening, but which rapidly wears away as the glass acquires the uniform temperature of the rest of the instrument. It seems to be only the rays near the edge of the glass which are thus affected. Professor Newcomb has looked through many other refracting telescopes, by way of comparison, and after full consideration believes the new instrument to be a great success.

PLANETARY SATELLITES,

Professor Alexander said, are claimed to resemble our moon in the coincidence of their times of rotation and revolution; and that in consequence every satellite presents always nearly the same side to its primary. One occasion for this belief is found on observing the special vicissitudes which the light of the satellites exhibits, each specified change recurring when they have again arrived at the same position in their orbits around their respective primaries. Another evidence is found in the remarkable phenomena of their apparent loss of light on certain occasions.

The loss of atmosphere is one of the supposable consequences of those stringent conditions, as indeed M. Laplace has intimated, when, after stating the distance at which the attractive force of the earth is in equilibrium with that of the moon, he adds: "If at this distance the primitive atmosphere of the moon had not been deprived of all elasticity, it would be carried to the earth, which would thus draw to itself. This is perhaps the reason why the moon's atmosphere is nearly insensible." We may fairly inquire whether this has not been the case with all the satellites, and their common experience.

Professor Loomis, in a paper on the

LAWS OF STORMS,

explained the process by which he computed the relative velocities of the winds, etc., at high altitudes, such as that of the signal service stations at Mount Washington, coming to the conclusion that, at the hight of 6,000 feet in the western quadrant of a storm, the velocity of the wind is more than double that of the storm. By another series of computations he obtained the forms of the isobaric curves in at least 200 cases. In 55 per cent of the whole number of cases, the major axis of the isobar exceeded its minor axis by half its length; in 30 per cent the major was double the minor; in 3 per cent the major axis was at least four times the minor. The storms of the United States are mostly of an oval form, with the longer axis most frequently in a direction about N. 40 E. About three quarters of the great storms originate in the extreme west. In a case of which the details were particularly reviewed, it seemed probable that the first development of magnitude in a storm began with the collision of moist air from the Pacific Ocean against the peaks of mountains in Oregon, resulting in heavy rainfall. But the most remarkable fact elicited was that the storm, once originated and organized, traveled over the highest mountain ranges without indicating sensible obstruction, proceeding eastward across the whole continent of North America.

An exceedingly interesting and valuable paper on the mode of formation of the earth, its condition as to interior fluidity, and the probable limits within which it was reduced from a fluid state to its present condition, under the title of "A Criticism on the Contractional Hypothesis of the Earth's Surface Changes," was read by Captain Clarence Dutton of the Ordnance Corps, U. S. A. Mr. James D. Warner of Brooklyn read a technical paper on a new set of Bernouilli's numbers, which are a mathematical invention for shortening certain processes by their application to the coefficients of development of expanding series.

At the conclusion of this paper, Professor Henry simply remarked "The Academy is now adjourned," and thus the session ended without the passing of resolutions or any other of the usual formalities.

Correspondence.

Freight Cars.

To the Editor of the Scientific American:

I notice, in your issue of April 11, an article headed "A Chance for Inventors," which article attracted my attention. Bearing as it does upon a matter of great importance, it ought to be called to the attention of car builders generally; and while I am compelled to differ with the author very widely in many respects, I fully concur in the belief that there is a need of improvement in this direction.

But where is the inventor who is able to overcome the the numberless difficulties that stare him straight in the face at every turn? We wait for him to appear. The author of the article referred to seems to exhibit a wonderful lack of knowledge in regard to the difficulties which must be met, when he supposes that the strength for carrying of a country wagon is to be placed in comparison with the strength for carrying of a freight car, and that its paying weight should be, in proportion, equal to the former.

For the past seventeen years, I have been a practical car builder, and have tried a great many experiments in building very light cars, both for passengers and freight, and every experiment has proved a failure. Some fifteen years ago, box freight cars weighed only from 15,000 to 16,000 lbs. and would carry 10 tuns. These cars proved to be sufficiently strong and durable at that time, when the railroads were doing only a local business, running short trains and resting them at almost every station (a car requires rest as well as a man, if it is to last long). Then every railroad had its cars under the master car builder's care, who watched over them as carefully as over his children; and if they did not return when they ought, they were looked after in the same way. Our repairs were then very light. But since that time, the world has not only been revolving, but moving in other directions; and today freight cars, formerly simply local carriers, are interchanged by nearly every railroad in the United States, and are drawn (in tremendous trains) thousands of miles, with but short stops and no rest from their loads.

It has been said that the steam engine is subject to fits and starts, and, when attached to one of these long trains, must of necessity test the strength of the most workmanlike and thoroughly built car to its utmost capacity, which would not be the case if only a few cars were taken. Couple even twelve or fourteen country wagons together, and I doubt very much if they will carry the load referred to (3,000 lbs. to a wagon) for very long, successfully.

Box freight cars have and can now be built to weigh not over 12,000 lbs., and I will guarantee to build them, not to exceed that weight, so that they will carry successfully 10 tuns to the car. But they must be taken in very short trains, as they would be likely to receive injury by sudden starts and stops if taken in long trains. Consequently, as the rule and not the exception is long trains, we are placed under the necessity of building our freight cars about three times as strong as they were built fifteen years ago; but the weight has not increased in that proportion, being only one or two thousand lbs. more: we therefore have reason to be thankful for this improvement already made.

Freight cars are subjected to very rough usage; for example, an engineer couples his engine to a train of forty cars, and undertakes to start gently; he finds that this makes no impression on his train; he therefore backs up with as much force as possible, and then, putting all the force of the powerful machinery to work, starts up again, and perhaps may repeat this several times before succeeding. In view of these severe tests that our freight cars are called upon to encounter, I think every engineer will say that the fault is not in their strength, but rather in their weakness. Wood or iron of a certain dimension has a capacity of overcoming a certain resistance; and when it is forced beyond its capacity, it breaks. Now the question is: In what form will a certain dimension of wood or iron resist the greatest force? This can only be settled by constant experiment.

How long would a train of country wagons stand the pressure above named? I am very anxious to learn how to build a lighter car than I am now building, to give me the same strength or power of resistance; and have therefore written this for the purpose of drawing out information.

Our box freight car bodies weigh 9,785 lbs., truck with brake, 4,445 lbs., truck without brake, 4,140 lbs., total weight of box freight car, 18,370 lbs. Our passenger car bodies weigh 27,330 lbs., trucks weigh 13,200 lbs., total weight of car, 40,530 lbs. The car will seat 72 passengers with a saloon and 76 without a saloon.

NEW ENGLAND.

Patent Affairs at Washington.

To the Editor of the Scientific American:

The past winter has probably been one of the busiest ever known in the Patent Office, and the work is still increasing, as will be seen by the fact that the number of fees of all kinds paid in during the first three months of this year is 19,528, being an increase of five hundred and twenty over the corresponding period of last year.

With this increase of business and the constant accumulation of material, such as files, drawings, models, etc., there is a great necessity for more space, especially in the model halls. The cabinets for exhibiting the models being full and running over, most of them having their tops covered, in some cases the models are piled, one on another, until the lower ones are broken with the superincumbent weight. Unless something is done soon, the models will be in such a terrible confusion that it will be almost impossible to examine them. The machinist is doing his best to make room by putting the models closer together, but this is a mere temporary expedient, and gives but little space. If the galleries in the South Hall were completed, a large number of cabinets could be added, but these, it is stated, cannot be built for want of money, although enough has probably been wasted in building a private conservatory over the roof of the West Hall to complete the galleries and have money to spare.

From the number of applications before Congress, it would appear that the lobbyists are endeavoring to run another Patent Office in the Capitol, as the following list of cases now before the Committee on Patents will show:

THE CONGRESSIONAL PATENT OFFICE.—LIST OF APPLICATIONS FOR EXTENSIONS OF PATENTS NOW BEFORE CONGRESS.

A. B. Wilson, Sewing Machines.
McClintock Young, Harvester.
J. Fritz, Rolling Iron.
J. Hazeltine, Water Wheel.
L. Ketchum, Harvester.
J. Nock, Inkstands.
T. W. Mitchell, Finishing Brush Handles.
C. W. Williams, Canal Locks.
J. Wyman, Setting Blind Staples.
Vinton & John, Furnaces.
Moses Marshall, Knitting Machine.
J. Lilley, Surveying Instrument.
A. Dillman, Corn Shellers.
Rollin White, Fire Arms.
Akin & Felthausen, Sewing Machines.
Rudolph Eickemeyer, " "
Reynolds, Power Loom.
A. J. Hathaway, Converting Motion.
L. C. Chase, Buckles.
J. Haines, Harvester.
H. L. Cake, Coal Screens.
Ward, Bullet Machine.
" Molding Shell.
W. W. Burrell, Corn Sheller.
H. G. Bulkley, Kilns.
A. Attwood, Car Wheel.
T. R. Crosby, Wiring Blind Rods.
A. G. Batchelder and others, Car Brake.
J. Young, Washing and Wringing Machine.
J. A. Pickering, Boot Straps.
J. H. Butterworth, Bank Locks.
J. C. Cook, Webbing.
R. A. Marcher, Enameling Moldings.
Eliza Wells, Forming Hat Bodies.
A. S. Macomber, Straw Cutter.
S. Wettered, Carding Machines.
J. W. Marsh, Sewing Machine Attachment.
W. Wickersham, Sewing Machine.
A. J. Vandergrift, Grain Separator.

In addition to these cases, I find the following names of parties who have applications filed, but the records do not show the inventions protected by their patents: S. H. Hodges, Henry Lill, N. Whitehall, Alpha Richardson's widow and heirs, T. & L. Winans, J. Kirby, E. P. Torrey, J. G. Perry, and G. Wellman.

One of the most conspicuous of these jobs is the case of the Wilson sewing machine, which is up before Congress for the third time. This patent covers up every "roughened surface," "four motion" or "wheel feed," and the sewing machine rings have controlled it now for twenty-one years, thereby shutting off all competition, which has enabled them to wring millions yearly from the people; "and yet they are not happy," but want this pretty little privilege for seven years longer. It is rumored among the knowing ones that the promoters of this extension expect to dispense something nice among those who are disposed to help them, and that $50,000 has already been sent down here as an earnest of the good things to come. The plan proposed at present, as near as I can learn, is to get Congress to pass an act directing the Commissioner to examine and decide the case in the same manner as a first extension, and then bring their whole force to bear upon him to decide favorably. At the two previous attempts, the application has been kicked out, the Congressmen being afraid to face their constituents with the additional discredit such a palpable job would give them—the Credit Mobilier and "back pay grab" being as much as they could hope to carry comfortably—but, by turning the matter over to the Commissioner, they hope to be able to oblige their good friends of the sewing machine ring, and yet throw the blame on the former should their constituents make trouble about it. The ring hope to succeed with the Commissioner by means of a pretended sale of the first extension for $50,000, so as to make out that this was all the benefit that Wilson received from it, and that he should therefore have another term of seven years as a compensation for being such a fool as to sell a patent worth millions for such a paltry sum. By means of this sale, and by tales of the hardships, sickness, and other troubles which Wilson encountered in his early days, they hope to work on the benevolent heart of the Commissioner and induce him to grant another extension. There are some persons who even go so far as to say that the same *weighty reasons* are to be employed with the Commissioner that are found so efficacious with the lobby, but, of course, people who know him will not believe a word of this; yet, in view of the rumor, it would give an ugly look to the matter to those unacquainted with him, should this extension pass.

In addition to this there is the Akin & Felthausen case, which, if extended, will also cover up the sewing machine business completely; but these parties, although formerly connected with the combination, appear to be—and I believe they are—working against them. They want Congress to extend their patent so that every one shall have the right to manufacture by paying them a small royalty. Such an extension, however, would have to be very carefully worded, or otherwise it would fall into the hands of the ring who bought of them the last extension, the assignment being so worded as to carry with it any future extension.

Besides these extension bills and the bills reorganizing the Patent Office, several bills have been introduced into Congress, affecting inventors and patentees. One of these authorizes the payment of $100,000 yearly for ten years as premiums for meritorious inventions, in the sums of from one to ten thousand dollars. Another bill proposes the extension of any patent for seven years on the payment of $100 by the inventor. Both of these, I believe, have been reported unfavorably. A third bill provides, first, that there shall be no more extensions; and, secondly, that any person or corporation shall have the privilege of manufacturing patented articles by paying a certain percentage (not yet fixed) on the selling price.

OCCASIONAL.

WASHINGTON, April 30, 1874.

Steam on the Canals.

To the Editor of the Scientific American:

If a man, using a lever, were to place his fulcrum on water when he had a chance to place it on dry land, he would not be considered fit for a juryman. But this is what inventors are doing in the Erie canal problem. If they would take one of the engines out of a boat which they are trying to run with a 200 tun cargo at three miles an hour, and put it on the tow path, it would take eighteen boats of 230 tuns each (4,140 tuns) two miles in an hour loaded, and go back light at four miles an hour, averaging on the round trip three miles.

Trains of boats could be drawn in this way, of such a length and so frequently that the capacity of the canal would be equal to the number of boats that could be got through the locks. A train every six hours would do a business of nearly 4,000,000 tuns in the season, at a cost of about one dollar per tun, including river and harbor expenses.

Highland, Iowa. WILLIAM SLOAN.

The Mercurial Telescope.

To the Editor of the Scientific American:

On page 20 of the present volume of the SCIENTIFIC AMERICAN may be found a communication on this subject from Mr. John Linton, of Baltimore. In reply let me state that if, on account of the instability of the mercury at the center of the revolving vessel, it is desired to dispense with a portion of the center, the loss will be only in point of illumination; in fact, if the mirror is large, there will be enough reflecting surface remaining. A diameter of three feet in the center of a ten foot mirror might be dispensed with, and at the same time the efficiency of the mirror would not be impaired; for we should lose only one eleventh of the entire reflecting surface.

One plane mirror would suffice for keeping the beam of light, from objects out of the zenith, always vertical upon the mercurial surface. Its width must be equal to the diameter of the mercurial mirror; and its length must be greater as the altitude of the object is greater.

By actual calculation, it is found that, when the latitude of the object is 30°, the plane mirror must be 19·99 feet long, in order to reflect vertically a beam of rays ten feet in diameter. If the object is 60° above the horizon, the length of the mirror must be 38·64 feet. Of course it is impracticable at present to construct an accurately plane mirror of these dimensions; consequently the great mercurial concave can be used only for the examination of objects when in the exact zenith. Nevertheless, its use would secure important results. At many available latitudes in the United States there are interesting celestial objects which culminate in the zenith; and even during the short time of their passing the field of view, the distinguishing features of each object might be noted. That an object may pass through the zenith of any place, its declination—which may be found in the star catalogues—must be equal to the latitude of the place.

The concentration of light, also, would greatly facilitate an examination, by the comparison method, of the spectra of celestial objects whose illumination is feeble. These few facts are presented with the hope that Mr. Linton may continue the experiments he appears to have begun. Let him communicate to the SCIENTIFIC AMERICAN at some future time a few details of his method, whether the results attained were successful or otherwise.

Amherst College, Mass. D.

The Reclamation of the Colorado Desert.

To the Editor of the Scientific American:

The possibility of the project of reclaiming the Colorado desert by turning the Gulf of California, or the river, into it, will be more readily understood when it is known that the whole desert is interlaced with high mountain ranges, leaving the valleys between them generally at considerable elevations above the level of the sea. The most traveled route from San Bernardino to Fort Mojave, nearly along the 35th parallel, shows this. After crossing the sierra at an elevation of about 5,200 feet, we steadily descend to and along the Mojave river, to about 1,100 feet above the level of the sea; we then rise until, at Marl Spring, it is above 4,000 feet; and it remains at or above 4,000 feet for fully 40 miles, when, after crossing Piute creek and the Mount Newberry range, it descends rather rapidly to the Colorado river, at about 500 feet elevation. Except part of the Armagozza region and Death Valley, north of said route (said to be the only spot in the United States actually below the level of the sea—by about 120 feet), the whole vast extent hardly shows a depression below 2,000 feet. The lofty unbroken Wahsatch mountain range seems to prohibit, pretty effectually, any attempt to turn the waters of the Colorado from above the Big Cañon of the Colorado into the desert.

A government grant, ostensibly for that purpose, will no doubt benefit some interested parties speculating upon the monopoly of the mines embraced in the region in question; but it is more than questionable whether the alleged object will be accomplished. R. D'H.

Fayetteville, N. C.

The Relative Attraction of the Earth and Sun.

To the Editor of the Scientific American:

In your issue bearing date March 14, I find an article from the pen of Mr. Ericsson, in which the subject of the relative attractions of the earth and the sun is presented in a most happy and satisfactory manner. Mr. Ericsson is right. The centrifugal force, as a factor in the calculation, was overlooked by me. I acknowledge my obligations to him for the correction. W. B. SLAUGHTER.

Brownville, Neb.

Transparent Paraffin.

The paraffin of commerce is a colorless, translucent substance, perfectly inodorous and tasteless. It floats on water, and has a density of about 0·870, and melts at about 113° to 149° Fah., forming a colorless oil which, on cooling, again solidifies into a crystaline mass. It boils at about 698°, and volatilizes without decomposition. Paraffin does not absorb oxygen from the air, and is only slowly attacked by sulphuric acid, even at the boiling point of water. It is not at all attacked by dilute nitric acid, and only by the strong acid after prolonged boiling. In fact, chlorine or any part of our most energetic chemicals but slowly acts upon this curious substance, which may be considered to be as neutral to the general run of chemicals as our glass vessels. Lately it has been discovered that if paraffin be heated for some considerable time in a tube sealed up, the result is a more fusible paraffin, exactly similar in its apparent chemical composition, but much more soft and fusible—that, in fact, if the heat be continued for a considerable time, the paraffin being still under pressure, we obtain ultimately a perfectly transparent liquid paraffin.

Ascent of Sap in the Bark of Trees.

M. Faivre has recently performed a series of experiments on the mulberry, hazel nut, and cherry laurel, which he considers goes far to prove the fact that the substances which supply the food of plants have an ascending motion in the bark. For this purpose, he made perfect or imperfect annular incisions through the bark, or detached pieces of the bark, to which buds were attached, or removed entire cylinders of bark from the trunk. The result of the experiments was that the buds always continued to develop when the communication remained uninterrupted with the lower portion of the trunk; while when this communication was completely destroyed, the buds invariably withered away. If the bud was separated by a perfect annular incision, it withered the more slowly the greater its distance from the incision; and in these cases the starch disappeared entirely from the portions of the wood above the incision between it and the bud. When entire cylinders of bark with buds on them were removed, the buds continued to develop, and even produced branches bearing leaves.

A CHECK for $60,000 was recently handed the inventor of metallic tips for childrens' shoes, in payment of his share in a release of the patent, which he had originally sold for $100. And now, with such encouragement as this, suggests the *Commercial Advertiser*, why can't he win the everlasting gratitude of mothers by inventing some kind of brass knee plates for little boys' trousers?

THE NIAGARA DIRECT AND DOUBLE ACTING PUMP.

"Machinery so simple in its details of construction, that in new mining and oil regions, where mechanic shops are not yet opened, any man of ordinary intelligence may be able to put it together and take it apart as occasion may require." Such is the aim of the manufacturer in devising the various varieties of steam pump, many of which are doubtless already familiar to our readers under the name of Niagara, and as the work of Mr. Charles B. Hardick, of No. 23 Adams street, Brooklyn, N. Y.

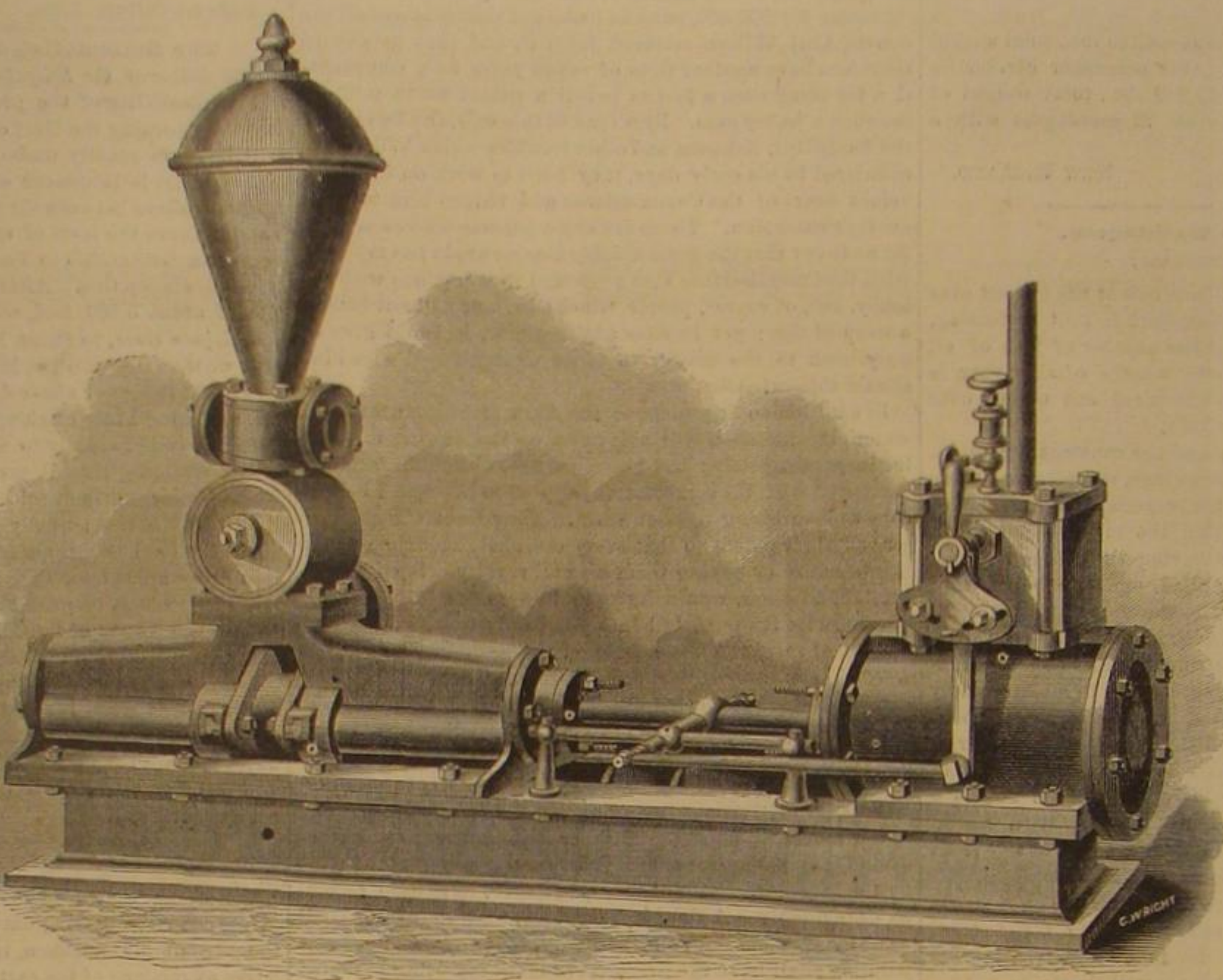
In the annexed engraving will be found a representation of an improved form of one of these machines, known as direct and double acting, for which is claimed many advantages which will doubtless commend it to those engaged in the multitude of industries to which the steam pump is an indispensable adjunct.

So far as is consistent with durability, we are told, the pump is cast in separate parts, so that, in case of accident or breakage, the portion immediately affected need only be replaced, the cylinders being separate from bed plate, water valve chest, discharge, and air chamber. This independence of parts is claimed to be an important item of economy in severe climates where, by the action of frost, all metal vessels are liable to fracture. The arrangement of patented water valves is such that, in case of obstructions entering the valve chamber through the suction pipe, they may be taken out, cleaned, and repaired in very short time, access being had to them through the bonnet on the valve chest. It is only necessary to remove one nut, as the valves are simply four square pieces of metal kept in place by the bonnet. As the valves on each face present an accurately fitting surface in the seat in the chest, each of the four faces may be used; and when, in the course of years, these become worn away, hard blocks of wood, of like form, it is stated, may be employed with equal facility and reliability. The valves are made of composition, or may be faced with leather or vulcanized rubber.

In the type of pump illustrated, there are no piston rings or interior packing, hence no necessity of removal of the cylinder heads. One plunger operates both cylinders, to pack which it is only necessary to unscrew the nuts shown at the center of the water cylinder, slip the caps of the stuffing box back, insert the packing, replace the caps, and the work is done.

There is a patent steam valve which insures the starting of the pump, whenever steam is let on, without reference to the point of stroke at which the piston may be, and hence it is impossible to set the machine on the center. It can, we are informed, be run at any rate of speed, and is thus particularly useful in boiler feeding, giving a certain and steady supply of water.

For mines and quarries, the manufacturer claims the pump to have proved itself especially adapted. Should it become submerged in the mine, it will start upon turning on steam from the boiler at the top of the shaft, and work notwithstanding the condensation of steam incident to its being carried over so long a distance. It has worked, we are informed, in the mines of Pennsylvania, Colorado, etc., under from 15 to 40 feet of water. Finally it is well suited to the pumping of gritty or muddy water, and is claimed to serve thoroughly all the purposes to which steam pumps are now applied. For further information, address as above.



THE NIAGARA DIRECT AND DOUBLE ACTING PUMP.

IMPROVED AUTOMATIC PACKING AND WEIGHING MACHINE.

The invention herewith illustrated is a machine adapted for use by spice manufacturers, in chemical works, tobacco factories, and in other establishments where powdered or granulated material is packed in paper, tin, or bottles. The apparatus is constructed *entirely of iron*, is simple, and does not require skilled labor to attend it.

It is claimed to insure uniformity of weights, with entire freedom from dust, and does not require the packages to be cleansed. The capacity of the machine is only limited by the number of tubes used and the speed with which it is run. Its working parts will be understood from the following description:

Through the *hopper*, A, run two horizontal screws, B, B, the threaded portions of which project through the left side, and their shanks through the right side of the hopper. On the screws are placed tin *forms*, C, C, corresponding to the inside of package to be filled. D D is a driving shaft which imparts motion to screw shafts B. B, by gear wheels, E. On each screw shaft is placed a pair of cone friction pulleys, F, F, one of which is rigidly fixed; the other slides along the shaft on a key or feather. These pulleys are kept in contact by a lever, H, which extends through the table and has weights applied to it as shown. Connected with the lever, H, is the rod, J, running longitudinally under the table. On the other end of this rod is an adjustable nut, K. L L is a right angled graduating lever, with fulcrum at M; one *leg* of this lever, extending upwards through the table, presses against the follower blocks, T, T. On the other leg slide compensating weights, P P, kept in position by set screws. The drawer, S, sliding under the table, catches any material that may drop from the tubes.

In operation, the attendant places an empty package on form, C. The follower blocks, T, are moved up against the bottom of the package, which brings the frictional pulleys, F, in contact, thus starting the screws, B, which force the material into the package on the form, C, causing the follower block T, and lever, L, to recede. The latter is brought in contact with the adjustable nut, K, carrying the same with it, separating the friction cone pulleys, F, and stopping the screws, B, instantly. In packing bottles, tin cans, etc., form, C, is removed and the package placed on the tubes surrounding the screws.

Patented September 9, 1873. For further particulars address Stewart, Marks, Ralph, & Co., 115 Arch Street, Philadelphia, Pa., where the machine may be seen in operation.

AUTOMATIC PACKING AND WEIGHING MACHINE.

New Industries in Illinois.

A correspondent of *Inter Ocean* gives some interesting information regarding the pioneers of Western industries, notably in the city of Rockford, Ill. A new watch factory is soon to be erected, the entire capital stock of which, some $150,000, has been taken up by the citizens, and several establishments for the manufacture of farm implements are in successful operation. Emerson & Co., the largest house in this business, shipped, in 1873, nearly 200 car loads of agricultural goods, and employ some 150 workmen.

Thomas W. Bakewell.

We regret to learn of the death of Mr. Thomas W. Bakewell, an inventor and manufacturer quite widely known and a frequent correspondent of these columns. Mr. Bakewell was of English birth, but emigrating to this country at an early age, he took up his residence in Cincinnati, Ohio. At this period steamboats were just appearing upon our Western rivers, and it was a problem to inventors to construct them to suit the requirements of shallow water and other local peculiarities, as well as to meet the demands of the large cargoes which they were required to transport. Entering with vigor into the solution of the question, Mr. Bakewell devised vessels on improved plans, which, proving successful, ultimately necessitated the erection of shops and shipyards. The increasing business soon called into existence extended facilities, and eventually added very materially to the prosperity of the city.

Mr. Bakewell did not confine his efforts, however, solely to boat building, but also erected a large manufactory, containing machinery of his own invention for spinning and weaving Kentucky hemp for making cotton bagging. The works were established in Covington, Ky., and proved highly profitable.

The subject of our sketch was well known as a finished scholar, and an able theoretical and practical mechanic. Many very excellent papers, with reference to the use of steam and on kindred mechanical topics, have been contributed by him to our columns. He died at Pittsburgh, Pa., at the advanced age of eighty-nine years

Improvement in Treating Photo-Negatives.

When, by means of a camel hair brush or otherwise, iodine is applied to the image, the atoms of metallic silver which formed the picture are acted upon by the iodine, and are converted into iodide of silver. Now, as metallic silver is not soluble in a weak solution of cyanide of potassium, but as iodide of silver is soluble, it follows that the application of this menstruum will instantly convert into clear glass every portion of a negative that has been touched by the tincture of iodine. Its use, then, will be obvious. Everything in a negative not desirable to be retained can be completely removed—a tree, a house, a background, a restless baby, or any other objectionable member of a group.

Iodine dissolves freely in alcohol, ether, chloroform, sulphide of carbon, petroleum, and in solutions of the iodides. It is the latter of these that we recommend as a solvent when the solution is to be employed in acting upon a negative. Drop a crystal of iodine into a little water, and no visible change takes place, the water remaining clear as before; but on adding a crystal of iodide of potassium, it will be found that, as soon as the latter has reached the bottom of the vessel, the iodine immediately becomes affected and dissolves readily, and the solution becomes of an intensely deep red color.

We find that if the iodine solution be thickened by the addition of a small quantity of mucilage of gum arabic, say a little more in proportion than is contained in common writing ink, all tendency to spread is destroyed. The solution may be applied by means of a delicate hair pencil, and in the most minute specks, lines, or stipples; and, after the clearing up application of the cyanide, these specks and touches will be found to be clear and sharply defined, showing that no extension has taken place.—*British Journal of Photography.*

C. B. L. send us the following recipe for a cement for mending steam boilers: Mix 2 parts of finely powdered litharge with 1 part of very fine sand, and one part of quicklime which has been allowed to slack spontaneously by exposure to the air. This mixture may be kept for any length of time without injuring. In using it, a portion is mixed into paste with linseed oil, or, still better, boiled linseed oil. In this state it must be quickly applied, as it soon becomes hard.

MODERN EGYPTIAN GARDENS.

Only those who have visited Egypt during the winter months can form any idea of the calm repose that almost invariably pervades that wonderful country at that period of the year. The clear blue sky and quiescent atmosphere cause such a dreaminess to overspread, as it were, the whole country, that, except near the cities, one may easily imagine one's self in a land of spectre palaces, villas, and mosques. The graceful heads of the date palm, poised calm and motionless in the air, relieve the towers of the country mansions of much of their monotony. It is winter, yet the orange trees are laden with golden fruit, t e jessamine, rose, and geranium are still in bloom. Theh leaves of the vine and other deciduous trees have just begun to turn red and brown, and to prepare to fall.

Our illustration, for which we are indebted to *The Garden*, is a good representation of a modern Egyptian villa and garden of the Mameluke period. Ths square basin and stately cypress, the vine-embowered path, producing shade and grapes in abundance, and the little summer house or kiosque in which the owner and his family enjoy the grateful weed and aromatic coffee, are faithful delineations of Egyptian garden life. During the past thirteen years, gardening has made rapid progress in Egypt, the frequent visits of the Pashas, princes, and Khedive to Europe having given the Egyptians of high rank quite a taste for European horticulture; and gardeners from England, France, and Italy have been employed in various localities, but more especially in the neighborhood of Cairo and Alexandria, to carry it out.

The Gezira garden is the best imitation of an English establishment in Egypt, and it has been created at an enormous expense. Embankments, artificial mounds, rock work, and water are all very naturally introduced; good breadths of lawn, dotted with trees, shrubs, and parterres of flowers, produce, in this land of sunshine, a more pleasing effect than in our own country, on account of the scarcity of grass in Egypt. To achieve this desideratum, large tanks or reservoirs have been constructed of sufficient hight to serve the fountains and to force water to every part of the garden, which, during summer, has to be kept in a state of perpetual irrigation. In the Gezira garden is a magnificent collection of tropical trees—palms of many kinds, ficus, cathartocarpus, musas, cycads, acacias and others too numerous to mention. Among the vast variety of climbing plants in this garden, the most notable is *bougainvillea spectabilis*, which grows with all the wild luxuriance of a wistara in our own country, and is annually covered with thousands of spikes of its lovely mauve colored bracts. In few countries is vegetation more rapid or luxuriant than in Egypt, if the irrigation is attended to; consequently it takes but a few years to have a perfect garden.

A MODERN EGYPTIAN VILLA AND GARDEN.

THE BOW AND STERN SCREW PROPELLER.

Mr. Robert Griffiths, of London, the well known screw propeller man, has lately made a discovery in the propulsion of vessels which, he thinks, is likely to effect a revolution in the economy of steam navigation. His plan is to inclose the propeller in tunnels, and to place one tunnel propeller in the bow and one in the stern. From practical trials made with small models, he concludes and asserts that he obtains an improvement equal to nearly 50 per cent in the speed of the vessel, without increasing the power. At a recent meeting of the Royal United Service Institution, Mr. Griffiths gave an interesting account of the progress of screw navigation, from which we select the following:

"It is generally admitted that barely 50 per cent of the power exerted by the engines is made available to propel the ship, by either screw, paddle wheels, or any other plan of propulsion which has yet been practically used, the other 50 per cent being lost in some way, to account for which there are a variety of opinions.

"I have for several years given up the idea that any further improvements were to be realized by any further change in the configuration of the screw propeller, and consequently turned my attention to the mode of applying it; my first patent in this direction, obtained in 1871, was for applying a screw at the bow of the ship within a tunnel in combination with the screw at the stern in the ordinary way; I afterwards fourd very great advantages in having both the bow and stern screws in tunnels, for which I obtained a patent in 1872. I was much surprised to find when I doubled the power by applying one portion to the bow screw and the other to the stern screw, each within a tunnel, the speed of the model increased nearly as the square root of the power, but if I doubled the power on either the bow or stern screws separately, the speed of the model in that case increased only as the cube root of the power. It is well known that the resistance to bodies propelled through the water varies as the square of the speed, while the power required is as the cube. At last it occurred to me that this great advantage must be due to the increased quantity of water that was passed through the screws within the tunnels, when both were at work, over what was due in the same time when only one screw propelled the model; for since one screw propelled the model from 58 feet to 60 feet in sixty seconds with 600 revolutions of the screw, and with the two screws of the same pitch together, from 96 to 100 feet in the same time and with the same number of revolutions, there must, therefore, be at least 50 per cent more water pass through the tunnels in the same time, and the thrust given to the screw shafts must be in proportion to the quantity of water acted upon by the screws.

"I had the mouth of the stern tunnel enlarged to the extent of 50 per cent, and this enlargement came below the keel. This it might be supposed would be an obstruction and cause a considerable loss of speed, but I was agreeably surprised to find when I tried it that I had a gain of 20 per cent in speed. I had found by my experiments that, as the supply of water to the screw is diminished, the power required to revolve it increases, and the speed of the ship diminishes.

"There are three important points to be considered in screw ships, namely, the propeller, the ship, and the engine. In the first there has been no improvements with regard to speed since 1840; secondly, with respect to the ships, the best types of ships were described by the old builders as having a cod's head and mackerel's tail, the length equal to three to four times her beam, and no better sea ships have been built than our sailing frigates of former days; but since the introduction of the screw the shipbuilder has been obliged to arrange his plans to suit the propeller, for experience has shown the deeper the immersion the more effective the propeller, and consequently steamships are now being made with an enormous draft of water in proportion to the beam. The eel might now be taken for the type of modern screw ships, which are made in length ten to fourteen times the beam; and had it not been for the introduction of iron for building ships, the screw would never have succeeded to the extent it has done. This great increase of length gives the shipbuilder no chance of improving the form of his ships, from a naval architectural point of view, which is not the case in my system, as whatever form or type the ship will be best for sailing will also be the best for the adoption of bow and stern screws.

"The great improvement in steamships during the last thirty years is to be found in the engines, from which about three times more indicated power is obtained now, with the same consumption of fuel than formerly, as well as other important improvements that have been made in this department.

"My attention was first drawn to the necessity of having bow and stern screws, on account of the danger attending the employment of ships of the enormous length in proportion to their beam; for every sailor must be well aware that, should an accident occur to the machinery in a heavy sea, or on a lee shore, there would be but a poor chance of saving the ship, especially if one of these long ships, with its machinery disabled, should get into a trough of the sea. I expected that the shipowners would have readily availed themselves of my arrangement on account of the safety it offered to the ship and passengers, and also that the Admiralty would have seen and promptly recognized the advantage and safety it would have been to the ships of war. Now that the high price of coal is being felt by the shipowners they may be induced to consider whether it will not be to their interest, as well as for the protection of their passengers, to adopt my system. In this paper I have confined myself to the advantages gained in speed or the saving of fuel by my system; but I will briefly name eight other important advantages in connection with it. (1) Thorough protection to the propellers. (2) Smaller screws and engines only are required. (3) No vibration whatever is produced by the propellers. (4) Ships so fitted can be stopped much sooner in case of danger. (5) There will be no loss of speed through racing of the engines. (6) Greater facility for steering and maneuvering. (7) Greater safety through dividing the power. (8) Ship can carry more canvas, and sail better. To sum up the result of my experiments, I find that to obtain the advantages of my system the propellers must be placed in tunnels, by means of which an extra supply of solid water will be kept up to the propeller, which cannot be effected in open water, and the extra supply of water can be obtained by using the bow and stern screws together, or by single screw ships, either at the bow or stern tunnels, by having the tunnel mouths enlarged or bell-mouthed. It may be thought there would be a loss of speed through the friction of the water passing through the tunnels when the ship is under canvas only, which, however, is not the case."

It is proper for us to add that Mr. Griffiths' conclusions appear to be based upon experiments with small models, which may have led to deceptive results as compared with trials upon ordinary vessels. The subject is one of interest and we shall notify any progress made by thorough and practical experiments.

Skin Grafting.

Dr. R. J. Levis, of the Pennsylvania Hospital, gives, in the *Medical Times*, an interesting article on this subject. The operation of skin grafting, he says, is now conclusively accepted as one of the resources of surgery.

The utility of the transplantation of minute pieces of skin, to granulating surfaces, has been demonstrated in a vast number of instances. It is admitted that, by creating centers of eccentric cicatrization on extensively ulcerated surfaces, the rapidity of the healing process can be much increased. Ulcers of a chronic character, which have obstinately resisted cicatrization in a concentric direction, can be healed by the ingrafting of new centers of germination in the midst of the areas of ulceration. Experience has also shown that the procedure is applicable to plastic surgery in facilitating the cicatrization of surfaces denuded by gaping in the division of cicatrices, and in the sliding of flaps of integument.

Besides the increase in the rapidity of healing, due to extending the lines of cicatrizing edges, a decided and important physiological influence is exerted by the presence of the grafts on ulcerated surfaces. The surface of an indolent ulcer seems to be stimulated to renewed vital action, and the increased healing impulse even influences to active germination the peripheral limits of an ulcer in which granulation has long entirely ceased.

The utility of skin grafting has, in my observation, been in no instances more demonstratively shown than in cases of extensive denudation caused by destruction of skin, as in burns, and loss of large areas of integument from traumatic injuries. In the case of a man whose back was extensively charred at a lime kiln, while lying under the toxic influence of its emanations, the sloughing integument having left an immense area of ulceration over his dorsal and lumbar regions, the successful ingrafting of numerous minute pieces of skin healed the vast ulcer with astonishing rapidity. In an instance of the entire loss of the skin of a leg, caused by deeply burning with coal oil, which had filled a shoe and saturated a stocking, the healing process was by the same procedure rendered as surprising and satisfactory.

It seems now probable that amputation, which, as a final resource, is by surgical authority justified in certain cases of extensive ulcers of the leg which all expedients have failed to heal, may be substituted by the simple device of skin grafting.

All of the conditions essential to successful skin grafting I have not, after extended observation, fully determined. The most favorable condition for the development of the grafts is certainly that of healthy, active granulation of an ulcer; and the more nearly this state is approached, the greater, as a rule, will be the success.

One of the beneficial claims for skin grafting is with reference to the avoidance of the eventual contraction which disfigures, deforms, and impairs motion after extensive loss of integument. Observation seems to show that where cutification is rapid from a number of skin forming centers, the resulting cicatrix is less violently contractile in its tendency.

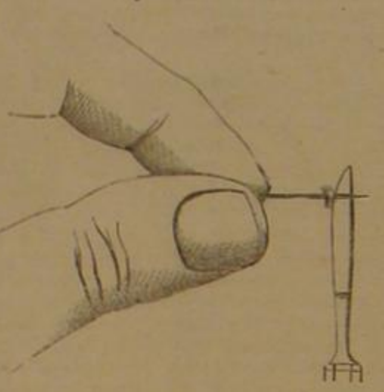
For successful skin grafting, it is simply essential that a minute portion of skin be removed from a sound part of the body of the patient, or from another individual, and placed on an ulcerated surface. It is customary to take the pieces to be transplanted from the patient's own skin; and I have generally chosen locations where the derma is thin, and not densely covered with cuticle, as on most of the front of the body, and, as a choice, from the inner surfaces of the arms and thighs. Grafts from the integuments of other individuals develop as readily, and I have frequently practiced removing them from limbs amputated for traumatic injuries, with apparently equal success. To avoid the possibility of conveying some form of specific infection by the process, it is certainly, as a rule, most advisable to transplant only from the patient's own skin.

A graft of skin should merely consist of the simple structures of cuticle and derma, and should avoid the underlying fatty and connective tissues. That even the whole thickness of the derma is not essential is demonstrated by the fact that successful grafting has been effected by using mere scrapings of the cuticle, in which are contained some cells of the superficial or papillary layer of the derma; but the practice is uncertain, and has not practical merit. The thickness of the true skin on the front of the body, it should be borne in mind, does not average more than from a quarter to half a line, and this depth should never be exceeded in the removing of grafts.

The operation of removing the portions of skin for grafting may be done by a knife or scissors, cutting off minute particles of the size to be used immediately in transplanting; or by taking a larger piece which is to be afterwards subdivided. I have adopted a method, first suggested to me by Dr. C. H. Thomas, of Philadelphia, which, for simplicity, convenience, painlessness, and effectiveness, may well displace all others.

It consists, as seen in the illustration, in merely penetrating the cuticle with a very delicate sewing needle, elevating a small point, and shaving off the minute elevation of cuticle and upper stratum of derma with a very sharp knife. The same may be accomplished, but hardly in so perfect and painless manner, by using fine scissors for the excision of the portion transfixed.

The operation, if properly performed, should be free from really painful sensation, and patients never object to its most frequent repetition. I have frequently done it without more than a tint of discoloration from blood, and blood need never actually flow from the very minute wound.

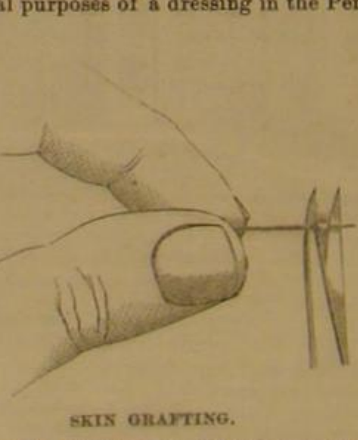


SKIN GRAFTING.

The graft is then immediately pushed from the point of the needle, and placed on the surface of the ulcer, the only care being to lay it with its epidermic surface upward. The graft need not be inserted into the granulating surface by making a wound for its reception, as has been advised and practiced, for such puncture allows a flow of blood that may elevate the graft from contact with the granulations.

As simple adhesion of the graft is all that is desirable, I have sometimes, with large and actively secreting surfaces, allowed them to be exposed to the desiccating influence of the atmosphere, so that the secretion may become viscid and hold the transplanted particles surely in position. To facilitate the same object of fixation after the grafts are deposited, I have occasionally allowed the ulcerated surface to remain uncovered until they became well agglutinated to it.

All active medication to the ulcer should be avoided, and the surface of ulceration be simply covered with a light pressing, for protection from disturbing influences. For this purpose the ulcer may be covered with a piece of muslin, saturated with oil or covered with cerate, or it may be merely protected with the waxed tissue paper, such as is extensively used for general purposes of a dressing in the Pennsylvania Hospital.



SKIN GRAFTING.

On most ulcers the dressing need not be removed for two or three days after the operation; but when secretion is profuse, the ulcer may be washed daily by allowing a stream of water to flow over it, carefully avoiding the wiping of the surface with sponges or cloths, which may disturb the grafts.

One of the earliest changes noticeable in the graft, after the first few days, is the detachment of its cuticle, which may occasionally be seen floating in the secretions of the ulcer, or it may be detached by a slight touch, leaving the true germinating material fixed in position. The graft, as it commences development as a germinal center, becomes so blended and identified with the granulations as to be for a time almost lost sight of, its re-appearance becoming evident in a bluish or lilac tinted pellicle, which indicates the progress of cutification.

In regard to the size of grafts for transplanting, I have, in several instances, grafted by removing, from recently amputated limbs, pieces of skin measuring one third or one fourth of an inch square; but such large pieces are very likely to fail in retaining their vitality, and I have had much more satisfactory success with quite small grafts; and for reasons already stated, this latter practice is certainly the best.

The number and position of the grafts will vary in accordance with the size of the ulcerated surface; and in large ulcers they may be distributed at short intervals, both centrally and near the periphery. Those near the circumference will stretch their granulations outward and stimulate the borders of the ulcer to activity; and with regard to the advantage of centrally located grafts, it will be well to remember their importance with reference to the difficulty often experienced in eventually healing the last of a chronic ulcer. A large ulcer, on which successful grafting has been performed, will soon present islets, from which cicatrization progresses in directions of the nearest healing points, until all are joined by an interlacement of newly formed tissue.

NEW BOOKS AND PUBLICATIONS.

A HAND BOOK OF THE LOCOMOTIVE, including the Construction and Management of Locomotive Engines and Boilers. With Illustrations. By Stephen Roper, Engineer. Philadelphia: Claxton, Remsen and Haffelfinger, 624-626 & 628 Market street.

The author of this work very truly believes that in a book, as in a clock, any complication of its machinery has a tendency to impair its usefulness and affect its reliability. Hence, in preparing a book which is intended to be a guide for the practical locomotive engineer, he avoids "mathematical problems and entangling formulæ," and offers a pocket volume, full of information, theoretical as well as practical, succinctly and clearly condensed. There are chapters on heat, combustion, water, air, gases, and steam; others on the construction of the locomotive and of its various parts, entered into with considerable details; instructions for the care and management of boilers and engines, tables of strength of materials, and useful practical hints for the guidance of the engineer. In brief, the volume is, as its name indicates, a hand book to which the locomotive mechanic can turn for information regarding almost every branch of his trade. It is neatly illustrated and bound in morocco, in convenient pocket-book form.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From April 7 to April 13, 1874, inclusive.

ELECTRIC LIGHT.—M. Day, Mansfield, Ohio.
FIRE TELEGRAPH.—J. H. Guest, Brooklyn, N. Y.
FOOD FROM MILK.—B. Smith, San Francisco, Cal.
IRON, STEEL, AND FURNACE.—J. Henderson, New York city.
METAL ROLLING MACHINE.—H. W. Hayden, Waterbury, Conn.
OIL STOVE.—J. H. Thorp, New York city.
SOLE SCREWING MACHINE.—J. Mundell *et al.*, Philadelphia, Pa.
WATER CLOSET BASIN.—J. Burns, New York city, *et al.*
WATER METER.—H. F. Read, Brooklyn, N. Y.
WATER METER.—J. S. Swan *et al.*, Kanawha, W. Va.

Recent American and Foreign Patents.

Improved Railroad Signal.

Jane D. Evans, West Chester, Pa., executrix of Henry S. Evans, deceased.—This is an improved railroad signal, so constructed that the advancing train will itself set the signals to indicate its approach and departure. Two pairs of inclined bars are pivoted at the sides of one of the rails in such positions that the free ends of said inclines will be struck and pressed down by the wheels of the cars. The inner ends of the inclines of each pair are pivoted to opposite arms of a three armed lever, which is placed in a notch in the tie, with its third arm projecting downward. To each pair of levers is attached a chain, which passes over and is secured to a wheel formed upon the signals, which are pivoted to the upper ends of two posts. Either of said signals may be operated from the other, and both set or both withdrawn at the same time. The three armed levers are again raised to their former position, as soon as the pressure of the wheels is removed from the levers or inclines, by springs attached to ties.

Improved Rotary Harrow.

James W. Hanger and Joseph H. Ryan, Clinton, Mo.—This invention relates to means for adjusting the pivoted harrows, so as to cause one side thereof to work deeper in the ground than the other; also to a spring connection between the tongue and axle and a caster wheel, the same also supporting the driver's seat, whereby the weight of the driver effects little change in the pressure on the harrows in passing over rough ground, while yet exerting a constant spring leverage on the tongue; and lastly, to the means of adjustment for the pivoted axles of the harrows.

Improved Steam Boiler.

Joseph Shackleton, Rahway, N. J.—This invention relates to an improvement on the improved steam boiler upon which the same inventor received a patent dated April 5, 1870. The water receptacle is provided with a water induction pipe at the lower part, and a steam eduction pipe at the top. A system of pipes extends through in horizontal direction, and is arranged symmetrically to the horizontal axis of the system in such a manner that an intermediate series of pipes is placed diagonally between and sidewise of the adjoining series of pipes. Every two corresponding horizontal pipes are connected in vertical direction by elbows to form pipe rectangles, which extend gradually from the smallest innermost tier to the larger outermost series, each rectangle being placed in separate connection with the water receptacle. A horizontal plate is immediately below the upper pipes of the innermost rectangles, extending laterally to the full width of the receptacle, and causing the impinging of the fire thereon, so that it is deviated from its direct upward course toward the chimney at the top of the furnace and thrown sidewise, passing between and around the vertical pipes toward the upper corner of the rectangles, and thence along the top of the furnace to the chimney. The upper parts of the pipe rectangles are thereby fully brought into effective participation, and the heating power of the fuel and the gases of combustion utilized.

Improved Post Hole Digger.

James W. Thomson, Portland Mills, Ind.—The post hole diggers now known to the public have the ends of the blade or the two blades pressed farther and farther apart until the lowest portion of the cut is reached, and leave a long slip on one side of the tool uncut, in which are often roots that bind the parts of earth together. This causes these old tools to stick, and to be raised with so much difficulty that they are thereby rendered impracticable in actual use. To avoid this difficulty the ends of the tool are, in the present invention, caused to overlap each other, so that they are only in line, and end to end at the bottom of cut, every particle of the sides being thoroughly excised, and the whole core coming out clean and without obstruction from the sides.

Preparing Transfers for Panel Sign Painting.

Charles H. Gordon, Brooklyn, N. Y.—Paper is first covered with a coat of starch, then calendered, and another coat applied, followed by a wash of gum arabic. The whole is next covered with a coating of clear white varnish. When the varnish is thoroughly dry it is dusted over with French chalk, and the letters or figures printed from the first plate with strong clear varnish. Said letters or figures are dusted with first color, say gold or red. When dry, and all superfluous color cleaned off, the foundation for the next color is laid, say blue, using the same process as for the first color (printing in varnish), and so in each color, till the whole of the picture or sign is printed on the transferring medium. When quite dry a solid ground is printed, of white or color, which, when transferred to the panel, will form the groundwork or base of the picture, etc. After this has stood some time to dry, but before it is quite dry, it is laid on a smoothly planed panel and passed through a machine, which causes the printed matter to adhere to the wood. It is afterward slightly damped and the paper removed, when the whole, groundwork, color printing, and varnish will be found transferred to the panel. Any and every kind of printing, it is claimed, can be treated in the above manner, lithographic, letter press or the finest steel engravings.

Improved Flocking Machine.

Edwin C. Gould, Bridgeport, Conn.—A shaft which revolves in bearings in the middle part of the frame is so arranged that one of its revolutions will oscillate a second shaft. To the latter are attached two pairs of arms projecting from its opposite sides. To the ends of each pair of arms is attached a striker, the edges of which, when the shaft rocks or oscillates, strike against the under side of the cloth as it passes from the flock box or sifter to the roller. The striker bars should strike the cloth in as nearly a perpendicular direction as possible, and the effect of their action is to straighten the flock, spread it evenly over the cloth, and at the same time knock off the surplus flock. The oscillating striker renders unnecessary the roller by which, in the original machine, the flock was pressed down upon the cloth, and produces a better article than when said roller was used.

Improved Brick Machine.

John S. Derby, Leavenworth, Kas.—This invention consists of a rotary brick press with radial molds, which turn in a mold ring supported on a suitable frame, and are rotated by a radial arm with pivoted catch. The bricks are molded in the ordinary manner and placed into the molds, and undergo successively the operations of pressing by means of an upper and lower press board, worked by suitable hand lever power, of cutting off to size, and of smoothing the upper surface. The lower press board of each mold is then carried up by means of its sliding piston and spring top, in connection with the hand lever, so that the bricks may be removed, and the board, by passing under stiff brushes, be cleaned, with the top of the mold, from sand and other impurities. The contact of the spring top with a projecting pin releases the lower press board, and carries it back into position for receiving a new brick. A shield or casing of the upper press board retains the clay therein, while suitable adjusting devices regulate the size to which the bricks have to be pressed.

Improved Brake and Rest for Carts.

William C. Jardine, Westchester, Pa.—This invention consists in arranging, on an ordinary tilting cart or dray, a brake and rest, so that when a cart is propelled down an incline the brake will hold and check the speed, and at the same time the front part of the body of the cart will be supported and the body retained in a horizontal position, thus relieving the weight and strain from the horse's back.

Improved Billiard Table Leveler.

Lyman A. Hunt, North Adams, Mass., assignor to himself and Sylvester N. Gardner, Troy, N. Y.—This invention consists of an inverted metal cup resting on the floor, with an oval-headed screw screwing up and down in a hole in the vertical axis of said cup, and carrying on its head a disk on which the table leg rests. The disk has a socket in the center of the under side, in which the head of the screw fits to keep said disk from jarring off. Each leg being provided with a foot, the screws are turned either way, as required, by a wrench applied to the head to raise or lower the table, and thus adjust it most accurately with but very little labor, and in a short time.

Improved Tree Protector.

Dwight Hitchcock, New York city.—In straps of light sheet metal, three or more of which are used, according to the required hight of the protector, are cut pairs of short parallel slits. The metal between the slits is bent outward to form a half-round transverse groove, and at the sides inward to form a half-round transverse groove. In this way are formed sockets to receive the wires, the arms of the loops or bends of which overlap or interweave with each other. Upon one end of each strap is formed a small tongue, which fits into a short transverse slot, formed in said straps near their other ends. Holes are also made in the straps, in such positions as to coincide with each other when the ends are overlapped, to receive a short bolt, which is secured in place by a nut screwed upon it. The outer arm of the last wire loop at each end of the straps overlaps the last arm of the loop at the other ends of the said straps. This construction enables the protectors to be opened out flat for convenience in packing for storage or transportation, and to be conveniently placed around the trees when required.

Improved Wash Boiler.

William Kolb and Mathias Kolb, New York city.—A partition wall divides the boiler into two divisions, the lower parts of which communicate with each other, while their upper parts only do so by means of a valve. After the boiler has been filled with soap suds up to the grate, it is set over the fire. As soon as steam forms, the suds will be forced out of one compartment into the other and through the wash. When nearly all the water has been forced out of the first compartment, a buoy connected with the valve will no longer be supported; the valve will, therefore, open, the steam will escape, and the suds will rush back into the first compartment. When the suds have risen so high therein that they float the buoy, the valve will be closed again, and the confined steam will again force the suds out of the compartment, and a continuous circulation will thus be maintained.

Improved Felt Cleaner for Paper Machines.

George Dunn and Robert McAlpine, Lee, Mass.—This invention consists of a suction box and a pump, in combination with the first felt of a paper machine, for cleaning it, mainly on the under side, of the matters collecting upon and adhering in the progress of the work, by suction continuously applied to the felt while in the performance of its function. It also consists of a perforated jet pipe, in combination with the felt and the pump, also for cleaning the felt, but more particularly its upper side, by blowing jets of air against the under side and up through it. The object is to enable the felt to be cleansed without stopping the regular work of the machine; also, without removing the felt for washing, as is required in some cases, and it is also designed, by acting continuously on the felt while it is at work, to keep it clean and in its best state at all times.

Improved Steam Boiler.

Nicolas D. Harvey, New Orleans, La.—The sides of the fire flue, back of the bridge wall, or the back ends of the boilers, are jacketed, and the mud drum is connected therewith. In this arrangement the feed water is pumped into the jacket, and not directly into the boiler. Before the feed water enters the boiler it is heated to the boiling temperature, and the sediment is deposited in the jacket, and readily finds its way to the mud drum, and is blown off. The water in the boiler is, therefore, kept comparatively pure.

Improved Water Feeder for Locomotive Tenders.

Mirabeau N. Lynn, New Albany, Ind.—The first part of this invention consists of a jointed arrangement of the spout, of peculiar construction, to adapt it for swinging laterally to the well in the tender, in case the latter does not stand directly in front of the spout, and thus save the adjusting of the tender so exactly as is now required, and which is difficult to do. The second part of the invention consists of a float open to the water below, and closed to the air at the top, with a pipe to admit air to the surface of the water in the interior space, so that the water will not be prevented by atmospheric pressure from flowing out through the spout when the surface is inclosed airtight by a strong cover of ice. A description and illustration of this device will be found on page 102 volume XXVIII., of this journal.

Improved Revolving Swing.

William A. Lowery, John A. J. Lowery, and William W. Lowery, Salem, Ind.—The swing seats are carried by arms attached permanently to the shaft: the latter is arranged in a step at the bottom, and a bearing at the top, to be revolved for carrying the seats around. The guys, for supporting the outer ends of the arms, are connected at the upper end with the top of the shaft by a cap, to revolve with the shaft, so that the latter is rotated by horse power, communicated to a sweep, below the arms.

Improved Cutlery Handle.

George A. Seaver, New York city, and John C. Milligan, South Orange, N. J.—This invention consists of two concavo-convex pieces of sheet metal, with flat margins, combined with the tang of a knife, fork, or other article, to form a handle. The pieces are placed on one side of the tang, with the convex side outward, and secured by lapping the edges of one over the edges of the tang and on the margins of the other, and stamping or pressing them together, thus making a strong and durable handle, with the requisite amount of swell, out of thin sheet metal.

Improved Wheel Plow.

John R. McConnell, Waterloo, Iowa.—The bent axle arm may be moved up and down to adjust the machine to run level. The furrow wheel works between the rear part of the mold board and the land side of the plow, and its lower side supports the downward pressure of the plow, and thus diminishes the friction, and consequently the draft. The draft bar and beam are made of such a length that the furrow may be turned by the rear plow just in the rear of the furrow wheel. The rear plow may be readily adjusted to take more or less land, as may be desired; and by suitable mechanism, governed by a hand lever, the plows may be raised from the ground, or adjusted to any desired depth in the ground.

Improved Spindle.

William G. Bartley, Rochester, Minn., assignor to himself and Anson B. Beach, of same place.—This invention consists of a funnel on the under side of the bolster rail, extending into a cup on the top of the pulley, to receive the oil which drips from the bolster bearing above; also, holes through the pulley to conduct the oil down, and also a tube on the under side of the pulley, extending down the spindle for some distance, to conduct the oil which drips from the bolster rail down to the step, and prevent it from getting on the face of the pulley and on the band. The invention is designed for the spindles of jacks, mules, and other spinning machinery.

Improved Fender for Vehicles.

Washington Bryant, Batesville, Ark.—This invention is an improved device for keeping the wheels of a wagon free from mud, to prevent it from clogging the brakes or loading down the wheels. The invention consists in the arrangement of scrapers attached to extensions of the rear ends of hounds, with the wheels of a wagon. They extend along the inner side of the wheel to the periphery of the inner end of the hub, so as to scrape both it and the felly, and also the spokes.

Improved Graining Roller.

William H. Burns, Chicago, Ill.—This is an improved roller for transferring the natural graining of any desired wood to a wood or other surface, so constructed as to enter the corners of panels and work close to the floor, thus enabling roller graining to be applied in places where the ordinary graining roller cannot be used. To this end, it is made with a shoulder at a sharp angle.

Improved Plow.

Thomas M. Allen, Macon, Ga.—This invention is an improvement in the class of plows whose standards and the braces therefor are made adjustable to vary the inclination of the share, and thereby regulate the depth it shall enter and run in the ground. The plow plate may be detached when desired, and the beam, standard, and brace may be readily adjusted to cause the plow to work deeper or shallower, as may be desired.

Improved Machine for Making Gear Wheel Patterns.

Joseph L. Hewes, Newark, N. J.—By this invention, it is proposed to do all the fitting of the rim, the teeth, and the finishing of the teeth of pattern wheels by mechanical devices, and thus to secure exact uniformity of shape and dimensions for special work, but largely economize in time and labor as well. The wheel rim of an ordinary gear cutting machine is fitted with teeth on the arbor whereon the wheels to have teeth cut in them are placed, to utilize the dividing apparatus for spacing the rim for the grooves; then, in place of the slide carrying the gear cutter, a slide is applied having a saw capable of adjustment, so as to saw the face of the rim for dovetail grooves. With the same sawing apparatus, but with several different interchangeable cutters and an adjustable clampholder for holding the blocks of which the teeth are to be formed, mounted on the mandrel for holding the rim to have the grooves cut in it, said rim being removed, are fitted the teeth with tenons for the grooves of the rim, so that all are finished expeditiously and alike.

Improved Printing Press.

Rlason B. Cooper, Monticello, N. Y.—One of two toggle jointed arms is pivoted to the stationary type bed, and the other is mounted on a support, which is movable in slots in the frame toward and from the stationary pivot of the first, and springs are attached to draw it up toward said stationary pivot. This movable support is connected with arms which carry the platen. The arms are connected at their joint by a yoke and connecting rod with the foot treadle for forcing the treadle up to the type bed by pressing the foot treadle down, which slides the support away from the bed, and, at the same time, brings down the joint so that the powerful action of the arms comes into use when the platen comes to the bed. By connecting the toggle jointed arms to the platen arms by the movable support, greater movement is obtained with arms of a given length than a connection with the joint would give.

Improved Pressure Regulator for Fluids.

Harmon S. Young and William H. Berger, Danville, Pa.—The object of this invention is to regulate the flow of gas or other fluids in conducting pipes, and consists in valves applied to the same stem or rod, and having different areas, and so located within a shell or case with reference to its inlet and outlet orifices as to rise or fall, according as the pressure of the fluid varies below or above a given number of pounds to the inch. The pressure is determined at will by a tension spring and nut, applied to the stem of the valves.

Improved Percolator.

Laurent Dursse, Grafton, W. Va.—This invention relates to glass percolators used in the preparation of medicines, and consists in novel means which enable the tendency to a too rapid evaporation to be entirely overcome.

Improved Attachments to Carpenters' Squares.

Charles H. McKee, Oakdale Station, Pa.—This invention consists in a carpenter's square of novel structure. One great object of this device is to enable a true diameter to be obtained by simply placing the legs so that each is tangential to a circle with the bisecting arm in place; and another to enable different radial lines to be made from the same center, without any change in the adjustment of the instrument, but by simply pivoting it at one end and turning it over the desired distance or part of a circle.

Improved Middlings Purifier.

Joseph E. Gardner, Mt. Gardner, Va.—This invention relates to purifying middlings, and consists in centrally apertured friction disks placed in the case, and having a spout combined with an inclined revolving cloth bolt with subjacent conveyer chamber.

Improved Self Corking Bottle.

Henry Miller and Thomas Miller, Pittsburgh, Pa.—This invention relates to an improvement in soda and other self stoppered bottles. Hitherto these have been provided with stoppers in spherical form and of such specific gravity as to require the bottle to be inverted in order to be filled. In this invention the stopper is of less specific gravity than liquids, which adapts the bottle to be filled without inversion. The neck of the bottle is also constructed in a peculiar manner, conducing to strength and providing a suitable support for the stopper when the contents have been discharged.

Improved Scaffold Clamp.

John R. Crockett, Oso, Tex.—This invention consists of a clevis which is placed around the upright post of the scaffold, secured by a bolt, and provided with a central curved projecting part, to which the supporting piece of the joists is hung by means of a loop. The supporting piece is secured to the main post by an arm with a forked sharpened end, while a forward projecting U-shaped arm takes up the joist, pressing the forked end strongly into the post by the weight upon the joist.

Improved Car Starter.

William T. Beekman, Petersburgh, Ill.—This invention relates to improvements in car starters of the class in which the draft is applied to a segment pivoted on the axle, and so arranged as to be connected therewith by a pawl and ratchet when moving backward. The improvement consists in the combination and arrangement of a draft bar of peculiar construction with segments placed contiguous to or against the inner sides of the wheels, so that they may take up no extra space but project upward into the same box with the wheels. It consists, also, in stops with the wheels arranged to lift the pawls off the ratchet wheels when the segments rotate backward.

Improved Saw Jointer.

George S. Prince, West Salisbury, N. H.—A short flat bar of steel, not quite as long as the radius of the saw, has a crotched end adapted to rest on the saw arbor. It also has clips attached to the edges to form guides, in which another short plate is fitted to slide forward and back. This last plate has a head on the outer end, in which a short flat file is secured by set screws, so that the points of the teeth of the saw may be caused to run against the sides and be filed off to dress them all to the same length. The arrangement of parts is such that a screw rod serves both to adjust the one plate on the other, and to hold it fixed in any position to which it may be adjusted, while screws are so arranged with the head that the file may be adjusted higher or lower on either side, or at either end, according to the bevel required to be given to the saw teeth.

Improved Book and Music Stand.

Julius E. Ulber, Port Huron, Mich., assignor to himself and Frederick I. Merryman, same place.—A sector shaped plate is hinged by its back strip to a standard, in relation to which it may be arranged under any suitable angle. A slatted side piece is applied to the plate, and is moved up or down, as required. The music rest is pivoted to the lower end of the slide, and may be turned again under any angle to the slide. The music, book, or other article which is intended to be used or exhibited on the stand, is placed on the rest, and the same then adjusted in the exact position desired, which is easily accomplished by means of set screws.

Improved Press for Hay, Cotton, etc.

Christopher D. Findlay and David D. Craig, Macon, Ga.—This invention consists in providing the tube or nut of a press follower with simple recesses and a single ball in each recess, the whole series of recesses and balls being arranged in spiral order corresponding to the thread of the follower screw, and also in combining, with the flanges of the tube and nut, conical rolls and a top-apertured and side-notched ring.

Improved Furnace Grate Bar.

William C. Wren and William Meyrick, Jeddo, Pa.—This invention consists of short parallel bars for holding the coal, mounted above a long supporting bar extending across the furnace, by short transverse plates, which sustain the heat so far above the supporting bar that it is kept comparatively cool, and is not, therefore, liable to be warped, bent, or burnt, or to crack; and the bars which are subject to the heat, being made in short pieces, do not strain the supporting bars. The short bars break joints at the meeting ends, to prevent a straight open space across the whole; also to guide the rake used by the fireman in cleaning the fire.

Improved Rocker for Cradles, etc.

Wendell Wright, Phœnicia, N. Y.—The object of this invention is to convert at will a rocking cradle or chair into a standing crib or standing chair; and the invention consists in adjustable feet attached to the rocker, which, when the rocker is in use, are turned inward, so that they do not in any manner interfere with the rocker. When it is desired to have the cradle stand firm, the feet are turned down.

Improved Cultivating Plow.

William C. Bell, Orange Court House, Va.—This is an improved plow for cultivating tobacco, corn, and other crops planted in hills or rows, so constructed as to cut up and destroy grass, weeds, briers, etc., which may be growing among the plants, and which will allow the parts subject to wear to be readily detached and replaced by new ones, or by others better adapted to the state of the plants to be cultivated.

Improved Lamp Holder.

James Telfer, L'Ance, Mich.—An arm of S shape is screwed directly into the standard of a sewing machine. The arm swings in its socket in every direction, and allows thereby the adjustment of the same, as required. The base part of the holder is provided with downward-extending feet, on which the lamp holder rests when screwed off, forming a neat base for the lamp, without requiring the taking out of the latter, which is retained on the holder by band springs, which enclose the lamp firmly until spread for taking the same out for refilling, cleaning, etc. By means of a shade, the light is thrown to the needle or part of the article to be sewn.

Improved Harvester Rake.

Erasmus H. Donaldson, Staceyville, Iowa.—To the forward end of a rotating shaft is rigidly attached a cross bar, to the ends of which are pivoted rakes, made in two parts or halves, which are placed upon the opposite sides of the bar. Rods slide longitudinally in keepers attached to the cross bar, and have cross heads formed upon their outer ends, which, when the said rods are pushed outward, catch upon the shanks of the rakes, and hold said rakes extended while sweeping the grain across the platform. As the gavel is swept into the receiving trough or upon the ground, the rakes are released by the inward movement of the rods. Suitable mechanism is provided to withdraw the catch rods to release the rakes at the proper time. The platform, which is curved into the arc of the circle, and through which the rake heads sweep, starts a little above the level of the cutter bar, passes below the same, and rises, at its inner end, above the drive wheel, and with its end is connected a trough to receive the gavel from the rake, and from which it is taken by the binders. A guide is attached to the outer end of the platform, to prevent the rakes from swinging outward, and to cause them to descend in proper position at the outer end of the platform.

Improved Shipper Lever.

Isaac F. Hoyt, Glenville, Conn., assignor to himself and J. R. Pilling, of same place.—This invention consists of the handle portion of the lever jointed to the main portion, and provided with a curved extension beyond the joint in a slot in the other portion. This raises the spring catch out of the notches of the quadrant bar, when the handle, after being taken in hand by the operator, is turned into line with the principal part of the lever.

Improved Feed Water Heater.

Robert O'Neill, Negaunee, Mich.—The casing is divided into four sections, from one of which the water is taken for the supply of the boiler. Flanges project inward from the inner surface of the shell, which support the heating plates. The plates are provided with a series of tubes, through which the water passes in descending from one section to another. These tubes are about three fourths of an inch in diameter, and each plate is provided with a large number of them, so that the water is divided and exposed to the exhaust steam from the engine, and is heated by condensing and absorbing the heat thereof.

Improved Sulky Cultivator.

Ephraim Ives, Pleasant Hill, Ind.—This invention relates to an arrangement of means for adjusting the plows toward and from each other, and for locking a pivoted portion of the frame. In this way the driver has complete control over his plows, so that he can guide them in plowing crooked rows, in avoiding irregular hills, and in plowing closer to or farther from the plants, as circumstances may require. The wheels and axle may be adjusted forward or back, according to the weight of the driver, so that his weight may balance the machine.

Improved Ratchet Drill.

William M. Ellison, Kingston, N. Y.—This invention consists of a sleeve on the upper part of the drill spindle or stock, with a screw cap and a collar, so formed that when the feed screw is adjusted to its bearing at the upper end it can be bound fast to the sleeve. The latter extends down to a chamber in the head of the drill handle, where it has a toothed wheel rising on another toothed wheel on the drill stock and geared with it by a little shaft and two pinions. The wheel of the sleeve has a few more teeth than the one on the drill stock, so that it turns slower, and thus causes the feed screw to turn slower than the spindle does, and thus slowly to screw out of it and feed the drill. The pawl of the handle acts on the wheel of the spindle for turning it. By loosening the screw cap at the top of the sleeve, the screw is freed so as to be turned readily by hand for setting the drill and releasing it.

Improved Reversible Plow.

John P. Dexheimer, Lawrenceburgh, Ind.—The pivots of an extension mold board are fixed in bearing brackets, one of which is arranged to slide in a bearing in the bottom of the plow, and is provided with a bolt to hold it at any desired point. The mold board may thus be extended more or less to regulate the turning of the furrow, as may be desired for different kinds of work.

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B. A. Jenkins, La Crosse, Wis., makes Iron Slat Blinds for build'ngs.

Hydrostatic Presses—Best in use. John Rodgers' Sons, Machinists, Engineers, and Iron Founders, Albany, N. Y.

Wanted—A Mangle for ironing plain goods Send description and price to J. F. Edgar, Corinth, Miss.

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Who will manufacture this Bit? See Scientific American, Feb. 14, 1874. Address Christian Monson, Moscow, Wis.

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Wanted—The address of makers of wooden match boxes. S.R., 447 N'th Market St., Philadelphia, Pa.

Money Partner Wanted—To work Jenner's Patent New Principles of Propelling on Canals, with boats now in use, without changing their form. Four miles per hour guaranteed with a 12x12 Engine or its equivalent. Call and see a working model, or send for circular. C. H. Jenner, Brockport, N. Y.

Wanted—Capital to patent an article needed by every traveler. Address J. W. S., Box 16, Woodbury, New Jersey.

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

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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.

Engines 2 to 8 H.P. N. Twiss, New Haven, Ct.

Steptoe, McFarlan & Co., No. 212 to 220 West 2d St., Cincinnati, Ohio, manufacturers of Wood-working Machinery and Machinists' Tools. Send for circulars.

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Temples & 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.

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

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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.

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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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.

ANSWERS TO CORRESPONDENTS

B. W. F. is informed that an American gallon contains 231 cubic inches: an English imperial gallon, 277 274.—F. D. L. will find a description of a process for black enamel on iron on p. 208, vol. 26.—P. S., who asks questions as to roofing, etc., should send his name and address.—H. E. J. should consult our advertising columns for books on carpentry.—J. F. F.'s reply to V. C. is incomprehensible.—W. H. S. will find directions for making vinegar on p. 58, vol. 30. Solid opodeldoc can be made by using more soap in the mixture.—G. O. D. will find recipes for gilding on glass on p. 283, vol. 30. Asphaltum varnish is described on p. 233, vol. 26. For painting on glass, see p. 123, vol. 30.—T. F. will find directions for a cement for mending china on p. 241, vol. 27. Tempering springs is described on p. 251, vol. 29. Black asphaltum varnish for cast iron is described on p. 283, vol. 26.—J. T. B. will find a recipe for jet black ink on p. 203, vol. 29.—S. A. M. will find directions for making marking ink on p. 251, vol. 29.—For whitewash, see p. 280, vol. 29. For paper boats, see p. 168, vol. 27.

W. F. H. asks: 1. How can I find the velocity of water in any sized flume? A. By experiment. 2 What percentage of power do overshot wheels usually yield? A. From fifty to seventy-five per cent. 3 Can you give me a rule for laying out bevel gears? A. You will find it in any treatise on mill work.

A. M. B. says: 1. In vol. 30, No. 12, you speak of an ice boat going nearly three times as fast as the wind. B. says that this is against common sense. Can you explain it? A. You will find the matter clearly explained on p. 176, vol. 28. 2. What would be the real lifting power of an engine of 4 horse power? A. It would be able to lift 132,000 lbs. one foot high in a minute.

In our answer to L. E. I., in the SCIENTIFIC AMERICAN for April 4, 1874, the sentence that "port area one half that of the piston" should read: "port area from one twentieth to one fifteenth the area of the piston."

G. A. B says: We use two kinds of brake shoes on our cars, one of wood, the other of iron. My friend says that the iron ones are the best, for the reason that he can screw down brakes as hard as he pleases with the iron shoes, and the wheel will scarcely ever slide on the rail: but with the wooden one, half the force expended will cause the wheel to slide. I, on the contrary, say that the wooden one is the best, for it is the one which retards the revolving of the wheel most with the least expenditure of "elbow grease;" we do not question which is the best material for shoes for general usage, but which will stop a train in a given time with the least power expended by the brakeman. Who is right? A. The friction between the wheel and the wooden shoe would ordinarily be greater for the same pressure, than when the iron shoe was used 2. What gum can I get which will dissolve in alcohol and after drying be again soluble in water? A. We do not know of any.

G. W. M. asks: About how deep will cast or wrought iron rust, if exposed to all weathers? A. Experiments have not been very extended, but it is supposed that, if the metal is not subjected to strain, it will rust about 1-16 of an inch deep in 25 years.

S. H. D. asks: Why is it that a common portable pump, used on a portable steam engine to feed the boiler, will not take hot water but will take cold water? A. The vapor formed by the hot water creates such a pressure that the valves cannot open.]

G. R. B. asks: Is the weight or pressure upon the valves of a steam engine the area of the ports or openings which are covered by the valves multiplied by the pressure per square inch, and are the valves balanced when the ports or openings are not covered by them? In short, is the theory of no port, no pressure, correct, and do the rules which apply to the figuring of the weight or pressure on the valves of an engine also apply to the pressure upon the piston packing? In other words, can the rings of the so-called steam piston packings be set out by steam? A. The pressure of the valve is that due to its own weight and the unbalanced pressure of the steam on it. Thus, if an equal area is pressed on top and bottom of the valve, all the pressure will be taken off. There are several styles of piston in which the packing rings are set out by steam pressure.

W. C. M. asks: 1. Is tallow the best thing for lubricating an engine cylinder? Is there anything that will improve it for the purpose? A. Some prefer oil. 2. How can I bleach tallow without injuring it? A. Melt and strain it before using.

H. W. says: 1. We attribute to Newton the discovery of the law of gravitation. Is there an apposite law of repulsion? A. Yes, but it acts at very small distances. Molecules repel each other according to the amount of heat they contain; the temperature of space, supposed to be 300° Fah. below zero, is sufficient for ether vibrations. 2. Newton dignified his discovery by declaring the law of gravitation to be a principle inherent in matter. In the same sense, is there not also an opposite law of repulsion which is a principle inherent in matter? A. No. 3. I suppose it may be said that gravitation is not now considered to be a principle, but an effect of force. In this view of the case, is there not repulsion which is in the same sense an effect of force? A. No. 4. Do or can astronomers explain the movements of cosmical bodies satisfactorily upon the theory that they are balanced between the centripetal and the centrifugal forces, or do they offer any satisfactory explanation of such movements on any basis which ignores the existence of a law, a principle or an effect, of repulsion which is independent of the above named forces? A. The moon falls toward the earth one twentieth of an inch every second, instead of going off at a tangent. See Loomis' "Treatise on Astronomy." 5. If the earth swings around the sun in an orbit predetermined only by its momentum, its centrifugal, and its centripetal force, why is it that, when its orbit is once disturbed or varied, as it has been thousands of times by the planet Mars, for example, that the variation does not remain a permanency? [A. Where two bodies have exactly commensurate orbits, the orbit of the smaller body is entirely changed. Hence the gap in Saturn's ring has been caused by one of its satellites. In the formation of a solar system, only those orbits survive which are incommensurate with each other. 6 Comets which come to the center of our system are hurled back into the depths of measureless space. What is the power which operates with such irresistible certainty? Can their eccentric orbits possibly be referred to the equal and unvarying centrifugal force? Is not every known mechanical supposition opposed to such a theory? A. All bodies move with their greatest velocities at the perihelion passages. Hence their ability to get away again. 7. But all orbits of all cosmical bodies are like those of comets, namely, they have an ellipsoidal form of revolution. Does not this indicate the idea that the laws which compel them to retain their orbits are in all cases the same as those affecting cometary revolutions? Here end the questions I desired to ask. The theory of a principle of repulsion has already been announced. It remains to ascertain how this law or principle or effect comes into existence. Take two balls of some light substance, dried pith is as good as any. Let one of these be surcharged with electricity, and it will attract the other. Let the two balls remain in contact with each other a short time, long enough for their electrical condition to become equalized, and they will repel each other. Now suppose the sun to be a highly charged electrical body, and a comet to be relatively an uncharged body, it follows that the comet will be drawn toward the sun by electrical attraction. It is true that the comet will be drawn by the force of the attraction of gravitation also, and will be governed by its centrifugal force, but the electrical attraction will supplement these forces. Arriving near the sun, the electrical condition of the comet becomes changed by reason of its proximity, and hence is repelled just as one pith ball is repelled by the other when the condition of the two has become equalized. It is proper to say here that while many various phenomena of electrical action are recognized, yet the whole subject of electricity, its connection with heat motion, the contraction or expansion of bodies by heat or from other causes, its development by motion or from contiguity of bodies, in short, the whole theory of the correlation of forces, can hardly be said to be understood, and in many respects is halting and unsatisfactory. Whether the sun is surrounded by what may be called an atmosphere of electricity, which reaches beyond the boundaries of the outermost planet, or whether the electrical condition of cosmical bodies is excited by their expansion by heat when they arrive at their points of closest proximity to the sun (which appears improbable), one thing is certain, which is that there is a law or principle or effect of repulsion which is a necessary law, and which defines those circular boundaries in space which the worlds may not overpass. A. Electrical forces appear to play a very subordinate part in Nature. Stars are seen to drift about in currents and vortices with an occasional collision. The resulting combinations are in exact accordance with the law of gravitation. The motes in a sunbeam, the shining *noctiluca miliaris* in the sea, or Brownian movements of minute particles under the microscope, may serve to illustrate these currents of circulating stars.

E. B. W. asks: 1. What is the rule for finding the area of a segment of a circle? A. It is equal to the area of the circular sector, bounded by the same arc, diminished by the triangular portion of the sector. 2. Also of an ellipse? A. The area of an ellipse is equal to 0·7854 times the long diameter multiplied by the short diameter. 3. What causes a liquid to circulate when running downwards through a hole, as, for instance, through an opening in the bottom of a vessel? A. The motion is given to it by the spiral form of the hole, or the position of the hole in reference to the center of the vessel. 4. What is the best recent work on surveying? A. Trautwine's works are among the latest and best.

T. G. asks: 1. How can I solder or braze two pieces of brass together steam tight? A. See p. 251, vol. 28. 2. What is the best thing to remove scale from a boiler? A. Try putting about two ounces of muriate of ammonia in the boiler twice a week. 3. Ought a person who wishes to be an engineer to study any books, or is practice alone sufficient? If not, what books are the best? A. By all means study good books. Begin with Bourne's "Catechism of the Steam Engine." 4. What is the best paint for a smoke stack? A. See p. 295, vol. 28.

C. R. asks: 1. How can I make a good cement for filling air holes in cast iron? I want something that will stand heat. A. You can tap the hole, and screw in a piece of metal. 2. Which drags the most water, a side wheel steamer or a propeller, both hulls being of the same size and shape? A. Generally there is no drag in either case.

D. B. S. says: 1. In a lecture on electricity, a piece of money was placed in a saucer of liquid that looked like water, and a person could have it if he could pick it out. In one hand was to be placed a ball connected with the wire of a battery, which did not have any effect on the person until the other hand touched the liquid, when that hand would immediately fly upward the length of the arm. What was the liquid? A. Probably water. 2 Why did the effect take place? A. The water in the basin was connected with the other pole of the battery, so that, on touching it, a violent shock was given to the system, with the result you describe. 3. Are caoutchouc and gutta percha the same? A. No. 4. Will a bell give the same volume of sound if struck on the outside that it will when struck on the inside, the blow being equal in both cases? A. Depends upon the size and form of bell. Small bells, we believe, give better sound when struck upon the outside.

M. asks: 1. Do you think I can master mechanical drafting without the aid of a teacher, other than books? Whose work would be the best on drafting? A. You can learn a great deal from a book, but there are many things that a draftsman should know that can only be acquired by experience. We can recommend Professor Warren's works. 2. Why will a screw propeller make more turns, other things being the same, in running against the tide than in going with it? A. We would like some good evidence that this is a fact before seeking for a reason.

M. W. H. asks: 1. Will vegetable or any freezable bodies freeze in alcohol? Will they freeze as soon as the alcohol gets below 32° Fah.? A. When the temperature of the alcohol sinks below the freezing point of the substances contained in it, they will freeze. 2. Why does a telescope magnify if we look through from the big end at anything close to the little end, while, when looking at anything a few feet off, it makes it smaller? A. In the former case the rays proceeding from the object glass enter the eye as a diverging beam. 3. Is there such a thing as a single glass telescope, or thing that can be used as a telescope? A. A single glass telescope is not possible. 4. Will nitro-glycerin explode as soon as the acids and glycerin are poured together, or does it have to be stirred together and left to stand for a while? What are the proportions of chemically pure nitric acid, sulphuric acid, and glycerin, by weight, to make nitro-glycerin? A. See p. 283, vol. 30.

M. M. asks: 1. Where gas from the city works can be bought for $3 per thousand feet, would it be economy to generate hydrogen by the action of sulphuric acid at 3 cents per lb. upon iron turnings at 1 cent per lb, and give it luminosity by passing through a filter saturated with coal oil at 20 cents per gallon? A. If these figures represented the entire expense of the manufacture, it would be. 2. What is the cheapest method of procuring oxygen upon a large scale without expensive apparatus? A. The oxygen companies use chlorate of potash heated in iron pots. The simplicity of the plant employed and the purity of the gas compensate them for the cost of an expensive material. 3. Is the calcium light made by a jet of common air through a flame of illuminating gas upon a piece of chalk of sufficient intensity to use as an illuminating agent? A. No.

J. H. says: I have two coal shafts, both sunk to the same vein, one for downcast and the other for upcast. I am using for a ventilating power, at the bottom of the upcast, a large furnace; and in addition to the furnace I have the upcast elevated 45 feet above the level of the down cast; both shafts are of the same size, 7x14 feet. If I make the mouth of the downcast 18 feet square in place of 7x14 and bring it down to the regular size at 18 feet down the shaft, which I think would make a kind of receiver, would it add to the weight or pressure of air in that shaft, and be any help to the furnace? A. No. 2. Is coal tar injurious to wire rope? A. No.

G. E. D. asks: How can I make sensitized paper? A. Take albumen paper, and float (prepared side downwards) on a bath of 1 oz. nitrate of silver in 18 oz. distilled water: add a few drops of citric acid to dissolve the first precipitate. Float for half a minute and dry in a dark room.

E. D. B. asks: 1. Are the grounds of cameos colored artificially after being cut, especially the beautiful green ones? If so, by what means? A. No. The different colors belong to the various strata of the stone. 2. What work on geometry has a full description of the curves of the fourth order? I have heard that, by the use of the cissoid, an angle could be trisected; is this so? A. In treatises on the calculus. The cissoid is a curve of the third order. It is described in Newton's "Universal Arithmetic." 3. Has there ever been a supposed metallic base of hydrogen discovered, or is any such supposition entertained by Science? A. It is considered a reasonable hypothesis by some scientists; but so far as we know, no such metallic base has been discovered. 4. Is the ultramarine water color made from the stone *lapis lazuli*? If not, what is the reason of its great cost? 4. Yes. Artificial ultramarine is also made, and sold much cheaper.

D. B. asks: 1. Where is the proper place to bolt a portable engine to a boiler, on the side or on top? A. Either place will do, if the boiler is properly braced. 2. Is a portable engine, placed on the top of the boiler and using a double crank, as strong as one bolted to the side of the boiler, using a single crank? A. Yes, if well proportioned. 3. I have a portable engine, cylinder 5 x 10 inches and speed 130 revolutions per minute; the firebox is 20½x19½ inches, with 32 flues (1¼ inches) of copper, 32 inches in length. I use the exhaust blast, contracted to ½ an inch, in a stack 8 inches in diameter and 17 feet high. The pressure is 30 or 40 lbs. Would it be more economical to lengthen the boiler to 4 feet, using the same number of flues? A. We would not recommend this change.

C. O. asks: 1. What is the difference between the actual and nominal power of a steam engine? A. Actual power depends upon actual conditions under which the engine works. Nominal horse power is obtained from assumed conditions. 2. What would be the power of an engine that has 36 inches stroke, 16 inches diameter of cylinder, and 45 revolutions a minute worked with 70 lbs. of steam? A. You do not send sufficient data. See article on "Indicating Steam Engines," p. 64, vol. 30. 3. How much is to be deducted for friction? A. From 20 to 50 per cent. The precise, amount can only be determined by experiment. 4. Is half the power lost by the crank in converting rectilinear into circular motion? A. No.

S. A. R. asks: In making steam connections using the globe valve, which end of the valve should be placed next the steam pressure? A. It is generally placed so that the pressure is on top of the valve. Some engines, however, prefer to arrange it in the other way, so as to be able to pack the stem under pressure.

J. H. H. asks: 1. What causes zinc to bubble and leave blow holes when poured into a plaster of Paris mold? A. It may be caused by impurities, or by insufficient vent in the mold. 2. What kind of antimony is used to harden zinc? I bought some, but it turned black and would not melt. A. You probably have a compound or an impure article. 3. I took a bottle and filled it with water, and then put in a cork with just enough lead on it to make it sink very slowly. I then connected a force pump to the bottle, supposing that when the pressure became great enough the cork would rise to the surface. I put 35 lbs. pressure on the bottle, but the cork stayed down. I then took off enough lead so that it would just float; then when the pressure was put on, the cork went down and would come up when I lessened the pressure. A. When the pressure was increased, the air in the cork was compressed, and sufficient water entered to make it sink. When the pressure was taken off, the air expanded and forced out the water.

H. S. H. asks: If a quantity of air be compressed to half its bulk, what pressure will it exert against the sides of a vessel? By what rule of proportion is the pressure governed? A. If the temperature is constant during the compression, the pressure varies inversely as the 1·408th power of the volume.

T. W. M. asks: Can you tell me of a cheap and simple method of reproducing manuscript music? A. Write it of lithographic transfer paper, have it transferred to stone, and printed by a lithographer.

R. U. asks: How is phosphor bronze made, and what percentage of phosphorus does it contain? A. Phosphor bronze is made by adding a small portion of phosphorus to common bronze or gun metal. The latter is composed of 90 parts of copper, and 10 parts or less of tin. To this, from 6 to 10 per cent of phosphorus is added, to make phosphor bronze.

C. R. asks: How can I make French polish, and how should it be applied? A. Dissolve 1½ ozs. shellac and ½ oz. sandarac in ½ pint naphtha. Wet a piece of flannel with polish, stretch a clean linen rag over the flannel, apply one drop of linseed oil to the linen, and rub in a circular direction.

P. H. B. asks: What kind of roof will a composition, said to be composed of French asphaltum, hydraulic cement, salt, coal, tar, and sand (of such consistence as to be easily spread with a plasterer's trowel upon paper felting) make? What is the difference between French and American asphaltum? What is and what are the uses of an oil called dead oil, said to be mixed with carbolic acid for disinfecting purposes? A. There is no asphalt called French asphaltum as distinguished in any peculiar quality from any other asphalt. The combination of ingredients specified by you is useless for the purpose indicated, as the salt would destroy its efficiency by continually attracting moisture from the atmosphere. Dead oil is the last that comes over in distillation, and is a fatty oil that is not likely to dry well in such a composition. A great deal of the material complained of is sold to be put on by the purchaser, and unless properly laid is not likely to give satisfaction; cases have occurred, we are informed, where the material has been sent out with the plainest directions, and where, nevertheless, the preparation of felting, etc., has been laid with the upper side down, thus exposing to the weather a surface never intended and not prepared for it.

A. D. B. asks: Will copper wire, which is covered with cotton and then with beeswax, do for a primary coil? A. Two thicknesses of it may be used. 2 I have a coil which is too small, the covering of the wire of the primary of which is worn off in some places, and the secondary coil has been cut in several places. Can I mend the fine wire, and, with more added to it, use it for the one I wish to make? A. There is no reason why the wire should not answer when properly joined. 3. Is it necessary to put layers of oiled silk or other insulator between the layers, it being covered with cotton? A. The oiled silk will perfect the insulation.

A. A. W. asks: What kind of wood are guitars made of? A. Well seasoned pine is frequently used.

C. G. asks for a recipe for making furniture polish. A. Take pale raw linseed oil 10 ozs., lac varnish and wood spirit each 5 ozs. Mix well, and it is ready for use. This is a reviver for French polished wood.

C. R., and Mrs. G. W. P. ask: 1. How can I make a light gray color to color a brown wall so that it will stand the weather? A. Put a very little blue black in ordinary whitewash. 2. How can I make a dark brown color for the same purpose? 2. Use umber or ocher in whitewash, to the shade required.

A. H. W. G. asks for a recipe for turner's cement, for holding small articles in the lathe. A. Take Burgundy pitch 2 lbs., resin 2 lbs., yellow wax 2 ozs., dried whiting 2 lbs.; melt and mix.

D. E. R. asks: How can I put a fine polish on walnut in a very short time, say 3 hours? A. Melt 3 or 4 pieces of sandarac, each the size of a walnut, add 1 pint boiled oil, and boil together for 1 hour. While cooling, add 1 dram Venice turpentine, and if too thick, a little oil of turpentine also. Apply all over; and after a few hours, rub it off.

G. F. F. asks: What is the best thing to use in cleaning silver plated goods? A. Prepared chalk in cold water; apply with a plate brush, chamois leather, or soft woolen rag.

Mr. E. Kireersky, of Penza, Russia, and many other correspondents ask for further particulars as to burning brick with petroleum, described on p. 55 of our current volume. Will our "Old Subscriber" send us the details?

J. S. G. asks: 1, Has the exhaust steam of a high pressure engine ever been used as a source of power? A. Yes. In the compound engine, its expansive power is utilized. In other inventions, it is used to run a second cylinder with vapor of a liquid of a low boiling point. 2. How is a compound engine constructed? A. See pp. 116, 304, vol. 25.

C. R. McC. asks: 1. Can water be raised and thrown with a hydraulic ram to 250 feet elevation and and 1,600 feet distance through ⅜ pipe with a strong spring and 21 feet of fall from springhead to ram? Would such a situation afford a reasonable supply of water for a dwelling and barn, by using the most improved ram? A. You can make a good ram answer the purpose, if you have plenty of water in the spring. A manufacturer will give you instructions as to the proper size of pipes.

C. F. B. says: I have a room 14 × 15, heated by a stove, which I wish to ventilate by leading a register into an air passage between the boarding and plastering. Where should the register be put, at the top or bottom of the room? A. You should have two registers, one at the top and one at the bottom.

R. A. M. asks: Would it be practicable to plate steel pens with zinc, tin, or other metals, either by dipping them in the molten metal or by electricity? Would it prevent them corroding without injuring the temper? I have succeeded in tinning a few without injuring their writing qualities, with a common soldering iron, with the aid of muriate of zinc. A. Steel pens plated with different incorrodible metals are largely manufactured.

P. H. W. asks: 1. What is tin foil, such as is used for wrapping tobacco, composed of? A. An analysis of a piece of tobacco tin foil in our possession showed that it contained mostly tin with some lead. Seven other samples obtained from different sources had the same composition. 2. What are storm glasses, indicating changes in the atmosphere in advance of storm, wind, etc., filled with? A. See p. 121, vol. 29.

J. W. B. says: 1. I wish to make a Rhumkorff induction coil. I have 10,000 feet of No. 32 silk covered wire for the secondary coil. Of what size and length of wire should the primary coil be? A. Forty feet No. 12 copper wire, silk-covered and varnished with shellac in alcohol. 2. What should be the diameter of the iron core? What should be the length of the coil? A. A bundle, 1 inch in diameter and 1 foot long, of No. 16 soft iron wire. 3. What amount of surface should the condenser have? Are tinfoil and paper the best to make it of? A. 50 square feet of tin foil and 50 square feet of paper soaked in melted paraffin is the best known. 4. What is the best material for the ends of the coil? A. Glass or hard rubber. 5. About what length of spark will I be able to get from a coil of that size? A. If carefully drawn, pure copper wire is used' well insulated with paraffin or shellac, you will get a spark 1 inch through air, with two cells of Grove's battery. 6. What is used for polishing black rubber with? A. French polish. 7. Do you think I could make a Rhumkorff on this plan, without loss of power or other defects? A. Yes; it is better to have less metal around the secondary coil. 8. What book on electricity and magnetism do you think the best? A, Noad's is a good work.

W. H. B. asks: Is there any quick way of finding the number of diameters which a small compound microscope will magnify? A. For scientific purposes, it is generally determined experimentally by means of a micrometer. If you can find the foci of the object glass and the eyepiece, the magnifying power of each can be determined approximately by dividing 10 by the focal distance. The magnifying power of the microscope is equal to the product of the two magnifying powers so found.

M. M. S. asks: 1. What load will a thimble skeined wagon bear, with 4 inch spindles, the wheels being three feet and one half in hight? A. We are not familiar with wagons of that kind. 2. What is the largest sized cube that can be cut from a globe whose diameter is 12 inches? A. One having a face about 6·93 inches square. The rule is to multiply the radius of the sphere by 1·1546, to find an edge of the cube. It is given in nearly every work on mensuration.

M. & S. ask: What is best to use on chills to prevent blowing? A. You do not send sufficient details to enable us to give you any information. Matters of this kind are best learned by experience. They may be considered secrets, akin to the secret of Opie, who was asked how he mixed his colors, and replied "with brains." We have seen it stated, however, that it is a good plan to cover the mold with a mixture of red lead and oil.

L. T. W. asks: 1. Will you give me the formula for ascertaining the number of square inches of heating surface in cylinder and flue boilers? A. Heating surface of cylinder boiler in square feet = 3·1416 × radius in feet × length. Heating surface of flue boiler in square feet = 3·1416 × radius of shell in feet × length in feet + 3·1416 × twice the number of flues × radius of flues in feet × length of flues in feet. 2. How do you estimate the horse power of a boiler, either cylinder or flue? A. We can give you no definite rule. 3. How can I compute the area in square inches of a square fire box? A. The area is equal to the product of the length and breadth, supposing the surface to be flattened out. 4. How many horse power would vacuum add to an engine, or, in other words, if a high pressure be converted into a low pressure engine, how would you estimate the added horse power? A. It would increase the mean pressure in a certain ratio, and the horse power in the same ratio, other conditions being the same.

J. B. asks: Can a concavo-convex lens, 1½ inches in diameter, be made to throw a focus ⅛ inch in diameter at a distance of 48 inches? A. The focal image of a star is a bright point. The diameter of the image compared with that of the object is proportional to their respective distances from the lens, if aplanatic.

A. S. says: 1. We put steam from a small engine into a tank for supplying the boilers, likewise the steam from pump at boilers; we use olive oil for lubricating. Will it hurt our boilers or cause them to scale? We use terra japonica as a boiler purge, and find it very effective in removing scale. A. The oil will not injure the boilers, unless you use a very large quantity. 2. When you speak of heating surface (in calculating horse power), do you mean all the parts exposed to the action of the fire or heat, such as the tubes, back end of boiler, and all below the brick work? A. All this surface is ordinarily counted. Some persons, however, do not estimate all. 3. Is there any means of finding where there is water for a well without digging for it? A. If the soil is not rocky, you can make borings with very little trouble. 4. Does a broad belt on a pulley cause more friction if only the same weight be applied, as a narrow one? A. No. 5. What is the best material for preserving belts and keeping them in working condition? A. Castor oil is often recommended.

E. S. W. asks: What is the amount of resistance per foot of cross section to a body moving in the air at a given rate, say 100 feet per second? When the velocity is equal to that at which air will flow into a vacuum, is the resistance equal to our atmosphere? Does much depend upon the shape of the body? What reliable experiments have been made, and where can the results be found? A. Experiments on this subject are far from complete. A *résumé* of the most important is given in the *Encyclopædia Britannica*, and the rule is deduced that the resistance of the air to the motion of a plane surface, in grains per square foot, is equal to 16 times the square of the velocity in feet per second. A sphere does not encounter more than one fourth the resistance that would be opposed to the motion of a plane surface with the same cross section.

P. O. T. asks: How can I estimate the amount of tannic acid in bark, leaves, and roots of different kinds? A. By precipitating the tannin with protochloride of tin mixed with chloride of ammonia, and measuring the precipitate.

L. W. E. asks: How many gallons of water are required, per horse power, to run a small engine for a day? A. From 50 to 75 gallons per day of 10 hours.

O. G. C. says: I am running an eight horse engine with coal. The furnace has a poor draft; would the pipe referred to in a recent issue of your paper, to throw steam direct from boiler to stack, be of any use? We run the engine all the time, and exhaust into the stack. Would it be of any use to reduce the size of the exhaust nozzle? It is large, I think 1¼ inches in diameter. How small shall we make it? A. Generally, the exhaust can be arranged to make enough draft.

G E. S. asks: Will a tin boiler, 2 feet long and 18 inches in diameter, be large enough and strong enough to run an engine cylinder 5 inches stroke and 3 inches diameter, at 30 revolutions per minute? A. Yes.

J. T. and others: Foaming in boilers is especially caused by impurities in the water, insufficient steam room, and too heavy firing.

W. S. W. says: 1. In your issue of March 14, the statement is made that the combustion of 1 lb. of coal in one minute is productive of a force equal to the work of 300 horse power during the same time. A. The work represented by 300 horse power is the same as that required to raise 9,900,000 lbs. 1 foot high in a minute. Now every unit of heat produced by the combustion of coal, if it could be converted into work, would be capable of raising 772 lbs. 1 foot high, so that the number of units of heat required for the production of 300 horse power would be about 13,000 a minute; and the total heat of combustion of ordinary coal exceeds this. 2 Have not theory and practice shown us that 2½ lbs. consumption of coal to the horse power per hour is a very favorable result? A. The large ocean steamers at present consume about 2¼ lbs. of coal per hour per horse power. Better results are obtained in some cases.

W. W. B. asks: 1. Will a gun with a long barrel shoot straighter than one with a short one? A. Other things being equal, probably one will shoot with as much precision as the other. 2. What was the name of the first newspaper printed in the world, and where was it published? A. The first periodical newspaper whose existence is not disputed; was published at London, May 22, 1622, by Nicholas Bourne and Thomas Archer. It was called *The Weekly News*. 3. Where was the first balloon voyage made, and who made it? A. At Paris, November 21, 1783, by Pilatre de Rozier, and the Marquis d'Arlandes. 4. How much does the atmosphere surrounding the earth weigh? A. About 11,000,000,000,000,000,000 lbs.

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 Theory of the Sense of Smell. By D. E. G.

On laying out Teeth of Gears. By H. I. C.

On a Museum of Natural History. By J. G. L.

On the Cause of the Tides. By W. M. D.

On Steam on the Southern Rivers. By G. W. S.

On Drying Lumber. By H. R. T.

On a Boiler Explosion. By A.

On Using Old Tin Cans. By J. P.

On Hydrogen. By V. P.

On Modern Telegraphy. By G. L.

On the Keely Motor. By D. D. P.

Also enquiries and answers from the following:

C. W. Y.—D. E. G.—J. T. B.—C. W. B.—H. G. H.—W. W. H.—R. H.

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

Correspondents in different parts of the country ask: Who makes ax helves and similar wooden articles? Who sells electric gas-lighting apparatus? Who makes cotton seed hullers and linters? Who makes a wood engraver's ruling machine? 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

April 14, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Pipe, composition, J. S. Patric	149,603
Planter, C. D. Wilson	149,698
Planter, potato, W. Cousens	149,642
Plow, J. M. Tingley	149,694
Pump, B. W. Felthousen (r)	5,832
Pump, steam mining, A. N. Rogers	149,681
Pump valve box arrangement, W. J. Silver	149,799
Pump valve, steam, J. A. Hagan	149,747
Punch, P. S. Gabrio	149,583
Purifier, middlings, H. S. Jewell	149,662
Purifier, middlings, R. Royer	149,683
Railway rail joint, J. M. Clem	149,722
Railways, collisions upon, Ryder & Plemond	149,794
Railways of snow, clearing, S. G. Smith	149,688
Rake, horse hay, W. S. Archer	149,704
Reflector, C. M. Murch	149,778
Reflector, C. M. Murch	149,780
Rigging connection, H. Gregory, Jr.	149,745
Roadways, removing snow, W. Y. Warner (r)	5,838
Roller and harrow, W. J. Morgan	149,776
Roof, G. Robinson	149,791
Rule, combination, C. H. Hardy	149,655
Sad iron heater, W. Frary	149,582
Sagger, B. Jackson	149,660
Sandal, rubber, J. H. Bentley	149,634
Saw, W. H. Bentley	149,562
Saw, circular, W. P. Hale	149,748
Saw grinding machine, W. Dreyer	149,644
Saw handle, Murray & Winterbottom	149,781
Saw mill, gang, G. W. Nichols	149,600
Saw mills, feed roll for, T. N. Egery	149,645
Saw mills, log turner for, L. P. Gilbert	149,649
Saw set, G. H. Thompson	149,810
Saw swaging machine, W. Glue	149,584
Saw table, F. H. and C. N. Hanna	149,654
Saw tooth swage, A. J. McCollum	149,667
Sawing machine, circular, O. A. Dean	149,643
Sawing machine, wood, J. L. Forker	149,736
Screw blank feeder, W. Aiken	149,627
Screw driver, W. S. Kyle	149,587
Screw threading chuck, W. Aiken	149,628
Screws, making metal, C. M. Spencer (r)	5,836
Separator, grain, H. S. Jewell	149,661
Separator, grain, E. H. Osborn	149,785
Sewing machine, J. and R. Blake	149,565
Sewing machine cabinet, B. F. Loomis	149,767
Sewing machine clutch, Blake & Davis	149,554
Sewing machine needle setter, H. H. V. Lilley	149,764
Sewing machine needle threader, B. P. Elliott	149,580
Sewing machine presser foot, O. Brewster	149,714
Sewing machine tension, R. Blake	149,566
Shaft coupling, W. J. Silver	149,798
Shingles, riving, D. Shankland	149,611
Ships' bottoms, coating iron, S. Williams	149,697
Skewer extractor, H. D. Boss	149,713
Skirt, etc., ornamental felt, J. E. Pollard (r)	5,834
Snow scraper, W. Thompson	149,619
Snow plow, G. C. Thomas	149,618
Soap for washing and bleaching, W. Johnson	149,756
Soldering iron, G. R. Smith	149,801
Soldering tool, D. Weidley	149,816
Soles, cutting rubber, G. H. Ives	149,659
Spark extinguisher, G. D. Gordon	149,742
Spike machine, J. J. McCartney	149,771
Spinning mule, J. Watts	149,815
Steering vessels, E. W. Brooks	149,568
Stone, artificial, J. L. Rowland	149,682
Stove, H. Sprague	149,803
Straw board coating, Sachs *et al*	149,684
Sugar, manufacture of, Duncan *et al*	149,731
Suspender, L. R. Curtis	149,727
Telegraph insulators, C. L. Le Baron	149,762, 149,763
Thrashing machine separator, D. Geiser	149,741
Toy buzz, E. L. Morris	149,596
Toy pistol, G. Geer	149,740
Trap, animal, R. S. Flournoy	149,735
Trigonometer, protracting, J. Lyman	149,590
Turbine wheel casing, Risdon & Tyler	149,607
Twine holder, W. L. Chase	149,720
Type-setting machine, F. G. Foster	149,647
Valve for steam pumps, J. A. Hagan	149,747
Valve, steam slide, J. Youngman	149,822
Vehicle axle, C. M. Murch	149,779
Vehicle hub, P. B. Watson	149,814
Vehicle spring, C. M. Murch	149,777
Vehicle wheel, R. M. Buchanan	149,716
Vehicle wheel, J. B. Withey	149,699
Vehicle wheel hub, J. V. Woolsey	149,625
Veneers, cutting, W. Ellis	149,732
Violin attachment, C. F. Albert	149,702
Washing machine, J. B. and W. H. Cleveland	149,576
Washing machine, H. H. Messenger	149,592
Washing machine, J. W. Ricker	149,606
Washing machine, R. A. Weiss	149,817
Washing machine, W. H. Willis	149,623
Watch chain hook, H. T. Salisbury	149,685
Watch, stem winding, etc., H. R. L. Jones	149,757
Watch balance spring holder, J. Shaw	149,795
Watch dust excluder, C. S. Moseley (r)	5,833
Watch roller abstractor, J. Kay	149,760
Water closet tank, J. Griffiths	149,746
Waterproof compound, J. G. Haley	149,749
Water wheel, T. N. Egery	149,646
Water wheel, Smith & Weld	149,802
Wheels, etc., cutting the teeth of, N. E. Nash	149,672
Wheelbarrow, J. A. Garver	149,737
Whip socket, A. V. M. Sprague	149,614
Whip stock, N. H. Bell	149,710
Whip stock covering, H. J. Bush	149,571
Windmill, C. A. Fargo	149,581
Windmill, Rue & Mann	149,793
Window screen, C. May	149,770
Wire, straightening, F. W. Mallet	149,666
Wrench, adjustable pipe, H. E. Acker	149,559
Wrench, pipe, A. Collis	149,646
Wrist covering spring retainer, T. F. Oliphant	149,784

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:

29,137.—Car Couch.—W. A. Brown. July 1.
29,162.—Plow.—L. Greene. July 1.
29,180.—Hoisting Apparatus.—J. Lemman. July 1.
29,212.—Spring Hinge.—A. Acker. July 1.
29,264.—Boat Lowering.—W. Flowers *et al.* July 8.

EXTENSIONS GRANTED.

27,898.—Reflector.—I. P. Frink. In two divisions.
27,901.—Harvester.—M. Hallenbeck.

DISCLAIMER.

47,113.—Making Bolts.—W. J. Lewis.

DESIGNS PATENTED.

7,365.—Tea Set.—J. Jepson, West Meriden, Conn.
7,366.—Shelf Brackets.—A. Tuttle, Boston, Mass.
7,367 to 7,375.—Carpets.—J. T. Webster, Philadelphia, Pa.
7,376.—Tea Set.—D. C. Wilcox, West Meriden, Conn.
7,377.—Spoon Handle.—B. D. Beiderhase, New York city
7,378.—Door Knob, etc.—B. Mallory, New Haven, Conn
7,379.—Burial Casket.—W. M. Reid, Amsterdam, N. Y.
7,380.—Picture Frame.—M. J. Rice, Boston, Mass.
7,381.—Weather Vane.—A. Simon, Jersey City, N. J.

TRADE MARKS REGISTERED.

1,716.—Braids, etc.—Arnold *et al.*, New York city.
1,717.—Catarrh Medicine.—J. E. Dotch, New York city.
1,718.—Liquors.—E. C. Hazard & Co., New York city.
1,719.—Fertilizer.—J. Horner, Jr., Baltimore, Md.
1,720.—Petroleum Product.—E. F. Houghton & Co., Philadelphia, Pa.
1,721.—Pictures, etc.—Peirce *et al.*, New Bedford, Mass.
1,722.—Gin.—Richardson *et al.*, Cincinnati, O.
1,723.—Hats.—S. Shethar & Co., New York city.
1,724.—Worm Proof Paint.—J. D. Stanley, Wilmington, N. C.
1,725.—Whisky.—Anderson Distillery Co., Louisville, Ky.
1,726.—Fertilizers.—Walton & Co., Wilmington, Del.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
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On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

List of Patents Granted in Canada.

April 15 to April 17, 1874.

3,294.—J. H. Thorp, Chicago, Cook county, Ill., U. S. Portable burglar alarms, called "Thorp's Revolving Bell and Taper Lighting Burglar Alarm." April 15, 1874.

3,295.—T. K. Knapp, Dansville, Livingston county, N. T. Knife and scissors sharpener combined, called "Knapp's Knife and Scissors Sharpener Combined." April 15, 1874.

3,296.—T. K. Knapp, Dansville, Livingston county, N. T. Improvements in mops, called "Knapp's Improved Mop." April 15, 1874.

3,297.—T. Piper, Hamilton, Wentworth county, Ont. Improvements in clutching devices for driving sewing machines, called "Piper's Improved Clutching Device for Driving Sewing Machines." April 16, 1874.

3,298.—R. Porter, Bothwell, Kent county, Ont. Machine or auger for boring pumps and other tubing, called "Porter's Improved Hollow Auger." April 16, 1874.

3,299.—B. L. Rowley, New Britain, Hartford county, Ct. Improvements on bridle bits, called "Rowley's Bridle Bit." April 16, 1874.

3,300.—T. T. Pearson and C. A. McLane, Hopewell Corner, Albert county, N. B. Steam generator, called "Pearson's Magic Steam Generator." April 16, 1874.

3,301.—H. Mackinnon, Toronto, York county, Ont. Improvements on coal oil cooking stoves, called "The Novelty Stove." April 16, 1874.

3,302.—I. Birks and J. C. Jouffray, Montreal, P. Q. Composition of matter, to wit, an effervescent drink, called "Ginger Porter or Ginger Stout." April 16, 1874.

3,303.—T. Robertson, Toronto, York county, Ont. Machine for shaping lozenges, called "Robertson's Lozenge shaping Machine." April 16, 1874.

3,304.—C. R. Shelton, New Haven, New Haven county, Conn., U. S. Improvements on driving whips, called "Shelton's Driving Whip." April 16, 1874.

3,305.—R. G. Little, Halifax, Halifax county, N. S. Improvements in churns, called "The Dairymaid's Friend." April 16, 1874.

3,306.—A. Thomson, Hamilton, Wentworth county, Ont. Improvements in the draft power of plows and other agricultural implements, called "Thomson's Extension Swivel." April 16, 1874.

3,307.—G. Boucher de Boucherville, Quebec, P. Q. Arrangement simple et facile autant que sur et commode d'attacher une corde et de sortir de la fenêtre d'un étage superieur, pour descendre en cas d'incendie, sans etre exposé à se frotter aux asperités du mur ou à se hurter aux sallies de la batisse, au moyen d'un crochet et d'un gond. (New mode of using a rope and hook to escape by windows or other openings of any buildings in case of fire, called "Crochet Projecteur.") April 16, 1874.

3,308.—D. D. Tennant, Yonge township, Leeds county, Ont. Improvements on hand seed sower, called Tennant's Hand Sower." April 16, 1874.

3,309.—D. C. McDonald and I. B. Gordon, Rushford, Alleghany county, N. Y. Improvements in horse hay forks, called "McDonald & Gordon's Boss Horse Hay Fork." April 16, 1874."

3,310.—E. Marshall, Iola, Allen county, Kan., U. S. Improvements on washing machines, called "Marshall's Washing Machine." April 16, 1874.

3,311.—A. Strain, Greenfield, Highland county, O. Improvements on car couplings, called "Strain's Improved Car Coupling." April 16, 1874.

3,312.—I. Hanrahan, Ottawa, Carleton county, Ont. Improvement on rock drills, called 'Hanrahan's Rock Drill." April 16, 1874.

3,313.—I. G. Covey, St. John's, N. B. Improvements on coal oil lamp stoves, called "Covey's Lamp Stove." April 16, 1874.

3,314.—C. B. Pettengill, Hebron, Oxford county, Me., U. S. Improvements on kitchen implements, called "Berry's Kitchen Implement." April 16, 1874.

3,315.—W. A. White, Toronto, Ont., assignee of J. F. Ross, same place. Clothes bracket, called "The Double Bracket Clothes Dryer." April 16, 1874.

3,316.—E. A. Smith and E. H. Roberts, Toronto, York county, Ont. Burglar-proof lock attachment, called "Smith & Roberts' Burglar-Proof Lock Attachment." April 16, 1874.

3,317.—I. B. Camyré, Montreal, Can. Improvements on boilers for washing clothes by steam, called "Camyre's Combined Steam Washer and Rinser." April 16, 1874.

3,318.—I. Gray and H. F. Teeter, Teeterville, Ont. Improvements on springs for all kinds of vehicles, called "Gray's Improved Elliptic Spring." April 16, 1874.

3,319.—C. Parker, assignee of G. Geer and O. I. Range, all of Meriden, New Haven county, Conn. Improvements on bootjacks, called "The Parker Adjustable Bootjack." April 16, 1874.

3,320.—C. Lockman, J. M. Davies, and A. Hammond, Hamilton, Wentworth county, Ont. Device for uniting strips of cloth, rags, selvage, etc., for rag carpets, called "The Ladies' Favorite Rag Carpet Joiner." April 16, 1874.

3,321.—A. F. Burnham, Borough of York, York county, Pa., U. S. Improvements on turbine water wheels called "N. F. Burnham's 1874 Turbine Water Wheel." April 16, 1874.

3,322.—A. Wynne, Indiana, Indiana county, Pa. Improvements on fireplaces, called "Wynne's Fire Grate." April 16, 1874.

3,323.—A. Smeaton, Quebec, P. Q. Improvements on tailors' squares, called "Smeaton's Oblong Tailors' Square." April 16, 1868.

3,324.—M. Day, Jr., Mansfield, Richland county. Improvements in electric lights. April 16, 1874.

3,325.—J. H. Bean and W. H. Fisher, Cincinnati, O., U.S. Improvements in hemmer attachments for sewing machines, called "Bean's Hemmer Attachments for Sewing Machines." April 17, 1874.

3,326.—R. Mackenzie, Montreal, P. Q., assignee of W. Perry, Jr., same place. Improvements on machine for making spiral springs, called "Perry's Spiral Spring Machine." April 17, 1874.

3,327.—J. M. Wilders, Croxton Kerrial, Leicester county, Eng. Improvements on thrashing machines, called "Wilder's Improved Thrashing Machine." April 17, 1874.

3,328.—R. H. Brown, J. M. Caller, and W. A. Perkins, Salem, Essex county, Mass.; J. A. Enos, Peabody, Essex county, Mass.; and O. C. Smith, Ipswich, Essex county, Mass. Improvements on leather-dressing machines, called "The Union Leather Whitening and Buffing Machine." April 17, 1874.

Advertisements.

Back Page - - - - - - -	**$1.00 a line.**
Inside Page - - - - - - -	**75 cents a line.**

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

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Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

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ILLUSTRATED PRICED MANUALS, in four parts, viz. 1st. MATHEMATICAL. 2d. OPTICAL INSTRUMENTS. 3d. MAGIC LANTERN. 4th. PHYSICAL AND SCHOOL APPARATUS. Mailed to any address for 10 cts. each. JAMES W. QUEEN & CO., 601 Broadway, New York. 924 Chestnut Street, Philadelphia.

WANTED—Proposals for constructing a first class **TOWER CLOCK.** C. F. CARPENTER, Louisville, Ky.

FOR SALE, CHEAP,

FIFTEEN HORSE ENGINE AND BOILER, in running order. 63 Fulton St., N. Y.

A RARE CHANCE—TO LIQUIDATE A Partnership, Messrs. W. W Carre & Co. offer for sale their extensive saw-milling establishments at Logtown, Pearl River, Miss. Address JOHN W. RUSSELL Commission Timber Dealer, 57 Broadway, New York; or to W. W. CARRE & CO., 330 Delord St, New Orleans.

BARTLETT'S "Boulevard," "Street," and "Park" Lamps—**Price List, April 15, 1874.**

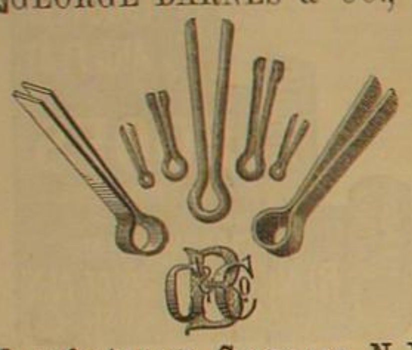
"Park" size, plain style, glass 9x14	$3 00
"Street" size, plain style, glass 10x16	5 00
"Boulevard" size, plain style, glass 15x20	6 50

Reflectors furnished with each size from $1 to $3 each, according to size and finish. Iron supporting frames or brackets, $1.
Fancy and the ordinary old style square street lamps furnished from $ 3 upward, according to style and quality. Factory Sales-room, No. 569 Broadway, New York.

REYNOLDS & CO.

MANUFACTURE *Screws & Bolts* For Machinery of every variety. ALSO Bridge and Roof Bolts. STEEL & IRON SET SCREWS A specialty. Also, Small Articles for Patentees, in great numbers, at No. 145 East St., New Haven, Conn.

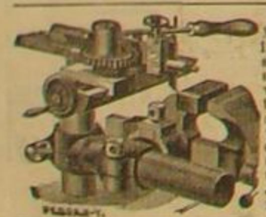
GEORGE BARNES & CO.,



Manufacturers, Syracuse, N. Y.

Improved Foot Lathes.

Small Engine Lathes, Small Gear Cutters, Hand Planers for metal, Ball Turning Machines, Slide Rests, Foot Scroll Saws. The very best. Selling everywhere. Catalogues free. N. H. BALDWIN, Laconia, N. H. Just the articles for Artisans or Amateurs.



Universal Hand Planing Machine, a labor-saving invention, attached to any vise, to bench with stand and chuck, or to work itself, set to work in any direction in a moment. Up and down feed to Tool; reversible self cross feed. Quickly saves its cost in hands of all metal working mechanics. JACOB E. SUITTERLIN, mf'r, 60 Duane St., N. Y.

Grant's Lightning Screw Plate.

The only screw plate in the world that makes perfect threads—equal to lathe work—at a single cut. Will do at least five times as much as any other. Also a large variety of Bolt Threading Machines of novel and improved construction. Fine friction clutches. WILEY & RUSSELL, Greenfield, Mass.

KEYSTONE PATENT FORGES (FAN BLAST,) Large or Small, Portable or Stationary, for Hand or Power. Best and Cheapest for every class of work. Keystone Portable Forge Co., Philadelphia.

MORRIS, TASKER & CO.,

PASCAL IRON WORKS, PHILADELPHIA,

TASKER IRON WORKS, NEWCASTLE, DELAWARE.

OFFICE .... FIFTH AND TASKER STREETS, PHILADELPHIA.
OFFICE AND WAREHOUSE .... NO. 15 GOLD STREET, NEW YORK.
OFFICE AND WAREHOUSE .... NO. 36 OLIVER STREET, BOSTON.

Manufacturers of Wrought Iron Welded Tubes, plain, galvanized, and *rubber coated*, for gas, steam and water, Lap-Welded Charcoal Iron Boiler Tubes, Oil-Well Tubing and Casing, Gas and Steam Fittings, Brass Valves and Cocks, Gas and Steam Fitters' Tools, Cast Iron Gas and Water Pipe, Street Lamp Posts and Lanterns, Improved Coal Gas Apparatus, &c. ☞ We would call the

Especial Attention to our Patent Vulcanized Rubber-coated Tube.

THOMAS T. TASKER, JR. STEPHEN P. M. TASKER.

SAWS.

EMERSON'S PATENT INSERTED TOOTHED CLIPPER, expressly for heavy feed, will saw 50,000 feet of lumber in 10 hours.

The Patent Flange Tooth is the cheapest Inserted Toothed Saw ever made. Has *been in use more* than four years, and gives perfect satisfaction.

N. B.—The Patent Adjustable Swage given with each INSERTED TOOTHED SAW.

Also, our *Patent* Ready Gummed and Solid Saws of all kinds.

THE PATENT PLANER SAWS are superseding all others. 500 teeth given with each saw that will cut 500,000 feet of lumber without sharpening. The teeth are now made by a new process, every one perfect. This Saw will cut more and better lumber than any other saw in the world.

All Goods Warranted of Superior Quality.

SAWS.

EMERSON'S PATENT ADJUSTABLE SAW SWAGE, lengthens the tooth and spreads it at the same time.

Sent prepaid to any part of the United States or Canada, on receipt of Price, $5.00, or sent C. O. D.

EXTRA THIN CIRCULAR SAWS. For Circular Saw Mills.

With Cast Steel or Gun Metal Collars, for resawing, veneer saws, Shingles, Clapboards, Looking Glass, and Picture Frame Backs, and all kinds of thin lumber.

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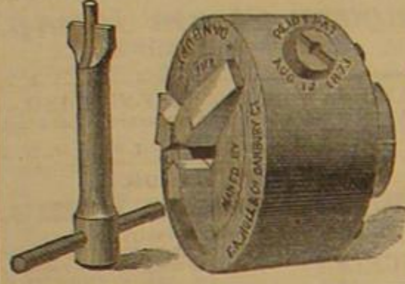

THE "DANBURY" Universal Drill Chuck

C. H. REID'S PATENT, AUGUST 12, 1873,

A success. Heartily endorsed by all using it. Stronger and **more durable** than any other. Holds drills from 0 to ⅝, full size, and will hold much larger by turning down shanks to ⅝. Is operated quickly and always easily; cannot clog, **set**, or in any way **get out of order.** Has now been a year in constant use, working perfectly. All are sold with full warrant, to be returned if not satisfactory. F. A. HULL & CO., Manufacturers, Danbury, Ct. Send for Illustrated Descriptive Circular.

Troy, N. Y., Feb. 16, 1874.

B. F. STURTEVANT, Esq.,
82 SUDBURY STREET,
Boston, Mass.

Dear Sir:
At 6.30 a.m., on Friday, Feb. 13, 1874, we put the blast on two Cupolas, and in twenty-four hours from that time had melted

625,000 LBS. OF METAL; TWENTY PER CENT. OF WHICH CONSISTED OF STEEL SCRAP IN LARGE PIECES.

We accomplished this with the blast from **ONE OF YOUR No. 8 PRESSURE BLOWERS,** and did not increase its speed any over that at which it has been running in our works for several years past.
Believing this to exceed anything on record.
I remain,
Yours truly,
ROBERT W. HUNT, Supt. Bessemer Works, of Messrs. JOHN A. GRISWOLD & CO.

C. HENRY HALL & CO., 20 Cortlandt St., N. Y. City.

THE PULSOMETER.

The simplest, most durable and effective STEAM PUMP now in use. Will pump gritty or muddy water without wear or injury to its parts. It cannot get out of order.

Branch Depots:
11 Pemberton Square, Boston, Mass.
1327 Market St., Philadelphia, Pa.
59 Wells Street, Chicago, Ill.
South Western Exposition, New Orleans.
811 & 813 North Second St., St. Louis, Mo.

J. G. ROGERS & CO., Madison, Ind., are the original introducers of **TANNATE OF SODA** for cleaning boilers. Their preparation of this Salt was patented May 21st, 1871. Its success has led to many fraudulent imitations against which the public is warned. *Their T. S. is the solid Salt itself—no dilution.* ONLY 1 TO 2 OUNCES DAILY REQUIRED. Price 35c. a lb. Send for book. References: Remington & Sons, Ilion N. Y.; Root Steam Engine Co., N. Y.; Owens, Lane Dyer & Co., Hamilton, O.; Oneida Community, Oneid., N. Y.

American Saw Co.

Removes its Business Office, May 1st, 1874, to TRENTON, N. J.

STEAM BOILER AND PIPE

COVERING

Saves ten to twenty per cent. CHALMERS SPENCE CO., foot E. 9th St., N. Y.; 1202 N. 2nd St., St. Louis, Mo.

Samples from B. E. Hale & CO., 56 and 58 Park Place, N. Y. Sole Agents for Eastern States.

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Samples from Rock River Paper Company, Chicago, Ills.

DAMPER REGULATORS **BEST** AND LEVER GAGE COCKS. MURRILL & KEIZER, 44 Holliday St., Balt.

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L. & J. W. FEUCHTWANGER, Chemists, Importers of Drugs, Chemicals, Minerals, etc., have removed from 55 Cedar St. to No. 180 Fulton St., two doors above Church St., New York.

IMPROVED 1874.
DOUBLE ACTING
BUCKET-PLUNGER

SteamPumps

ALWAYS RELIABLE.
VALLEY MACHINE COMPANY,
Easthampton, Mass.

Working Models

And Experimental Machinery, Metal, or Wood, made to order by J. F. WERNER, 62 Center st., N. Y.

ENGINES AND BOILERS, New and Second Hand, Portable and Stationary. For description, address GOODWIN & WHITE, Oil City, Pa.

IRON PLANERS,

ENGINE LATHES, DRILLS, &c. Send for Price List. NEW HAVEN MANUFACTURING CO., New Haven, Conn.

NOYE'S

Mill Furnishing Works

are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for catalogue. J. T. NOYE & SON, Buffalo, N. Y.

N. Y. STEAM ENGINE CO. 98 CHAMBERS ST. N. Y.
We make Without Charge, For Patterns, GEAR WHEELS, with our Patent Moulding Machine.

FOR **Machinists' TOOLS,** *OF ALL KINDS,* ADDRESS: N. Y. Steam Engine Co. 98 Chambers St. NEW YORK.

☞ T. V. Carpenter, Advertising Agent. Address Box 773, New York city.

HART'S PATENT SAW SET

Upon trial, will be found to be the most powerful and simple Saw Set ever offered to the public. Care has been taken to make the parts of the best material and of proper proportions to give the greatest strength. Directions for using accompany each Set. For sale at all hardware stores, or sent by mail, prepaid, on receipt of one dollar. UNION NUT CO., 78 Beekman St., N. Y.

R. A. Vervalen's Brick Machines,

Made at Haverstraw, Rockland Co., N. Y. Making nine tenths of all the brick used in the State. Send for circular.

NEW-YORK STEAM ENGINE CO.
MANUFACTURERS OF
MACHINISTS' TOOLS
OF ALL DESCRIPTIONS
CHAS. A. CHEEVER TREAS. GEO. O. DOW. SECY. No. 98 CHAMBERS ST. NEW-YORK

HOUSTON'S PATENT

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