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[NEW SERIES.]

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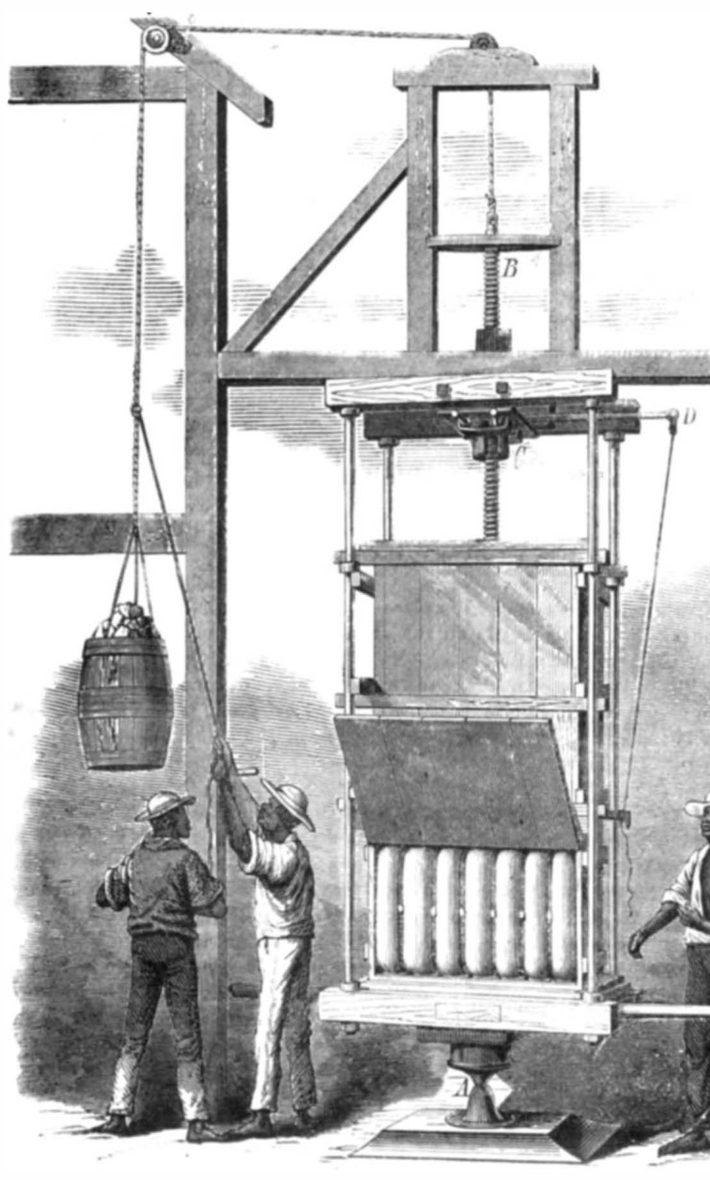
BALANCED SCREW AND REVOLVING COTTON PRESS.

The several points of merit claimed for the improved cotton press herewith illustrated are simplicity of construction, rapidity, and reliability of action, and the saving in time of pressing effected. These, with other advantages below noted, combine to render the device suitable for employment by cotton raisers, or applicable to the pressing of tobacco, hay, hops, cloth, paper, hair, hemp, moss, cider, wine, rags, straw, and, in brief, to any operation where inventions of similar nature are now employed.

The apparatus, as shown in the illustration, revolves on the pivot, A. The screw, B, having a crosshead which travels in the guides on the upper part of the frame, extends down through a nut, C, on the revolving portion. To the upper portion of the screw is attached a cord which, passing over suitable pulleys, carries a barrel of stones or similar counterpoise.

The nut, C, is made in two sections which, by means of the lever attachment, D, may be closed together or opened at will. When the parts are closed and the lower portion of the press rotated on its pivot, by means of the handles shown, the screw, acting on the nut, is necessarily caused to travel downwards, so forcing down the follower and compressing the material. When the pressure is finished, instead of it being necessary to turn the press in the opposite direction, and so waste time in raising the screw to its former position, the sections of the nut are opened, releasing their engagement with the screw, which is then lifted bodily by pulling down on the counter weight, as represented in the figures on the left. It is claimed that, through the economy of time thus effected, one third more bales per day can be pressed. After the cotton box is filled, the follower block does not require to be turned down three or four feet before reaching the point at which pressure begins, but is lowered or dropped at once, so that the real work commences with the first revolution of the machine.

The press, if desired, can be run by steam power, a belt being placed on the drum under the cotton box. It can be located in the lint room or erected as shown in the engraving, by framing a supporting beam into the gin house and allowing the apparatus to stand near to and outside the the buildings. The frame is of iron or wood, as desired, is portable, and occupies no extra space. Five hundred pound bales are readily made with two hands, or animal power may be applied if required.



BALANCED SCREW AND REVOLVING COTTON PRESS

By a slight change in the adjustment of the nut, the machine can be converted into a tramper press, the screw and follower being used to pound the lint in the box down into its place, thus obviating the injury to the health of the workers who enter the receptacle and tramp the material with their feet.

The invention was patented April 10, 1871, since which time it has been modified and improved in many particulars. It is now in successful use in many localities in the South, and gained a premium at the late St. Louis fair. The manufacturers state that other forms of the press, arranged so that the screw works upward, so that the bale may be removed from the top will shortly be offered. July and August being the months in which cotton presses are principally used, planters and others desiring further particulars regarding sale of State and county rights, or for presses, should lose no time in addressing J. H. Woolfolk, Box 295, Vicksburg, Miss. The special agent for Texas, Louisiana, Mississippi, and Alabama, is Dr. D. R. Lemman, New Orleans, La.

More Machine Honesty.

The "knockdown" system, as the appropriating of fares collected by stage drivers and car conductors is termed, is not, it seems, peculiar to this country. The employees in the London street car lines have been resorting to the same means of increasing their wages. From the fact that people pay fare according to the distance they travel in most of the London conveyances, it will be seen that it is a very easy matter for the conductor to collect a certain sum for the longest ride, but to hand in the amount necessary to pay for the shortest, pocketing the difference.

Mr. Weir, has recently devised an apparatus which, the London *Times* says, works excellently, and which will probably come into general use in that city. A bronze door is placed across the entrance of the vehicle, so arranged that but one person can pass through at a time. Then in a small locked metal box is a registering apparatus which consists of a slip of paper which is pricked at the entry or exit of each passenger. The needle which makes the mark and the band of paper is set in motion by the opening of the door, so that each passenger is indicated by a separate puncture. In order to denote exactly how many people paying a certain fare are to be accounted for, at every station on the line at which a change in price is made a projection is fixed in between the tracks. Against this, as the car passes over, a small wheel connected with the registering mechanism by a pneumatic apparatus strikes, so that, by suitably moving the indicators, a blank space of some length is left after the last puncture denoting the lower fare. At the end of the journey, the slip of paper is removed, and gives the exact number of fares of every amount for which the conductor is responsible. The conductor is provided with a peculiar key in order to let himself out of the vehicle to make his collections, and an indicator marks each time that he does so. The above appears to be a rather complicated method of making conductors honest, but it may do for London.

The Spontaneous Combustion of Charcoal.

Professor F. Hargreaves states that the kinds of wood generally used for the manufacture of gunpowder charcoal are the black dogwood, the willow, and the alder. They are all well adapted for the manufacture of charcoal, although the dogwood is always used for the best sporting gunpowder. The wood is converted into charcoal by heating it in iron cylinders.

After the charcoal is taken from the cylinders, it is placed in iron coolers provided with tightly fitting lids, and allowed to stand for 14 hours, by which time it is generally quite cold, when it is sent to the charcoal mill to be ground, and afterwards to be mixed with the other ingredients for gunpowder.

But there are examples where the charcoal has spontaneously taken fire on the day after grinding. This is owing to the fact that charcoal absorbs mechanically within its pores a large quantity of oxygen gas from the atmosphere; and the condensation of all gases liberates heat, and, charcoal being a bad conductor, the heat cannot escape. The amount of oxygen absorbed by the charcoal varies with the degree of carbonization; the higher the heat, the more gases it will absorb.

The absorption with sticks of charcoal is not so quick as with ground charcoal: hence the spontaneous combustion of stick charcoal does not occur so often.

Fighting Fire with Explosives.

Western settlers, when a prairie is in flames, find that the only and best means of protecting menaced property is to plow up the ground around the latter for a width of several yards. Over this the fire cannot pass, for the simple reason that it finds nothing upon which to feed. The sole effective method by which the ravages of any great conflagration can be checked (and the truth was amply demonstrated in Boston and Chicago) consists in following the same plan; and in crowded cities, by destroying buildings adjacent to the burning locality, the latter can be entirely isolated from other portions, so that the fire may be confined to a limited area, on which may be concentrated the entire force of the extinguishing apparatus. The value of this heroic remedy is becoming widely recognized, and in this city a corps of sappers and miners has been organized, comprising fifty-six persons selected from the officers of the Fire Brigade, who are being regularly instructed in the use and nature of explosives, electric fuses, etc.

The first public experiments of the organization recently took place on Ward's Island, in the neighborhood of this city. A number of brick walls were erected, of various thickness, having a depth below the ground of one foot, and built upon a timber foundation. The first wall attacked was 20 inches thick, and the object of the experiment was to show the comparative effects of mining powder and dynamite suspended in cubical boxes against it. Fifty pounds of mining powder barely blackened the bricks, while six pounds of dynamite in a box 5 by 5 inches, cut a hole through the wall of about the size of the box. Then experiments followed in cutting down masonry varying in thickness from 8 to 36 inches, with cartridges containing from one to five pounds of dynamite, the effect being to divide the walls at the marked places with great accuracy. Floors were also torn up with the same powerful material, and finally seven walls were blown to fragments by a continuous line of cartridges arranged in rubber tubes and covered with bags of sand.

The trials were mainly very successful, and showed that by the use of explosives not only could whole buildings, during great fires, be quickly demolished, but, in smaller conflagrations, the dynamite cartridge could be advantageously used in gaining rapid access to edifices through walls. This proceeding now requires lengthy labor with axe and pick, the flames in the time thus lost often making serious headway.

The Solar Eclipse of April 16.

A total eclipse of the sun was observed by Mr. Stone, English Astronomer Royal at the Cape of Good Hope, on the 16th of April last. The line of totality passed over the southern extremity of Africa, beginning at Port Nolloth on the west coast of Cape Colony, somewhere about 250 miles from Cape Town, and took a curved path, with the convexity turned toward the north, ending at sunset about half way across.

The day was especially favorable for observation, and the sky was entirely free from clouds. Mr. Stone states that the rose-colored flames extended very nearly around the moon, although, of course, of unequal hights at different parts. The spectrum near the moon's limb was carefully examined in order to discover fresh lines, but none appeared, and hence there cannot be any medium capable of producing sensible absorption of light around the moon.

At the instant of totality the whole field appeared full of bright lines, all the principal Fraunhofer lines being reversed. Mr. Stone's observations tend to confirm those of the eclipses of 1869, 1870, and 1871, and their most important portion is that referring to the visibility of the Fraunhofer lines in the spectrum of the coronal atmosphere, showing thereby that that reflects the light of the photosphere.

A DEATH from hydrophobia recently occurred in Philadelphia about four months after the bite was given.

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Contents:

(Illustrated articles are marked with an asterisk.)

GOVERNMENT AID TO SCIENTIFIC INVESTIGATION.

Those who had the good fortune to hear the closing lecture of the series delivered by Professor Tyndall in this country will not soon forget the eloquent tribute he paid to scientific investigators, intent on the discovery of truth regardless of its bearing on practical ends, or the earnestness with which he insisted on the public duty of supplying them with means for their work.

The appeal was as plausible as eloquent. At first sight nothing would seem more reasonable than that the public at large, whose indebtedness to Science is so great, should do something towards supporting those who carry on the work; or that any means which should honorably relieve original investigators of the daily drudgery of earning a living, and at the same time supply them with the fullest apparatus for their researches, would immensely increase their productions.

But when we remember that in every age there have been plenty of scientific men who have had at command all that money or position could give, yet have remained comparatively barren, while the great discoveries, more especially the original views opening up new lines of thought and giving new directions to human industry, have usually come from seemingly less favored workers, we cannot escape the suspicion that original thinking is quite as likely to be hindered as helped by easy circumstances. Besides, the best work in Science has rarely been done by men either dependent or very closely allied with the ruling clique of their day, freedom from class prejudice being an essential condition of independent thinking.

No doubt a good deal of honest work might be furthered by aiding the right men at the right time: but such men are rarely the ones that would be reached by public enactment, even if it were possible for them to maintain intellectual independence in connection with personal dependence. Radically new truths are inevitably unpopular, and none but popular men would derive much assistance from the public funds. The endowment of Science would therefore act very much as the endowment of religion has always done, by creating a class of nominal "leaders" whose instincts would be opposed to progress. Having risen to place and power by the advocacy of certain views, how could they give their countenance to men laboring to overthrow such views?

Run over the list of names—from Copernicus to Darwin—of those whose influence has been greatest on the progress of human thought. How long would their owners have been allowed to continue their work at public cost, in the face of popular clamor against their heresies? Had Professor Tyndall's plan been adopted a few hundred years ago, the world would still be flat, the center of the Universe, and only six thousand years old.

In applied Science, the case is equally strong. How long would Fulton have been allowed to squander public money in his "crazy" attempt to propel shipping against wind and tide with "boiled water"? Or Stephenson, in the equally wild project of drawing wagons across the land at the extravagant rate of twelve miles an hour? What administration could sustain the sarcasm of the opposition party after supplying Draper with money to waste in foolish experiments for painting with sunshine, or Morse with means to develop his impious scheme of annihilating time and space? What committee of wise men, having to render an account of their expenditures, would have dared to aid the experiments, of Goodyear in rubber, Young's attempt to make candles out of shale, Bessemer's scheme for making steel direct from the ore, or any one, in short, of the great achievements which, until the events proved their practicability, were accounted visionary, if not impossible, by practical men?

There is another fallacy underlying Professor Tyndall's proposal—one that he has strikingly exemplified in his own person quite recently—and that is the assumption that abundant and complicated apparatus is required for, or at least helpful in, the work of discovery. In some cases it may be; but ordinarily it is quite as apt to absorb the experimenter's attention so that he misses the point of the phenomena entirely. That was a brave array of steamers, fog whistles, artillery and the like, which Professor Tyndall took down to the coast to study the effects of different atmospheres on the transmission of sounds; but he had scarcely published the results of his costly observations when Professor Reynolds made known a few experiments with a hand bell which upset entirely the conclusions the government-aided observer had so jubilantly arrived at.

As a rule, the greatest discoveries are made with the simplest apparatus, the keys which have unlocked the grander mysteries of the Universe being mental rather than material: or, if material, have proved effective through simplicity and skillful handling rather than because of their complexity.

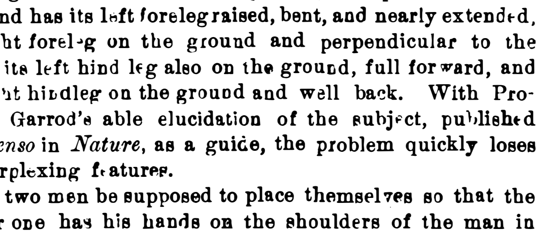
FOUR FOOTED MOTION.

The present exhibition of paintings of the Royal Academy in England contains a picture, by Miss Thompson, entitled "The Roll Call," which depicts a muster of soldiers on the day after a battle.

From the drawing of a horse in the painting, a very interesting discussion has arisen, extending even to eminent naturalists, regarding the motion of four footed animals while walking. The horse, in the picture, is represented walking, and has its left foreleg raised, bent, and nearly extended, its right foreleg on the ground and perpendicular to the same, its left hind leg also on the ground, full forward, and its right hindleg on the ground and well back. With Professor Garrod's able elucidation of the subject, published *in extenso* in *Nature*, as a guide, the problem quickly loses its perplexing features.

Let two men be supposed to place themselves so that the hinder one has his hands on the shoulders of the man in front, and that both walk in step—State's prison gait. Reverting this to the horse, we have the amble, a mode of progression natural to the giraffe, but only acquired by special training in the horse. Again, suppose the two men to put the opposite feet forward simultaneously, in other words, to walk out of step. This will exemplify the trot. Suppose, however, the two men to walk out of step; but instead of the diagonally opposite feet being set down at the same moment, imagine the first man to begin his step a little in advance, so that, by the time the forward man has got his right leg entirely raised, the rear man has just begun to lift his, although they keep the same number of steps. Then the sequence of steps would not be right front and left hind, left front and right hind, coupled; but right front, left hind, left front, right hind, separate and distinct. Professor Garrod has a simple and graphic way of expressing this, thus:

A



The dark dashes mean the times of contact of the right foot, the dotted lines same of the left foot. The two upper horizontal rows refer to the fore legs; the lower, to the hind. The dotted lines, beginning exactly where the continuous ones end—considered horizontally—indicate that one foot is lifted exactly when the other is put down.

From this it will be seen that, in walking, the horse never has more than two legs on the ground at a time. Draw a vertical line through any portion of the diagram, as at A, and it will be clear that only two of the horizontal foot lines are cut. The same line shows the picture referred to in the beginning to be correct, with the exception of one slight error. Following line A down, we find the first dotted line at the top, meaning the left fore foot, not cut; hence it is off the ground. The next line is divided squarely in the middle, and hence the right fore foot must be firmly planted. The dotted line below is just met at its beginning, consequently the left hind foot is about to commence its step; and the next line being at its rear end indicates that the right foot has just finished, and is being removed from the ground. If the reader will compare this with the foregoing description of the painting referred to, he will find that the correspondence is complete, excepting as regards the right hind foot, which, instead of being on the ground as represented, should, according to our diagram, be just leaving it. This also would be in accordance with the rule that no more than two legs can be down at a time, and thus the mistake which the artist makes in fixing three would be avoided.

We would commend the diagram herewith presented as a very simple guide for artists and draftsmen generally, as, by following its indication, they can hardly fail to depict the horse correctly. A general idea of the position of the animal being first settled upon, it is only necessary to draw perpendicular lines at various points, and try the results until a suitable *pose* is obtained. The figure very clearly solves a question over which many heads, wise and unwise, have often puzzled.

THE RAILWAYS OF THE UNITED STATES.

The seventh annual "Manual of Railways of the United States," by Henry V. Poor, 68 Broadway, New York, has just been published. It is a work of over eight hundred pages, and contains a large amount of carefully prepared information, including official particulars of all railways in operation, their extent, cost, capital, earnings, dividends, indebtedness, names of officers, directors, etc. The tabulated general statements concerning the American railway system afford valuable and instructive information.

The inauguration of railways in this country may be said to date from the year 1830, when railways were in operation to the extent of 23 miles. At the close of 1873 there were *seventy thousand, six hundred and fifty one miles* of railway in operation. This great increase, during the brief time of forty-three years, is something marvelous to contemplate. The grand average cost is put down by Mr. Poor at $60,000 per mile, or upwards of four thousand millions of dollars in the aggregate. The total earnings were over $526,000,000, and the operating expenses 65 per cent thereof, or $342,600,000, leaving as net earnings the sum of $183,810,000, out of which interest on bonds and stock dividends were paid. The average of the latter were 3·45 per cent on the capital stock, the aggregate of which is one thousand nine hundred millions of dollars.

During the year 1873 the increase in railway construction was 3,916 miles, against 6,167 miles for 1872. The expenditure for construction in 1873 is less by 50 per cent than in 1872. This sudden great contraction in payments, amounting to more than $120,000,000, was disastrous in its effects upon the various branches of industry connected with railway building. But as soon as Congress shall fix upon some decisive settlement of the national finances, whereby a lower rate of interest for the American indebtedness can be established, then railway bonds will improve in value, and a more extensive construction may be expected. As compared with Europe, the United States are considerably in advance in the matter of railway mileage.

The aggregate of railways in 1873 in the various countries of Europe was as follows: Germany, 12 207 miles; Austria, 5,865; France, 10 333; Russia, 7 044; Great Britain, 15,814; Belgium, 1,301; Netherlands, 886; Switzerland, 820; Italy, 3,667; Denmark, 420; Spain, 3 401; Portugal, 453; Sweden and Norway, 1,049; Greece, 100

	Miles.	Population.
Railroads in 1873 in Europe	63,360	282,456,742.
" " United States	70,650	40,232,000.

SOME OF THE USES OF PARAFFIN.

In addition to the properties which have brought it into such extensive use for illuminating purposes, paraffin has qualities which give it an exceedingly wide range of useful applications. White, clean, incorruptible, odorless, tasteless, plastic, water repellent, a non-conductor of electricity, and but slightly affected by most chemical agents: it needs only to be better known to become the most variously useful of the hydrocarbons.

For waterproofing fabrics for wearing apparel, military equipment, and the like, it is much better than rubber, since it is odorless and does not become sticky with heat. Among the most gratefully acknowledged of the many gifts sent out to Livingstone in the wilds of Africa, were boots and blankets thus prepared, the one enabling him to travel through mud, the other to sleep in it with comparative comfort. For the waterproofing of tent cloths, ground sheets for soldiers, and other articles of the sort, it has been found equally serviceable.

A more generally useful application of paraffin is for the lining of casks and other wooden vessels, to keep them sweet and to prevent either the absorption of their contents by the wood or their escape through the pores. Already it has been largely applied to beer barrels, wine casks, and other vessels of the kind, with the happiest results. It keeps them from becoming musty and foul; and still more, by filling the pores and joints of the staves, it prevents the escape of the life of the liquor, carbonic acid gas. Water buckets, butter firkins, and other wooden articles of domestic use might be similarly treated; and as the material is cheap, easily obtained, and easily applied, it can be tried on as large or small a scale as one may feel disposed.

Being indifferent to most chemicals, paraffin serves the same purpose equally well in the laboratory of the chemist and chemical manufacturer. In the manufacture of gun cotton, for example, wooden tanks lined with paraffin have been used for holding the mixture of concentrated sulphuric and nitric acids employed in that process, the protection of the wood being complete and lasting. Wooden boxes, protected in the same way, have been similarly employed in the construction of voltaic batteries. As a non conductor of electricity, paraffin is further useful, as an insulator, for which it is now extensively employed in electric telegraphy; also in connection with batteries for medical use, especially as an acid-proof coating to insulated conducting wires. In surgery, it has been found an excellent material for covering for splints in cases of fracture.

Those troubled with loosely fitting plates of artificial teeth, owing to absorption of the gums, can easily remedy the defect by dropping upon the plate a little melted paraffin, from a lighted candle or otherwise, replacing the plate while the paraffin is yet warm. Being clean, tasteless, plastic at a low temperature, and unaffected by saliva, this substance will be found much superior to wax or any other material for the use, a few drops rightly placed making a perfect fit with a plate otherwise unwearable.

In the laundry, paraffin rubbed on the hot flat iron imparts a beautiful gloss to starched goods, greatly lightens the labor of ironing, and leaves no greasy stain. For this use it is much superior to spermaceti. Friction matches are now prepared with paraffin in place of the sulphur formerly employed; it burns without odor and goes out instantly, greatly reducing the dangers of accidental fires. Dissolved in naphtha, paraffin has been applied with excellent effect to decaying brick and stone work, filling the pores of the brick or stone and putting a stop to the destructive action of the weather. Fine wood work exposed to the elements might be protected in the same way. Heated with sulphur to a moderately high temperature, paraffin is decomposed, with the evolution of abundance of sulphuretted hydrogen. A steady and copious flow of this indispensable reagent in the laboratory is thus easily and cheaply obtained.

REFRIGERATING MIXTURES AND THEIR PHYSIOLOGICAL EFFECTS.

All solid bodies when becoming liquid, all liquids when assuming a gaseous state, absorb heat. The chemical compounds known as refrigerating mixtures are based on one or the other of these changes of condition. The Carré ice machine, it will be remembered, operates through the liquefaction of ammoniacal gas and the return of the same to a gaseous condition. At the moment of vaporization of the liquid, a lowering of temperature takes place, sufficient to cause the formation of considerable quantities of ice. Hydrated sulphate of soda and hydrochloric acid, and ordinary ice and salt, are examples of freezing mixtures, of which perhaps a score more could be cited, the effects of all of which are well known to chemists.

There is one of this class of compounds, which, although not a stranger to the chemical laboratory, has recently been found to possess greater frigorific capabilities than any other mixture yet discovered. We allude to ice and sulphuric acid, into the properties of which M. Berthelot, of the French Academy of Sciences, has recently made some interesting investigations.

It is well known that, in winter, crystals of hydrated sulphuric acid ($S^2O^4,H^2O + H^2O$) are easily obtained. These M. Berthelot mingles with ice, and he calculates the resultant cooling, first from the ice liquefied, and second by the acid also liquefying and the disengagement of heat due to its mingling with the water. On using 1·7 ounces of acid and 4·5 ounces of water, the investigator calculates the fall in temperature to be 125·6° Fah. If the mixture be made, not at the ordinary temperature, but at say 68° Fah., the mercury should fall fully 140°, so that at the end of the experiment the thermometer will mark —112° Fah. These are calculated results, but M. Berthelot is of opinion that, according to his theory, he will be able to reach —148° Fah., and perhaps absolute zero, about —516° Fah.

Substances when brought to such extremely low temperatures act very energetically as a rule upon the body. Solidified carbonic acid at a temperature of —111·6° produces serious burns when compressed between the fingers, injuring the skin in a manner similar to a red hot iron. Late discovery has, however, found that this frigorific effect varies strangely with the nature of the cold object which is brought in contact with the skin or mucous membrane. Melsens, a well known Belgian chemist, has recently called the attention of the Academy of Sciences of Belgium to the fact that brandy, frozen to a temperature of from 22° to 31° below zero Fah., by means of a mixture of ice and chloride of calcium, can be eaten with impunity and possesses a flavor superior to that of the liquor in its ordinary state. The temperature of any alcoholic beverage may thus be reduced without the material hurting the tongue. A wooden spoon must be used, as a metal one burns the mouth very quickly. The investigator says that not until the liquor is cooled to 76° below zero is any sensation of cold experienced; and it has been eaten at —95°, causing no more uneasiness to the eater than a mouthful of rather hot soup. It is remarkable that brandy at 95° placed on the arm, makes only a slight irritation, while ether paste or solid carbonic acid burns briskly.

The only explanation which seems plausible regarding these exceptional conditions would appear to be that the alcohols, when thus rendered extremely cold, remain enveloped in a certain quantity of vapor which hinders their contact with the organs, in like manner as a layer of steam prevents the contact of a drop of water with a heated plate. M. Melsens is, we understand, prosecuting further investigations, the results of which will doubtless throw more light on the curious phenomena.

PROGRESS OF THE FIRELESS LOCOMOTIVE.

On the New Orleans and Carrolton Railway, they employ the new fireless locomotives to draw the cars from Napoleon avenue to Carrolton, 3½ miles. From Napoleon avenue to Canal street, in center of New Orleans, horses are still in use. The company are now running eighteen of the fireless locomotives, with much success and economy. General G. T. Beauregard is the president of the company. The fireless locomotive has been heretofore illustrated and described in the SCIENTIFIC AMERICAN, having been used to some extent in this vicinity. It is now employed in Brooklyn, N. Y., on the East New York & Canarsie railway. It consists of a hot water tank, which is charged with very highly heated water at the starting station, and the steam which rises from the water is used to drive the engine in the usual manner. No fire is required in connection with the locomotive, but it depends solely for its power on the supply of hot water with which it was originally charged. The object is to provide a substitute for horses in the propulsion of street cars, and to get rid of the gas and other objectionable features of the ordinary steam locomotives. The fireless locomotives of the New Orleans and Carrolton Railway Company have each a pair of 4½ inch cylinders and 11 inch stroke, fitted with link motions and slide throttles. Each machine has one hot water tank 3 feet in diameter and 6 feet long, steam dome 12 inches in diameter and 18 inches high. The tanks are so thoroughly jacketed, with felting, asbestos composition, and wood, that they only lose 3 pounds of steam pressure per hour from radiation. A locomotive charged with hot water at 6 A. M., and left standing until 9 P. M., 15 hours, will then yield steam pressure sufficient to move half a mile or more.

The water is supplied to the tanks of the locomotives from stationary boilers located at Carrolton, and each machine makes a round trip of seven miles upon one charge of hot water. One minute is required to charge each locomotive. The water is supplied at a temperature of 375° Fah., which produces a steam pressure of about 175 pounds to the inch at starting, which becomes reduced, by the time the machine has run 7 miles, to from 40 to 50 pounds. The charging boilers are arranged in two batteries of two boilers each, and these boilers are 26 feet long and 3 feet diameter, built of the best materials. Two boilers only are required for use at once. These fireless locomotives, as substitutes for horses, are found to effect a saving of $4 a day for each street passenger car. The new machines are easily worked, and give much satisfaction. The engineer who works the locomotive is also conductor of the car. He simply stands at one end of the car, with one hand on the throttle lever and the other on the brake. The patent fare boxes are used to receive the fares. The fireless locomotives draw their cars at the rate of 8 or 9 miles per hour.

NEW LAW CONCERNING COPYRIGHTS FOR LABELS.

Heretofore it has been the practice, under the copyright law, to grant certificates of copyrights to every applicant on furnishing a printed copy of the title of his book, work, or print of any sort; and under this practice it has become customary for medicine dealers and others to file in the titles of labels used upon bottles and other articles of merchandize. This has proved to be a very convenient and economical method of obtaining a registration, though it was not considered to be of much value. At its recent session, Congress passed an amendment to the copyright law which changes the place of registration for labels from the Library of Congress to the Patent Office; and raises the official fees on label copyrights from one dollar up to six dollars. The immediate effect of this increase of price will be to reduce the number of copyrights taken; while another feature of the bill, that which provides that the Commissioner of Patents shall only grant copyrights for labels that are not trade marks, will doubtless serve to introduce official red tapeism, vexation and delay into the business of obtaining copyrights, from which it has heretofore been free.

This last provision of the bill appears to authorize the Commissioner to refuse copyright for a label, provided that officer takes a notion that such label is a trade mark. If held to be a trademark, the applicant must pay $25 in order to apply for trademark registration; and the application for a trademark will be then officially examined, subject to the usual liabilities of rejection.

The examinations and opinions of the Patent Office in respect to trademarks or copyrights are not what the people require. They want a simple, quick, and free method of obtaining registration for labels and patterns of every kind, with liberty to contest before the courts, in the usual manner, all issues pertaining to infringements. This is also what is necessary in respect to patents. When will our legislators learn that the true and proper way to encourage authors and inventors, thereby promoting the progress of useful arts, is to make the matter of registration simple and easy, instead of surrounding it with the perplexities and expenses of official inquisitions?

The new law goes into effect August 1st. The following is the text of the bill:

A BILL TO AMEND THE LAW RELATING TO PATENTS, TRADE MARKS, AND COPYRIGHTS.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That no person shall maintain an action for the infringement of his copyright, unless he shall give notice thereof by inserting in the several copies of every edition published, on the title page or page immediately following, if it be a book; or if a map, chart, musical composition, print, cut, engraving, photograph, painting, drawing, chromo, statue, statuary, or model or design intended to be perfected and completed as a work of fine arts, by inscribing upon some visible portion thereof, or of the substance on which the same shall be mounted, the following words, namely: "Entered according to the Act of Congress, in the year ——, by A. B., in the office of the Librarian of Congress, at Washington;" or, at his option, the word "copyright," together with the year the copyright was entered, and the name of the party by whom it was taken out, thus, "copyright, 18 –, by A. B."

Sec. 2. That for recording and certifying any instrument of writing for the assignment of a copyright, the Librarian of Congress shall receive from the persons to whom the service is rendered, one dollar; and for every copy of an assignment, one dollar; said fee to cover in either case a certificate of the record, under seal of the Librarian of Congress; and all fees to be received shall be paid into the Treasury of the United States.

Sec. 3. That in the construction of this act the words engraving, cut, and print shall be applied only to pictorial illustrations or works connected with the fine arts; and no prints or labels designed to be used for any other articles of manufacture shall be entered under the copyright law, but may be registered in the Patent Office; and the Commissioner of Patents is hereby charged with the supervision and control of the entry or registry of such prints or labels, in conformity with the regulations provided by law as to copyright of prints, except that there shall be paid for recording the title of any print or label not a trade mark six dollars; which shall cover the expense of furnishing a copy of the record, under the seal of the Commissioner of Patents, to the party entering the same.

Sec. 4. That all laws and parts of laws inconsistent with the foregoing provisions be, and the same are hereby, repealed.

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW MEAT PRESERVING PROCESS.

M. Sacc has obtained excellent results by using acetate of soda in powdered form. The meat is placed in a barrel and the acetate placed in, when it is left for forty eight hours. Thus prepared, the meat, it is said, will keep for any length of time, and may be prepared for cooking by soaking for 12 hours in water, to every quart of which a quarter of an ounce of sal ammoniac is added.

NEW RELATIONS OF PLANETARY ORBITS.

Professor Daniel Kirkwood announces the discovery of some remarkable relations of the asteroid orbits to those of the larger planets. Near the close of the last century, Laplace noticed a relation between the mean motions of Jupiter's first three satellites; and from the results obtained by that astronomer, it occurred to Professor Kirkwood that similar relations might probably be found in the zone of minor planets interior to the great masses of Jupiter and Saturn. The investigation has led to interesting discoveries, which the author promises shall soon be published in full. As specimens of the correlations detected, he states the following:

1. Five times the mean motion of Concordia *minus* nineteen times that of Jupiter, *plus* fourteen times that of Saturn, equals zero. 2. Five times the mean longitude of Concordia *minus* nineteen times that of Jupiter, *plus* fourteen times that of Saturn, is equal to a semi circumference, or one hundred and eighty degrees.

These discoveries, while tending to throw light upon the genesis of the solar system, may, according to Professor Kirkwood, be explained by the nebular hypothesis of Laplace or equally well by the accretion theory advocated by Proctor, so that they do not tend to confirm the comparative truth of either supposition.

CURIOUS EXPERIMENT IN ELECTRO CAPILLARITY.

M. Becquerel notes another interesting experiment in electro-capillarity. A tube of glass is closed at one of its extremities by a membrane of collodion. With the tube is placed some sulphate of copper, and it is plunged in monosulphide of sodium. Crystallized copper is deposited within the tube, and sulphide of copper outside. Eventually the membrane becomes dissolved and disappears, but without interruption to the phenomena of deposit. The crystaline crust takes the place of the collodion without interrupting the functions. It becomes constantly thicker, metallic copper continuing to form on one side, and the sulphide on the other. It is suggested that this experiment may be of importance from a geological or mineralogical point of view.

REFLECTING POWER OF FLAME.

Recent experiments by M. Sorel prove that carbon retains its reflecting capacity even at the highest temperatures. A sunbeam becomes reflected by diffusion and is polarized in exactly the same manner, whether it falls upon a brilliant flame or upon smoke.

A SIMPLE METHOD OF REMOVING THE TEETH OF CHILDREN.

The operation consists in simply slipping a rubber ring over the tooth and forcing it gently under the edge of the gum. The patient is then dismissed and told not to remove the appendage, which in a few days loosens the tooth and causes it to fall out. Grown children, who shrink from the shock and pain of the dental nippers, may also have their teeth removed by means of the rubber, which is a mild form of treatment.

ADULTERATION IN INDIA RUBBER.

The *Bulletin Thérapeutique* says that, in order to use old and worn out pieces of india rubber scraps left from factories, manufacturers having easy consciences wash the material first in a solution of subcarbonate of soda or potash, and then, when dry, pulverize between cylinders. This powder, placed layer by layer between sheets of new rubber and heated to a certain degree, forms a homogeneous mass, in which the fraud cannot be detected. The mixture is, however, weak in tenacity and elasticity, and is unfit for surgical use, while dangerous for belting or other industrial employments.

STRENGTH OF GLASS TUBES.

M. Cailletet has found that a tube of thin glass, 20½ inches in length and ⅘ of an inch in diameter, was crushed by an exterior pressure of 1,155 lbs. to the square inch, while similar tubes were burst by an interior pressure one half less. In making use of very thick glass, capable of resisting a pressure of four or five hundred atmospheres, he found the glass to sustain no permanent change of form. Upon this fact, he proposes the construction of a very sensitive and very simple manometer.

THE roadway of the great steel bridge over the Mississippi is finished and a train has passed over it. The formal opening of the structure will take place on July 4.

THE EFFECT OF AIR PRESSURE ON ANIMAL LIFE.

In our issue of June 20 we described the important discoveries recently made by M. Bert, in relation to the influence which modifications in barometric pressure exercise upon the phenomena of life. M. Bert's investigations have necessarily been directed to two diametrically opposite conditions, the diminution of pressure and the augmentation of the same; and in our former article we explained the results obtained by researches conducted under the first mentioned circumstances. From an industrial point of view, the examination of the effects of compressed air upon the system, which we now propose to follow, is especially interesting because of the many cases, as in bridge building, diving, etc., in which workmen are obliged to labor in such an atmosphere.

A careful distinction, M. Bert says, must be made between the effects of the mere compression itself and those of a sudden decompression. To illustrate the influence of the latter proceeding upon animals, the apparatus shown in Fig. 1 was constructed. This was a large cylinder of sheet steel into which air was forced by the pump, C, actuated by the gearing at A. At D a worm coil was placed in cold water in order to refrigerate the air, and at E a recipient for the condensed moisture in the blast. *b* is a manometer, and *c* a large valve which, on being opened, allows the compressed air to escape, producing a sudden decompression within the cylinder.

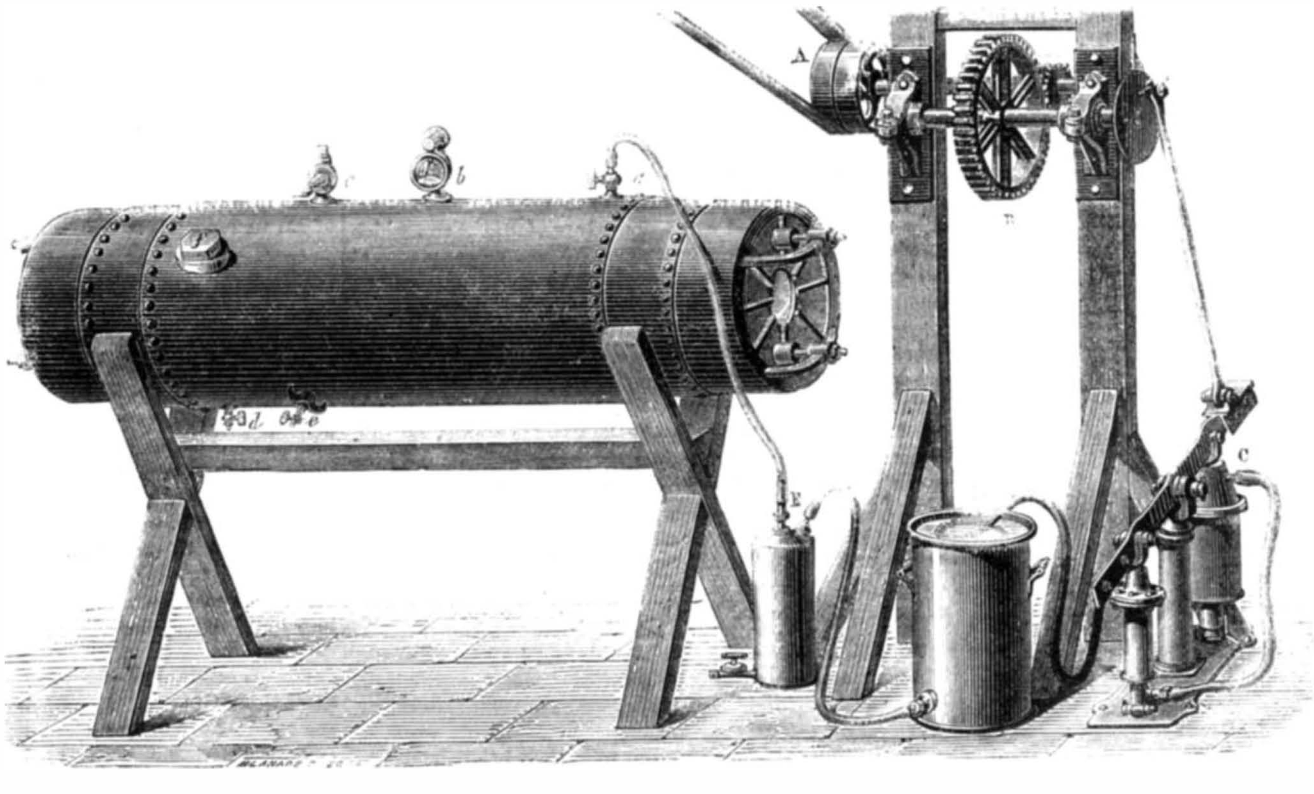


Fig. 1.—APPRATUS FOR SHOWING THE EFFECTS OF COMPRESSED AIR.

Inside the last mentioned receptacle a dog was placed, and air forced in to a pressure of eight atmospheres. After maintaining this pressure for three or four minutes, the escape cock was opened, allowing equilibrium with the exterior air. The animal was then removed, but exhibited no distress, running about the laboratory as if perfectly uninjured. In a short time, however, its motions became feeble, its hind portions appeared to be paralyzed and dragged upon the floor, then the other members became similarly affected, and respiration ceased. On opening the body the vessels were found filled with a mixture of gas and blood, and the heart contained clots. The gas, on examination, proved to be nitrogen with a small admixture of carbonic acid.

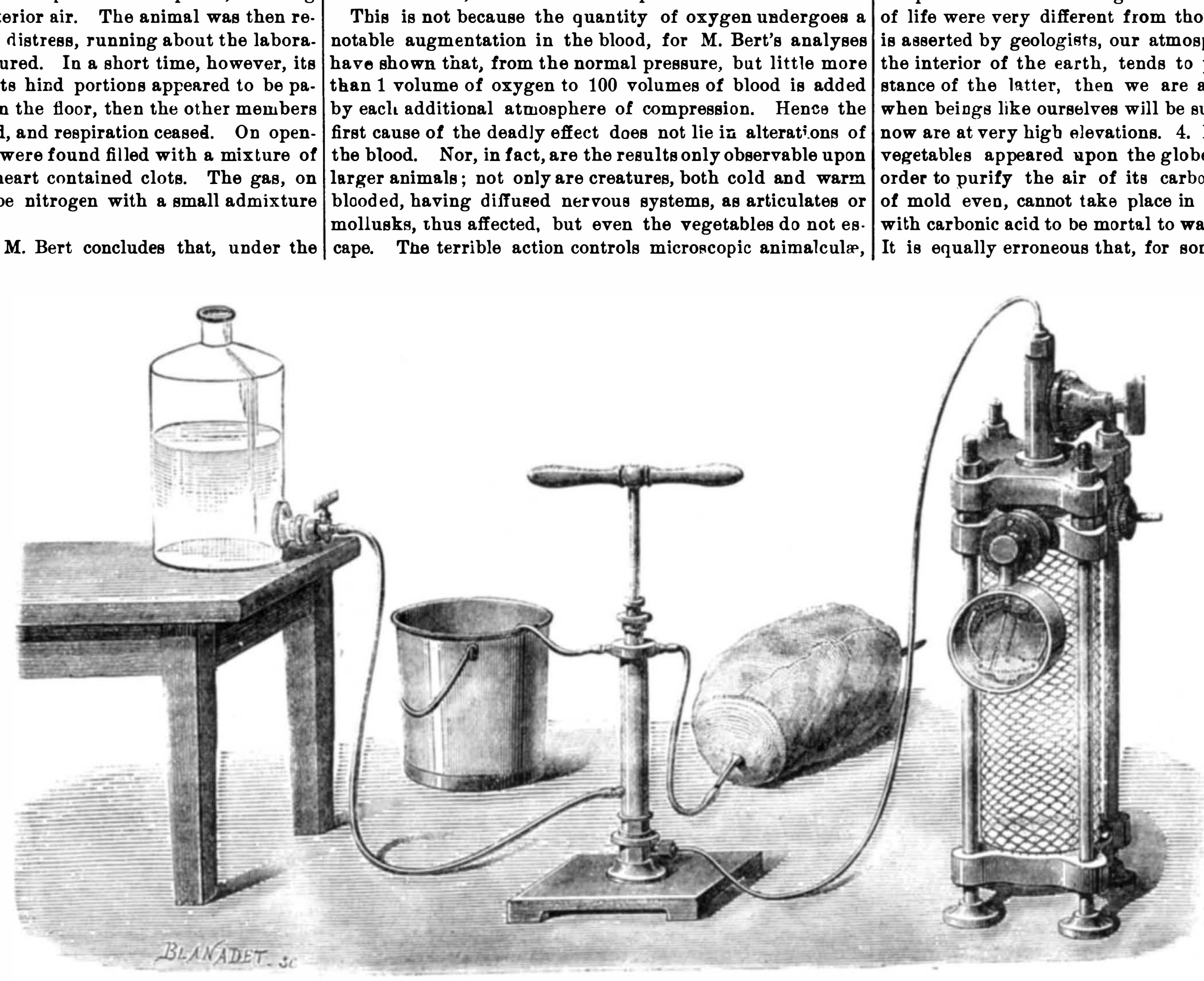


Fig. 2.—APPRATUS FOR SHOWING THE EFFECTS OF OXYGEN AND AIR.

From this experiment M. Bert concludes that, under the influence of compression, the nitrogen of the air becomes dissolved in the blood in increasing proportions, just as carbonic acid becomes taken up in water in making the so called soda water. On suddenly removing the compressing force, the gas passes to a free state, its bubbles become more numerous, rendering the blood foamy, obstructing the circulation, causing paralysis, and finally death. Nor is the blood alone thus charged with the gas, for the latter penetrates to every humor of the body, even to the tissues, the interior of the eyes, and the liquid which bathes the spinal marrow.

When the pressure is at about seven atmospheres, the results are not so grave. A paralysis of the posterior portions and often sharp pain ensue, but the effects may be passing. If, however, the pressure be stronger, the gas is disengaged so suddenly that death is instantaneous. Thus an explanation is found for the serious maladies which have attacked laborers working in compressed air, and for the paralysis which frequently happens when the pressure is above three and a half atmospheres.

Passing from these results of sudden decompression and compression, we are led to consider those due to compression itself. To this end M. Bert has devised another apparatus, shown in Fig. 2, which consists of a cylinder capable of withstanding twenty-five atmospheres, a bag containing oxygen, a compressing pump, and pipes enveloping the latter, so as to cover it with a current of water. A bird was placed in the cylinder, and air forced in to ten atmospheres, without appreciable effect. When, however, for air, oxygen was substituted, the animal was taken with strong convulsions, and quickly died. To obtain the same result with air, twenty-five atmospheres' pressure was required. Conversely, however, if air at the above pressure was used, deprived in great measure of its oxygen, it became harmless. These experiments, exactly counter to those described in our previous article, tend more conclusively to show that mortal convulsions are due to the tension of the oxygen and not to the degree of physical compression, and that oxygen, in certain quantities, acts as a violent poison, similar in effect to strychnine and like substances, which excite the spinal nerves.

This is not because the quantity of oxygen undergoes a notable augmentation in the blood, for M. Bert's analyses have shown that, from the normal pressure, but little more than 1 volume of oxygen to 100 volumes of blood is added by each additional atmosphere of compression. Hence the first cause of the deadly effect does not lie in alterations of the blood. Nor, in fact, are the results only observable upon larger animals; not only are creatures, both cold and warm blooded, having diffused nervous systems, as articulates or mollusks, thus affected, but even the vegetables do not escape. The terrible action controls microscopic animalculæ, infusoria, and the *mucedinæ*, which cause certain fermentations. The effect is only explained by the supposition that the oxygen acts upon the elementary particles of the body so as to arrest or modify injuriously the chemical functions of which they are the agents. Hence the general accidents, convulsions, and death.

It would seem that the phenomena produced by overdoses of oxygen would consist in strong oxidations; that the tissues of the body, in other words, would be burnt up. Strange to say, just the reverse takes place. Animals become rapidly cooler, and produce little carbonic acid and urea; and, in brief, oxygen in excess arrests oxidation.

The practical industrial utilization of M. Bert's discoveries readily suggests itself. Divers, it has been noticed, experience pains in the chest when some 160 feet beneath the surface, and the same sensations are felt by laborers working under a pressure of five atmospheres. These troubles are incontrovertibly due to an excess of oxygen, and it only remains to supply air poor in that gas. The mechanical arrangements to this end are easily constructed for caissons and fixed structures, but some ingenuity will be needed to devise apparatus for divers who work under constantly changing pressures. Hydrogen or nitrogen could be used to dilute the air.

The author deduces from his investigations a number of interesting conclusions regarding the past and present conditions of life upon the earth, which may be briefly summarized as follows:

1. Temperature being left out of consideration, there is for animals and vegetables upon high mountains an impassable limit, which varies with the species. This is one of the causes of geographical distribution governed by latitude. 2. There would exist a like limit at shallow depths in the water of the ocean, if the same contained oxygen and nitrogen in solution, according to Dalton's law. A stream of air rushing from the bottom would extinguish all life met on its upward course. The varying richness in oxygen of the different currents, at different depths, has perhaps some influence on submarine geographical distribution. 3. At primitive geological epochs, when the pressure of our atmosphere was much stronger than it now is, the conditions of life were very different from those at present; and if, as is asserted by geologists, our atmosphere, by the cooling of the interior of the earth, tends to penetrate into the substance of the latter, then we are approaching a condition when beings like ourselves will be suffocated, exactly as we now are at very high elevations. 4. It is wrong to teach that vegetables appeared upon the globe before the animals, in order to purify the air of its carbonic acid. Germination, of mold even, cannot take place in air sufficiently charged with carbonic acid to be mortal to warm-blooded animals. 5. It is equally erroneous that, for some such similar reason, reptiles first appeared, or that they could breathe air which warm blooded animals could not. The exact reverse is the case, as the reptiles fear carbonic acid, more than the birds, and much more than the mammifers.

Finally, the gist of M. Bert's investigations may be thus briefly summed up:

1. Modifications in the manometric pressure of air act but in proportion to the tension of the oxygen contained in the latter. 2. Above the normal pressure there is an increasing tendency to poisoning by oxygen, characterized by the determination of inter organic oxidations, which may be opposed by employing deoxygenized air.

THE Society of Arts offers the gold medal or 20 guineas ($100) for an improved lamp for illuminating railway carriages. It must be capable of supplying a clear, steady, durable, and safe light. Specimen models, suitable for testing, must be sent in not later than November 1, which in effect means that they must be at the Society's house, London, on or before Saturday, October 31.

LUTECINE OR PARIS METAL.—MM. Le Mat, Picard, and Bloch give the following proportions for this alloy: Copper 800, nickel 160, tin 20, cobalt 10, iron 5, zinc 5. Total 1,000.

IMPROVED STEAM ENGINE.

The novel form of steam engine herewith illustrated operates upon the compound principle; but instead of having its high and low pressure cylinders separate, the former is placed within the latter. The smaller cylinder, into which live steam is admitted, constitutes also the piston head, and is moved both by the entering steam reacting against an auxiliary stationary piston placed within, and also by the expansive force of the steam which is used in the previous stroke, which is allowed to pass into the outer and larger cylinder. This will be rendered clear by the following detailed description of the engravings.

A is the small cylinder which constitutes the piston head of the engine, and which is closed at both ends, and travels in the large cylinder. It connects with the piston rod, passing through the right hand end of the latter, as shown. B is the auxiliary piston, which is perfectly motionless, and is secured to a hollow rod which is fastened, as shown, in the cylinder head, and connects with the pipe, C, through which the steam enters, as indicated by the arrow.

The head of the auxiliary piston is hollow; and leading out at each end of it are ports, D, which are provided with a rocker valve, to which is attached the operating rod, E, extending out through and beyond the piston rod. At each end of the bore of the cylinder, A, and underneath, are passages, F and G, leading to rotary valves, from which pass other conduits through the next adjacent end plate and opening into the main cylinder. Each of the rotary valves is so constructed that, when either is in the position shown on the left, it will open communication between the port, F, and the adjacent passage, the two forming a bent or V shaped conduit. When resolved in another position, the valve will, as represented on the right, close the port, G, and establish communication, by means of the other passage, through from the main cylinder to the annular space around the head, A, and between the flanges of the latter.

The two valves just described have bent arms, H, extending from them, as shown in dotted lines, Fig. 1, and in the transverse section, Fig. 2. These arms are connected by a rod jointed to both. Another arm, I, Fig. 2, is attached to the inner end of a shaft, which shaft is arranged within the exhaust passage leading out of the main cylinder. The object of this shaft and bent arm mechanism is to trip each of the valves connected with the arms, H, at the proper time, which it is caused to do by suitable apparatus operated by the engine in connection with the exterior crank. Similarly the rod, E, moving the rocker valve on the auxiliary piston, is also properly actuated to travel back and forth as is necessary.

The operation of the machine may now be readily followed. Steam being admitted into the small cylinder or piston head, A, the latter will be drawn in one direction lengthwise the large cylinder. On the head arriving at the end of such movement, the valves are tripped so as to open communication between the space that receives the live steam and that part of

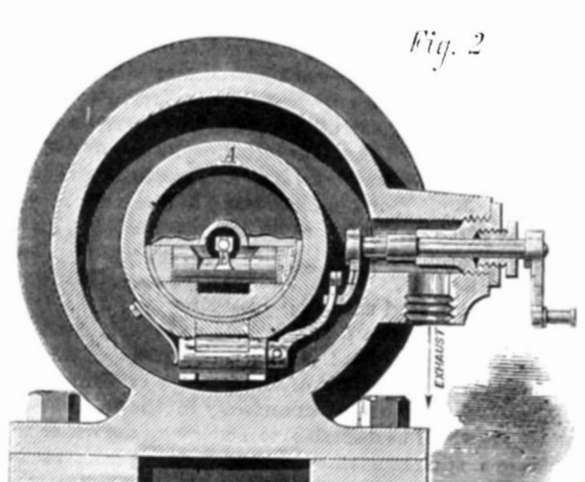


Fig. 2

the main cylinder next adjacent to the end of the same toward which the piston head has advanced. It will be observed that in Fig. 1 the head has just finished its stroke to the left, so that, as above stated, the valve connecting with the port, F, has opened a way through the latter and into the large cylinder. At the same time the rocker valve in the auxiliary piston is tripped so as to cut off admission of steam to the space into which the steam first entered, and to allow the steam to operate from the reverse side of the piston. This is clearly shown in the engraving. The head will now travel to the right, impelled not only by the action of the second quantity of steam but by the pressure of the first amount expansively in its rear.

The first quantity of steam, on escaping from the head into the main cylinder, will expand in both while the former is in motion, and, by pressing against the outer surface of one end of said head, will there exert a greater amount of force than it will on the stationary piston, B. Hence it is the excess of pressure which operates to drive the head.

The space in front of the latter, it may be supposed, contains steam used expansively in a previous stroke. This must be withdrawn from the front of the head and exhaust ed, an operation accomplished by the valve, in the passage, G, becoming placed as shown in Fig. 1, thereby establishing connection with the right hand or forward portion of the cylinder and the annular space around the head, which, as represented in Fig. 2, connects directly with the exhaust port.

Among the other advantages claimed by the inventor, for this machine, over the ordinary compound engine, is a smaller loss by radiation. The heat radiating from the steam entering the hollow piston rod aids in keeping the outer cylinder warm, while, by jacketing the latter, there would be comparatively little waste of steam due to condensation. The short passages and easy connection to the crank obviate the use of double crank and connecting rods, saving not only the wear and tear necessary to overcome back pressure in the smaller cylinder, but also the extra expense of construction. The invention can be applied to any ordinary engine by removing the cylinder and substituting the one described.

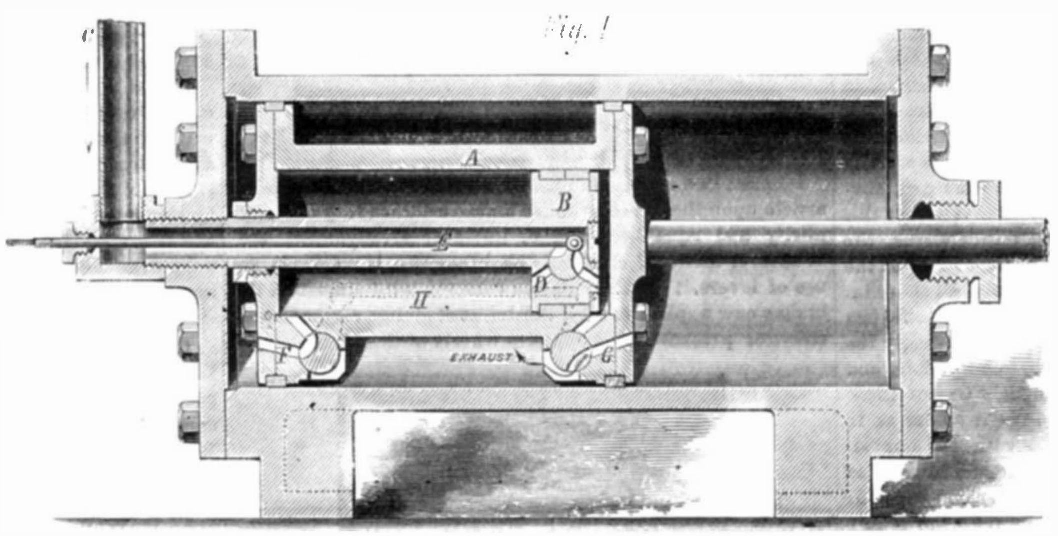


Fig. 1

DAVENPORT'S IMPROVED STEAM ENGINE.

Patented January 1, 1867. Further particulars may be obtained from the inventor, Mr. S. F. Davenport, Hallowell, Me.

THE GRAVITATION COMPASS.

A new mariner's compass, remarkably devoid of complication in its various parts, has recently been invented by the Earl of Caithness, F.R.S., of London, and patented in the United States. The ordinary compass is mounted upon gimbals, that is to say, upon two axes at right angles to each other, for the purpose of allowing the compass box the power of swinging freely in all directions, the necessary result being that the bottom of the compass box is kept, by the force of gravitation, parallel, to a great extent, to the plane of the horizon, while its mountings move in various directions, as influenced by the motion of the ship.

The essential feature of the Caithness compass is that, instead of its being mounted upon gimbals, it is mounted upon the top of a pendulum, which swings in a ball and socket joint. The gimbals of the ordinary compass are intended to give the compass box the power of moving in a true circle; but they do not absolutely give that power, and never can, since there are two points in the performance of the circle, in which there is a slight catch, which tends to make the box oscillate, first to the right and then to the left, or *vice versâ*, as the case may be.

The new Caithness compass consists of a ball close underneath the compass box, working in a socket fixed at the top of a conical support. The pendulum is about two feet in length, and is attached to the small ball, which has thus the power of giving a perfect rotation. It works in a perfect circle, and it does not matter how much the ship rolls. The Earl of Caithness calls it the gravitation compass, because the pendulum always points to the center of the earth. He says that it will bear very great rolling and pitching of the vessel—in fact a roll of more than thirty degrees.

In the course of a voyage across the Atlantic, made about the middle of October last, in the Java (Captain Martin), by the Earl of Caithness, he tried experiments with the compass on a large scale, the result being that the maximum vibration of the compass card was about a quarter of a point, while heavy standard compasses on board gave much larger vibrations.—*The Engineer.*

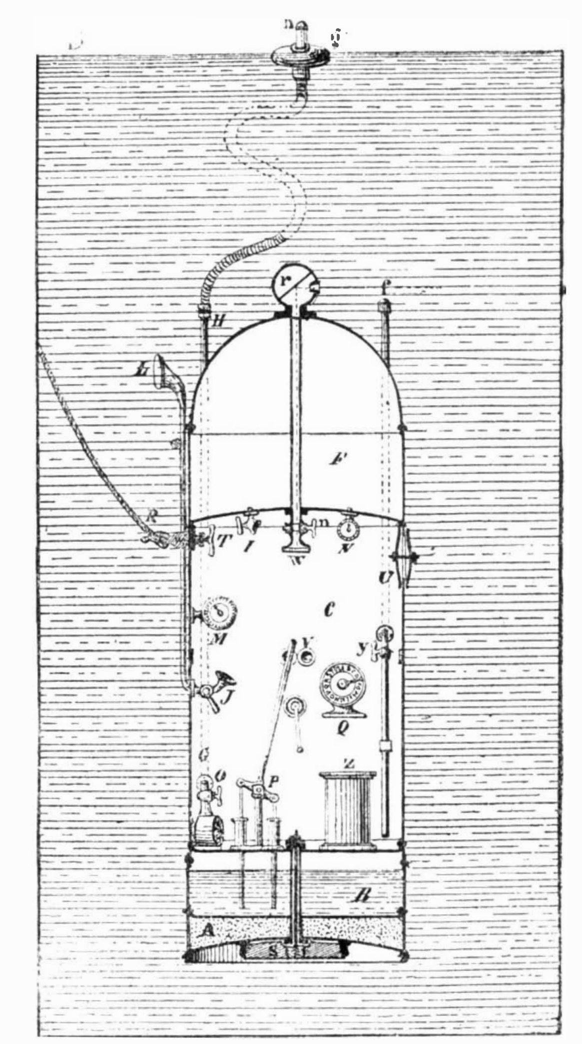
M. Neyreneuf has ascertained by experiments that negative electricity attracts flame, which positive electricity repels.

A NAVIGABLE DIVING BELL.

M. Toselli, an ingenious Italian inventor, has lately devised a novel diving bell, an engraving of which we present herewith, by means of which he can proceed to the bottom and rise at will, and travel around while submerged, or at the surface, with perfect safety. He has already descended several times to the bottom of the Bay of Naples, a depth of 224 feet, and finds the device admirably adapted for submarine exploration, for coral or pearl fishery, or for the clearing of sunken ships.

As shown in the illustration, the apparatus is a kind of turret divided into four compartments. The bottom division, A, contains lead, and serves to hold the bell in vertical position. B can be filled with water by opening a cock communicating from without, or may be rendered entirely empty by aid of the pump. Consequently this chamber serves to augment or diminish the weight of the machine and to determine its up and down travel, serving the same purpose as the natatory vessels in fish. In the large compartment, C, the operator and the observer are stationed; and finally, F is a reservoir, into which air is compressed in a quantity sufficient to last during the time which the bell is to be submerged. I is a cock which admits air from this chamber into the main compartment. G is the pipe for carrying off the foul atmosphere, which communicates with the tube, H, and a float, *g*. The latter has a valve, *h*, to prevent entrance of water. The bell has a rudder and a screw, not shown in the illustration, the screw being worked by a hand crank by one man, and driving the machine at the rate of about 25 feet per minute.

M is the manometer, which indicates exterior pressure, and hence the depth of submersion. N is another manometer, which shows the pressure of condensed air in the chamber, F. R is a life line connecting the bell with the ship. This contains a wire by means of which telegraphic despatches may be sent to the instrument, Q U is the manhole, allowing access to the interior of the machine and closed with a double door. V are heavy glass deadlights, and Z is a seat.



The ingenuity of the inventor will be made apparent by considering the simple way in which M. Toselli avoids the dangers common to machines of this class. Thus, should the tube, H, which carries off foul air, break or choke, water would be pumped immediately out of B, the bell would ascend, and meanwhile the bad atmosphere would be allowed to escape through the extra pipe, *f*. In case the electric wire in the life line should part, preventing the passage of signals, the machine would again ascend and communicate with the vessel through the speaking trumpet, L J. If the line remained intact, the bell could be instantly hauled to the surface by those on the ship, in case of a breakage of the hydraulic pump, on signal being transmitted. If pump, wire, and life line should all break down at once, then the operator would unscrew a nut and free the lead underneath, when he would immediately ascend to the surface. Finally, if by some extraordinary circumstance the ship should break the line and lose sight of the bell, or if the vessel itself should sink, the operator would first, by unscrewing a nut within, cast his bell loose from the life line, and would then ascend. As soon as he reached the surface, he would be enabled to view his surroundings by means of a camera obscura at *r*; and by revolving the same by its tube, W, he could sweep the entire horizon. Lastly, having determined his course, he could proceed in the proper direction by means of his screw and rudder.

Correspondence.

Notes from Washington, D. C.

To the Editor of the Scientific American:

Congress has adjourned without enriching the lobby so much as usual. In fact it is generally conceded that our Solons have left Washington with cleaner consciences, in this respect, than any of their recent predecessors, and that there never were fewer jobs put through by any Congress for many years past. The patent lobby fared especially badly, not a single extension case, so far as I can learn, having passed, notwithstanding all their efforts. Whether this is owing to a slight spasm of returning public virtue, the approaching elections, the efforts of the press, or fear of the Grangers, is more than I can tell; but probably all these influences had their effects, and so the work of the lobbyists went for naught, although they mustered pretty strongly the last days of the session, trying, both by persuasions and threats, to forward their respective schemes. One of these —a second George Francis Train—even went so far as to threaten the Senators and Representatives with the opposition of the Internationals, of which he represented himself as a high officer, if they did not pass the extension case for which he was working, and that he would take the stump against the members of the committees on patents, if his efforts failed. Of course the Senators were immensely frightened at this fearful threat, but somehow they yet live, and have gone home without helping the client of Train *secundus.*

The bill to reorganize the Patent Office also failed, and a bill, introduced a few days since by Mr. Conger, amending Sections 23, 25, 33, 53, and 64 of the Act of 1870, as a substitute for the first bill, likewise failed to pass. The only act completed, so far as I can find, relating to the Patent Office, is one introduced by Mr. Wadleigh, which allows the usual sentence indicating that a work is copyrighted to be substituted by the words "Copyrighted, 18—, by A. B.," fixes the fees for recording or furnishing a copy of an assignment of a copyright at one dollar, and enacts that labels shall not be copyrighted, but registered at the Patent Office, for which a fee of six dollars is to be charged. This act takes effect August 1, 1874. The object of the change in the first section is to allow the use of the short sentence on small works of art, photographs, etc., that would be defaced by the use of the long rigmarole now employed.

Many curious schemes have been brought before Congress, some of which never got any further than the committee rooms, among which may be classed the application of some would be philosopher for an appropriation to test his method of artificially producing rain; and another case where an inventor wanted a law enacted that every election district in the United States should have his patent ballot box, to receive the votes for President, Vice President, and members of Congress, at a cost of fifteen dollars for each box. The committee to whom this case was referred contented themselves with recommending its adoption to the different State authorities, and so nipped this pretty little scheme in the bud. I endeavored to find out this patent, but could find none under the name of reputed inventor; but judging from the description I received, it must have been similar to one patented in 1858, and used in your city some years ago, as it was said to be composed of iron and glass. OCCASIONAL.

Levees on the Mississippi.

To the Editor of the Scientific American:

Please tell your readers who reside on the banks of the the lower Mississippi that the proper way for them to build levees is to build them on an average a mile back from the banks of the river on each side. They will thereby show a little respect for the river, and give it an opportunity to discharge the waters of the vast valley which it drains; and will secure the remainder of their country from periodical overflow.

This line, a mile back from the river, should not follow the meanderings of the stream, but should average a mile on each side. In places where there are high banks on one side, as at Vicksburgh, the river should be permitted to overflow the low ground on the opposite side for two miles; and if, for any other reason, as at New Orleans, it would be impracticable to permit the river to overflow on both sides, a similar space on the opposite side should be left for the river to spread itself a little whenever it might have business of importance to transact.

Sioux Rapids, Iowa. W. T. CROZIER.

White Ants.

To the Editor of the Scientific American:

The white ants of the torrid zone are somewhat smaller than the large black ants, which are sometimes troublesome here and are rather voracious, eating their way through a wooden box to obtain sugar, of which they are very fond, and of which they will consume a large quantity.

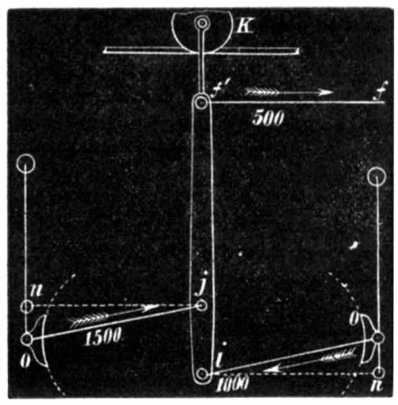
But the white ants of the torrid zone throw the black ones entirely in the shade as regards voracity. Pernambuco (South America) is on about the 8th southern parallel; and the inhabitants build houses and make furniture of the native wood, which is hard and heavy, and proof against these ants. In one instance, a family moved from the South to Pernambuco, taking their household goods with them. Among the rest was a mahogany bureau with white wood inside work, as usual. This bureau, containing linen and cotton goods, was placed in a room but little used, and was not visited for some days. The lady of the house unlocked an upper drawer, and to her astonishment the front piece, of mahogany, fell to the floor, and on looking in she discovered that the inside work was nearly all eaten out, and her goods were in one common mass, resting on the floor, in a mixed condition but otherwise uninjured. The depredators had departed, but were soon discovered cutting out the interior of another piece of furniture. They proved to be the white ants of the torrid zone. TRUMAN HOTCHKISS.

Stratford, Conn.

The Westinghouse Brake.

To the Editor of the Scientific American:

I notice in a recent number of *Engineering* an illustrated article upon the Westinghouse brake, commending the simplicity and equable action of its lever arrangement, etc. Whatever merit, of simplicity or otherwise, there is in its use of levers, it certainly has (in common with almost all the brakes now applied to cars) the defect of giving very unequal stress or pressure upon opposite wheels of the truck.



Let *k f j i* represent the lever that operates the brake blocks, *o*. I use the delineation and letters employed in the article referred to. The lever is held up by a pulley at *k*, which travels back and forth on a rod, as shown. Power is applied to the lever at the point, *f'*, through the medium of the rod, *f' f*, in the direction indicated by the arrow, one pair of the brake blocks being operated by the rod connected to the lever, at *j*, and the other pair by the rod connected at *i*, the pull being in the direction indicated by the arrows, and the leverage three to one, that is to say, the distance from *i* to *j* is one fourth of the distance from *i* to *k*. Hence a pull of 500 lbs., applied to the rod, *f' f*, will cause a pull of 1,500 lbs. upon *j*, and a pull of only 1,000 lbs. on the rod *i*.

This unequal stress upon the brake blocks may not be a very serious matter, but it is a universal characteristic of the lever arrangement now applied to car brakes. The fault might be easily mended by connecting the rod, *j*, to the suspending bar of the brake blocks a little above the usual point, and the rod, *i*, a little below the usual point, as at *n*.

Worcester, Mass. F. G. WOODWARD.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

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

Positions of Planets for July, 1874.

Mercury.

At this time, June 20th, Mercury can be beautifully seen after sunset, below Venus, and a little further north.

On the 27th of June, Mercury will be at its greatest elongation, east of the sun. July 1, Mercury sets at 9 P. M. July 31, Mercury sets at 6h. 25m. P. M.

Venus.

Venus, which has been so beautiful all through the month of June, increases in apparent diameter, but sets a little earlier in July.

July 1, Venus rises at 7h. 11m. A. M., and sets at 9h. 33m. P. M. On the 31st, Venus rises at 8h. 17m. A.M., and sets at 9h. 00m. P. M.

Mars.

Mars is very unfavorably situated. It rises early in the morning, and sets at 7h. 42m. P. M., or nearly with the sun, on July 1. On July 31, Mars rises at 4h. 14m. A. M., and sets before 7 in the evening.

Jupiter.

Jupiter's diameter is becoming perceptibly less, and it sets before midnight. It comes to the meridian, the position best adapted to good observation, in the afternoon, so that we have only a few hours of darkness in which to watch its changes.

July 1, Jupiter rises at 10h. 51m. A. M., and sets at 11h. 15m. P. M. On the 31st, Jupiter rises at 9h. 15m. A. M., and sets at 9h. 26m. P. M.

Saturn.

The month of July is the best of the year for observations on Saturn; and although Saturn is very low in altitude, it will be an interesting object.

July 1, Saturn rises at 9h. 29m. P.M., and sets at 7h. 21m. A. M. July 31, Saturn rises at 8h. 25m., P. M., and sets at 5h. 12m. A. M. It is among the small stars of *Capricornus.* Saturn does not attain an altitude of more than 31° during the month.

Uranus.

Uranus rises in the morning and sets early in the evening, and is therefore not well situated for observation.

Neptune.

This planet can be seen only by means of a good telescope. It crosses the meridian in the morning at 7h. 15m. on the 1st, at an altitude of 58°.

The Comet.

Clouds have prevented good observations upon the comet. It is bright enough to be seen very easily with the naked eye, and with an opera glass is a beautiful obj ct. On the 13th of June an observation, made during partially cloudy weather, gave R.A. 7h. 4m. ±, Dec. + 69°. At that time its apparent motion was very slow.

It does not set, and is very readily found. On the 13th it made a nearly equilateral triangle with the pole star and the brighter star of the pointers. The same position would enable one to find it as late as the 18th of June, and probably it has not changed its position very much. To the eye, it is an elongated hazy star. With a glass, the nebulous center and the streaming train are very interesting objects. It passes the meridian at present (June 21) at 1h. 20m. in the morning, below the pole.

Sun Spots.

The record is from May 15 to June 16. Fourteen views have been photographed during this interval. Spots have generally been very small, only two groups appearing which contained good sized spots. In some instances the changes from day to day have been very marked; in others, only such as result from the sun's revolution on its axis. The daily motion of one group is shown for five days, from May 27 to June 1. While the group as a whole remained recognizable, there was a decided change in the arrangement of the constituent spots. Faculæ have been unusually extensive and are beautifully marked in one of our pictures which happened to be very clear. The same picture also shows the mottling of the sun's surface, which is usually shown when both the weather and photography are good. Very bright faculæ accompanied a group which was near the eastern limb on June 15. They were less prominent on the next day as the group was more distant from the limb.

Barometer and Thermometer.

The meteorological journal from May 17 to June 20 gives the highest barometer, June 15, 30·27; the lowest barometer, June 1, 29·58; the highest thermometer, June 9, at 2 P. M., 86°; the lowest thermometer, May 20 and May 22, at 7 A. M., 50·5°.

Amount of Rain.

The rain which fell between the evening of May 17 and the afternoon of May 18 amounted to 0 28 inches.

The rain which fell during May 20 amounted to 0·17 inches.

The rain which fell during May 25 amounted to 0·43 inches.

The rain which fell during the night of May 31 and the morning of June 1 amounted to 0·45 inches.

The rain which fell during the night of June 3 amounted to 0·16 inches.

The rain which fell during the afternoon of June 12 amounted to 0·45 inches.

Spectrum of the Comet.

Father Secchi has observed the spectrum of Coggia's comet, and finds the lines of carbonic oxide and carbonic acid very brilliant. The same astronomer notes a curious phenomenon which recently happened in Jupiter's first satellite. The atmosphere at the time of observation was quite clear, and the disk of the planet, while plainly defined, presented a slightly wavy surface. As the satellite neared the edge of Jupiter, and had advanced so that a distance of about one of its diameters separated it from the same, the observer was surprised to see the disk apparently extend itself toward the satellite, touch it, and then retract. This to and fro motion continued until the satellite was completely obscured by the planet, a period of four or five minutes. Father Secchi suggests that if similar undulations of the solar disk take place at the time of the passage of Venus, there will be strong elements of uncertainty in the observations, and that it would be desirable to employ means which will reduce to a minimum these effects of atmospheric oscillation.

Fatty Matters in Cast Iron.

An experiment made long ago by Proust revealed the fact that fatty matters can be extracted from cast iron when the latter is dissolved in certain acids. M. Cloez has recently separated these materials in a pure state, and their analysis reveals the interesting fact that they consist of carburets of hydrogen of the series $C^{2n} H^{2n}$, and present all the terms thereof at least from C^6H^6 (propylene) to $C^{16}H^{16}$. This is a veritable organic synthesis, realized by the aid of substances purely mineral, and is susceptible consequently of important applications. In the *Science Record* for 1873 will be found an account of the extraction of similar matters from meteoric iron.

THE Sandy Hook boiler experiments, which have been suspended since December last, will be resumed about the beginning of August. The recording instruments used last year were found to vary considerably in the forms made by different makers, and careful tests are now being conducted in order to ensure absolute uniformity and correctness of indications.

PRACTICAL MECHANISM.

NUMBER IV.

BY JOSHUA ROSE.

SCREW CUTTING TOOLS.

Lathe tools for cutting screws have necessarily, from the nature of their duty, a comparatively broad cutting surface, rendering them very subject to spring. Those used for V threads, being ground to fit the V of the thread, are, in consequence, weak and liable to break, to avoid which they should only be given enough bottom rake to well clear the thread, and top rake sufficient to make them cut clean. They are used at a slow rate of cutting speed, and may therefore be lowered to a straw-colored temper (as reducing the temper strengthens a tool). Firmness and strength are of great importance to this class of tool, so that it should be fastened with the cutting edge as near to the tool post as is convenient.

For use on wrought iron, it is sometimes given side rake; but this is not a necessity and is of doubtful utility, because the advantage gained by its tendency to assist in feeding itself is quite counterbalanced by its increased liability to break at the point. It should always be placed to cut at the center of the work. For use on brass, it must be ground on the top face to an inclined plane, of which the cutting point is the depressed end, that is to say, it must have negative top rake.

For cutting square threads, the tool shown in Fig. 14, with the sides ground away beneath sufficiently to well clear the sides of the thread, is used.

If the pitch of the screw to be cut is very coarse, a tool nearly one half of the width of the space between one thread and the next should be employed, so as to avoid the spring which a tool of the full width would undergo. After taking several cuts, the tool must be moved laterally to the amount of its width, and cuts taken off as before until the tool has cut somewhat deeper than it did before being moved, when it must be placed back again into its first position, and the process repeated until the required depth of thread is attained.

Fig. 24.

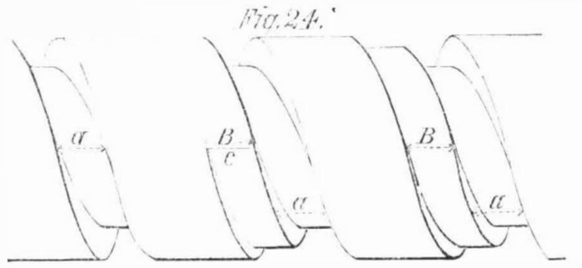


Fig. 24 represents a thread or screw during the above described process of cutting. *a a a* is the groove or space taken out by the cuts before the tool was moved; B B represents the first cut taken after it was moved; *c* is the point to which the cut, B, is supposed (for the purpose of this illustration) to have traveled.

The tool used having been a little less than one half the proper width of the space of the thread, it becomes evident that the thread will be left with rather more than its proper thickness, which is done to allow finishing cuts to be taken upon its sides, for which purpose the side tool (given in Fig. 22) is brought into requisition, care being taken that it is placed true, so as to cut both sides of the thread of an equal angle to the center line of the screw.

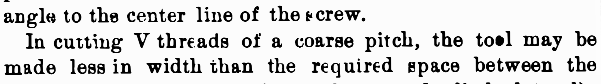
In cutting V threads of a coarse pitch, the tool may be made less in width than the required space between the threads demands, so that it may be moved a little laterally in order to take a cut off one side of the thread only at a time, by which means a heavier cut may be taken with less liability for the tool to spring in; but the finishing cut is better if taken by a tool of the full width or shape of the thread.

The most accurate method of cutting small V threads is to use a stout chaser fastened in the tool post, and then feed it with the screw-cutting gear of the lathe, the same as with a common screw cutting tool. Such a chaser should be made hollow in the length of the tooth, possess a minimum of top rake, and be placed to cut at the center of the work; and it should be so placed in the tool post that the teeth stand exactly parallel to the line of the cut.

CHASERS.

An outside chaser for cutting wrought iron by hand should be made hollow in the length of the tooth, and have top

Fig. 25.



rake, as shown in Fig. 25, to enable it to cut easily; for the strain required to bend the shaving out of the straight line will hold the teeth to their cut. Top rake may, in fact, be applied to such an extent that the chaser will cut well of it self without having any force applied to it except sufficient to keep it level, but if made so keen, it soon loses its edge and is very apt to break. The bottom edge of the teeth is rounded off so that the chaser will slide easily along the rest. It is an error to make this tool very thick. For cutting 14 threads to an inch, the chaser should be one quarter of an inch thick; and for cutting 8 to an inch, the thickness should be five sixteenths of an inch, so that the fulcrum off which the teeth take their cuts may be close to the cuts, in which case the chaser will be steadier and more under control. The leading tooth should always be a full one and come just level with the edge. When finishing the thread being cut, hold the chaser horizontally, or it will, in consequence of the top rake, cut a thread deeper than itself. For use in the tool post, with the rest fed by the proper gear for the pitch, less top rake is required, and the thickness must be much increased to gain strength and avoid spring; for the fulcrum off which the tool thus used takes its cut is at the point *a*, described in Fig. 11, instead of being directly beneath the cut, as in the case of a hand chaser.

An inside chaser, that is, one for cutting threads in a hole or bore, should be, if to be used for cutting a right handed thread, cut off a left-handed hub, otherwise the chaser will have its thread sloping in the opposite direction to the thread to be cut, as may be demonstrated by placing an inside and outside chaser (both having been cut off the same hub) together, when it will be seen that the teeth of one will not fit in the teeth of the other, as they should do; the cause being that, after an inside chaser is cut by the hub, it has to be turned around to be placed in a position to cut, which turning reverses the direction in which its teeth slant.

All chasers should be tempered to a brown color and be used at a slow rate of cutting speed.

TOOL STEEL.

The cutting tools for all machines should be made of hammered (which is tougher and of finer grain then rolled) steel. Even in a bar of hammered steel, the corners, from receiving the most effect from the action of the hammer, are of better quality (that is, more refined) than the rest of the bar. This fact is clearly demonstrated in the manufacture of the celebrated Damascus swords and gun barrels, in which the square bars of metal are, after being hammered, twisted and then hammered square again; the twisting process is then repeated, and the bar again forged square, the whole operation being repeated until the body of the entire bar is completely intersected with metal which has, at some time during the forging process, formed the corners of a square. The effect of this treatment becomes apparent upon immersing the metal in acid, which will eat away those parts which have not formed a corner at some stage of the process of manufacture, more rapidly than the rest of the metal, and that to such a degree as to give to the whole the appearance of having been engraved, thus evidencing that the parts that have received the most hammering are of finer quality than the rest of the bar.

For cutting tools, it is highly necessary to gain every attainable superiority in the steel; and if we cannot take three months of time to prepare bars for this special purpose (as they do in the above process), we can at least employ well hammered steel, and thus secure the best known practicable results.

The test of tool steel is the speed at which it will cut and the length of time it will last without being ground, concerning which it is difficult to get data, unless by actual experiment with different kinds of steel upon work of the same diameter and texture of metal, because the cutting speed employed by workmen varies as much as 8 feet per minute upon the same diameter of work. The proper cutting speed for work is, however, to be hereafter treated upon, hence nothing further upon the subject need be now said. The use of more than one kind of tool steel in a workshop should always be avoided, because different kinds of steel require different treatment, both in forging and hardening; and when more than one kind is in use in the shop, the whole of them are liable (from not noticing the particular brand) to wrong treatment.

Mushet's "special tool steel" makes an excellent tool for roughing work out on the lathe or planer, and will undoubtedly stand a higher rate of cutting speed than other steel. Its peculiarity is that it is hard of itself, and therefore requires no hardening. Immersing it in water when it is heated causes it to crack. The advantages claimed for it are its high rate of cutting speed, and that it is easily ground, since it will not soften by heating during the operation. It is, on the other hand, difficult to forge in consequence of its excessive hardening even when heated; it must not be forged at so great or so low a temperature as other steel, or it will crack; and as it is not adapted for general tool purposes, its disadvantages, independent of its increased cost, render its introduction into the general machine shop unadvisable.

FORGING TOOLS.

In forging a tool, it should be formed in as few heats as possible, for steel deteriorates by repeated heating, unless it is well hammered at each heat; and if the tool has a narrow edge, care should also be taken to hammer it on that edge before the metal has lost much of its heat, and to strike it more lightly as it gets cooler, for striking a narrow surface of steel when it is somewhat cool has the same injurious effect upon it as striking it endwise of the grain (which is termed upsetting it), destroying its cutting value and strength.

In using American chrome steel, be careful to forge it according to the directions supplied by its manufacturers, its treatment being almost the opposite for that applicable to English tool steel, the former requiring to be heated to a much higher temperature for forging, and to a less temperature for hardening, than the latter.

TOOL HARDENING.

The degree to which a tool may be hardened is dependent in a great measure upon its shape. Stout tools, such as are shown in Fig. 6, may be made as hard as fire and water will make them; so also may the tools presented in Figs. 8, 9, 18, 19, 20, and 23; while slight tools, such as are given in Figs 14 and 22, should be lowered in temper to a light straw color, which leaves them stronger than they would be if hardened right out, that is, made to a moderate red heat and quenched in the water, without being taken out until quite cold.

The practice of lowering stout tools to a straw color is sometimes resorted to, but it is certainly an error, for it is undoubtedly advantageous to make the tool as hard as it can be made, so long as it will bear the strain of the cut, which is possible and easy of accomplishment with Jessop's, Moss', Sanderson's, or other similar grades of tool steel.

If a tool so hardened is found to break, it is in consequence either of its being bad steel or else it has been heated to too great a temperature in the process of forging or hardening, unless it has been given too much rake for the duty to which it has been allotted. Tool steel may be forged at such a temperature that it is not positively burned, and yet has lost part of its virtue; and while under such circumstances it would break if hardened right out, it will cut and stand moderately well if the temper be lowered to a straw color.

This is simply sacrificing the degree of hardness to cover the blunder committed by overheating, and it is from such causes that the variation of cutting speed employed by mechanics arises; for a youth who has learned his trade in a shop where the tools were overheated, and consequently underhardened, settles down to the rate of cutting speed attainable under those circumstances and adheres to it; while he who has been accustomed to the use of tools properly forged and hardened right out, upon entering another shop where the tools are overheated in forging and underhardened to compensate for it, finding he cannot get the cutting speed up to his customary rate, breaks off the tool point to see if it has been burned, and, finding that the grain of the metal does not appear granulated, sparkling, and coarse, as it would do if positively burned, condemns the quality of the steel.

The grain of properly forged and hardened tool steel appears, when fractured, close and fine, and of a dull, whitish tint, the fracture being even on its surface.

American chrome tool steel may be made unusually hard by using very clean water and adding a piece of fuller's earth and a piece of common soda, each of the size of a hazel nut, to a pailful of water.

In all cases where a tool can be ground to sharpen it, it should be hardened before grinding, for steel hardened with the forged skin on is stronger and better than that in which the skin is removed before hardening. Heat the tool the distance that it is necessary to harden it, and plunge it into the water suddenly to the distance it requires hardening; and if it is intended to harden it right out, hold it still a moment, then dip it a little deeper, and withdraw it again to the amount of the last dipping, repeating this latter operation until the tool is cold; for by this means the junction of the hard and soft steel in the tool is graduated and not sharply defined, the result being that the tool is less liable to fracture either in hardening or in using. If the tool to be hardened has a thick part to it, let that part enter the water first and immerse the tool slowly, so that it will be cooled as nearly equally as possible and thus be prevented from cracking in hardening.

Tools heated by charcoal are much superior to those heated by common coal, and need not be made quite so hot to harden. To harden steel, never get it hot enough to cause it to scale. Thin pieces of steel, and taps, dies, reamers, drifts, and similarly shaped tools, should be dipped endways; for if dipped otherwise, they are sure to warp in hardening. Very slight tools may be prevented from cracking by making the water quite warm before immersing them, and then holding them still in the water; in fact, all water for hardening purposes should have the chill off it by heating, before being used, or the articles hardened in it are very liable to crack. If the article requires to be hardened all over, immerse it (suspended on a wire hook) so that the water may have free and equal access to the whole surface of the steel, which is not possible with tongs in consequence of their jaws covering part of the steel.

The best method of lowering the temper of taps, reamers, or other round steel is to heat a tube in the fire and hold the article in the center of the tube; and it is well to let the tube be rather shorter than the tap or reamer, so that the end, which is made square for the wrench to fit, may be kept longer in the tube than the rest of the tool so as to make it rather softer. The tool should be revolved slowly in the tube to make the temper even. Care should be taken not to make the tube too hot; for the more slowly a tool is lowered, the more even the temper will be.

Flat pieces of steel, as dies, etc., should be lowered (that is tempered) by placing them on a piece of heated iron and turning them over and over to temper them evenly.

The colors produced upon the surface of a piece of hardened steel by lowering it are from very light straw, deepening successively as it lowers, to yellow, bright brown, purple, and blue. As a general rule, tools which are stout and easy to make and to grind should be hardened right out. Those slight in proportion to the strain placed upon them should be tempered to a brown. All screw-cutting tools, such as taps, dies, etc., also reamers, flat cutters, revolving cutters, and spring tools, should be tempered to a brown color; drills should be tempered to a bright purple, and chipping chisels to a blue.

RAILWAY OR SEA ALARM.—Air is compressed in a cylindrical reservoir from which a tube conveys it to three organ pipes (giving *do, mi, sol*), which can be sounded separately or together. In fog the *do* is sounded; and whenever an engine driver hears it in an advancing train, he sounds his *mi*, then the other driver sounds his *mi* if he is on the right line, then both sound *sol*.

COMPOSITION FOR THE DESTRUCTION OF BUGS AND THEIR EGGS, FLEAS, ETC.—This mixture, which has been patented in France, consists of 80 parts of bisulphide of carbon and 20 parts of essence of petroleum.—*M. Doré.*

TAPER SLEEVE PULLEY AND WHEEL FASTENER.

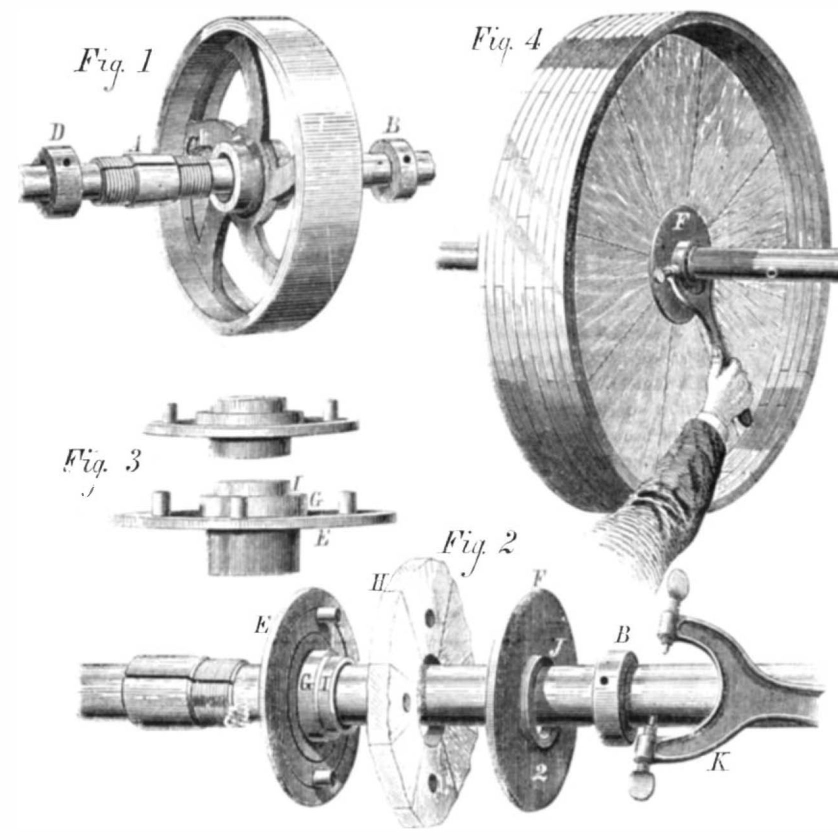
Our engraving illustrates a simple device for fastening pulleys and wheels upon shafts, perfectly concentrically with the latter. It possesses the merit of simplicity, and seems to be a valuable improvement, equally as well adapted for wooden pulleys as for those of metal. We also represent the improved wood and iron pulley, obtained by the use of the fastener and its attachments.

The appliance is shown in connection with a metal pulley in Fig. 1. A is the holder, made of truncated conical form, with a cylindrical bore and split open from end to end. This travels upon the shaft and extends through the hub in the opposite side of which it is met by a nut, B, which screws upon the thread cut on the smaller end, C, of the sleeve. The nut draws the holder as far into the hub as possible, besides contracting it against the shaft, thus securing it to the latter as well as to the hub, and thereby fastening both hub and shaft tightly together. The hub is bored slightly tapering to fit the holder. As the pulley in Fig. 1 is supposed to be a very heavy one, the larger extremity of holder, A, has a right hand screw thread, and is provided with a nut, D, fitting the same. The object of the latter is to crowd the pulley off the sleeve without necessitating the use of a hammer or sledge. In moderately heavy and light pulleys, this last mentioned thread and nut are dispensed with (see Fig. 2), a few blows on the hub with a wooden mallet being sufficient to start the wheel off the sleeve in case it should stick after loosening the nut, B.

Where the device is to be used in connection with a wooden pulley or with one having no hub, an artificial hub is made by means of a pair of annular plates, E and F, Figs. 2, 3, and 4. The shoulder, G, on plate, E, is the centering shoulder or bearing on which the web of the pulley, shown (with the outer portion broken away) at H, fits. This shoulder is of the same size or diameter in all sizes of flanges, or for large and small shafts. This will be evident from Fig. 3, which also shows that where greater power is necessary a corresponding bearing for the sleeve is given in the length of the hub.

The portion, I, Fig. 2, is a centering shoulder for the aperture or female flange, J, and projects far enough through the web of the wooden pulley to enter the latter. The parts being brought together, the nut is set up on the holder, as already described, by means of the wrench, K. This instrument, it will be seen, is adjustable through the whole range of ordinary line shafting. The final operation of setting up, with the wooden pulley in position, is represented in Fig. 4. The pulley consists of eight segmental pieces, in each of which the grain of the wood is in a radial line from center to circumference. In smaller pulleys the flanges have only two pins; but in larger ones, four of the latter, as shown in Fig. 3, are employed. That the irons may be absolutely interchangeable, the same number of holes is bored in all wooden parts, whether all are to be used or not. The pulley, thus made of wood and iron, is claimed to combine the maximum of strength with the minimum of weight. There are no keys or key seats to mar the hubs or shafting, no set screws; while the pulley is readily detached and applied to another shaft when desired.

Patented through the Scientific American Patent Agency, by Augustus Newell, of Chicago, Ill., Feb. 6, 1872. For further particulars address the manufacturers. A. B. Cook & Co., corner 13th and Peach streets, Erie, Pa. [See advertisement on another page.]



TAPER SLEEVE PULLEY AND WHEEL FASTENER.

A NEW WATER PITCHER.

Unsightly spots and wet places are often made upon tables

upon which pitchers of drinking water are placed, owing to the water, dripping from the spout, condensing on the cold exterior and running down, or becoming accidentally spilled in filling glasses.

The device herewith illustrated consists in forming around the base of the pitcher a gutter or channel, A, which communicates with a cup at B, in which a sponge is kept. The latter not only catches the water which may drip from the spout above, but also takes up such as may flow down the sides and accumulate in the gutter. When the sponge becomes soaked it is simply necessary to remove it, squeeze it dry, and replace it. From its position, it is always handy to absorb water which may be accidentally spilled, thus saving the employment of napkins for that purpose. If desired at any time, the sponge can be entirely removed and the pitcher used as an ordinary similar vessel. The gutter below gives it an enlarged base, and thus, in a measure, lessens the danger of upsetting. The invention might also be applied to receptacles for chemical solutions, the spilling of which would cause stains or corrosions.

Patented through the Scientific American Patent Agency. April 28, 1874. For further particulars address the inventor, Mr. J. B. Cox, Mount Laurel, Burlington county, N. J.

Sea Weeds.

At this season, when many of our readers are looking for health and recreation at the seaside, a few hints may be found useful concerning the gathering and preservation of *algæ* or seaweeds. They rank among the most beautiful natural objects, while the work of collection and mounting are delightful occupations for the leisure hour.

The best time to collect is when the tide has just commenced to flow, after the lowest ebb, as the seaweeds are then floated in, in good condition. All specimens should be either red, green, purple, black, or olive; no others are worth preservation.

Mounting is done by immersing a piece of paper just below the surface of the water, and supporting it by the left hand; the alga is then placed on the paper and kept in its place by the left thumb, while the right hand is employed in spreading out the branches with a bone knitting needle or a camel's hair pencil. If the branches are too numerous, which will be readily ascertained by lifting the specimen out of the water for a moment, pruning should be freely resorted to, as much of its beauty will depend upon the distinctness of the branching. Pruning is best performed by cutting off erect and alternate branches, by means of a sharp-pointed pair of scissors, close to their junction with the main stem.

When the specimen is laid out, the paper should be raised gradually in a slightly sloping direction, care being taken to prevent the branches from running together. The delicate species are much improved in appearance by re-immersing their extremities before entirely withdrawing them from the water. The papers should then be laid flat upon coarse bibulous paper, only long enough to absorb superfluous moisture. If placed in an oblique direction, the branches are liable to run together.

They should be then removed and placed upon a sheet of thick white blotting paper, and a piece of washed and pressed calico placed over each specimen, and then another layer of thin blotting paper above the calico. Several of these layers are pressed in the ordinary way, light pressure only being used at first. The papers, but not the calico, may be removed in six hours, and afterwards changed every twenty-four hours until dry. If the calico be not washed, it frequently adheres to the algæ, and if the calico be wrinkled it produces corresponding marks on the paper.

The most convenient sizes of paper to use are those made by cutting a sheet of paper, of demy size, into 16, 12, or 4 equal pieces. Ordinary drawing paper answers the purpose very well. For the herbarium, each species should be mounted on a separate sheet of demy or cartridge size. Toned paper shows off the specimens well, a neutral tint answering best for the olive, pink for the red, and green for the green series.

Equine Mechanics.

From recent calculations by H. Fritz, of Zurich, Switzerland, it appears that the useful work performed, per day of ten hours, at speeds of from 2·9 to 9·7 feet per second, for horses attached to agricultural implements, is as follows: Single horse to mower, 27,324,000 foot pounds; two horses to mower (each), 17,496,000 foot pounds; same to combined reaper and mower, 23,760,000 foot pounds; single horse to reaper without automatic binder, 30,132,000 foot pounds; two horses to similar implement, 20,979,000 foot pounds; and finally, two horses to reaper with automatic binder, 23,960,750 foot pounds. This, on the average, gives about 23,000,000 foot pounds to the horse, or some 638 foot pounds per second.

The fact of the animal's gait, it appears, must also be taken into consideration, as, at a walk, the body is supported always by at least two members, while, at a trot or gallop, there is an instant when the horse is suspended in the air, to accomplish which the entire weight must be overcome. M. Sanson, who has also lately carried on some investigations into the subject, says that, in order to gallop or trot, the animal develops an average energy of about 0·1 the weight of its body; while it walks, this is reduced to 0·05. On weighing over a thousand horses, the above author finds that the average weight of animals, varying from 4·8 to 5·4 feet in hight, is about 1,201·2 pounds. Hence the necessary effort for a horse to displace his own weight, at a walk, is 1201·2 × ·05 = 60·1 lbs.; at a trot, 1,201·2 × 0·1 = 120·1 lbs. At an average walking speed of 3·2 feet per second, the horse accomplishes, therefore, per day of ten hours, 60·1 × 115,200 = 6,923,520 foot pounds, or, at a trotting speed of 7 feet per second, per day of four hours, 120·1 × 100,800 = 22,106,080 foot pounds. Consequently, to produce a useful labor of 23,000,000 foot pounds, the horse must, when walking, develop a total power of 29,523,520 foot pounds, and, when trotting, of 35,106,680 foot pounds.

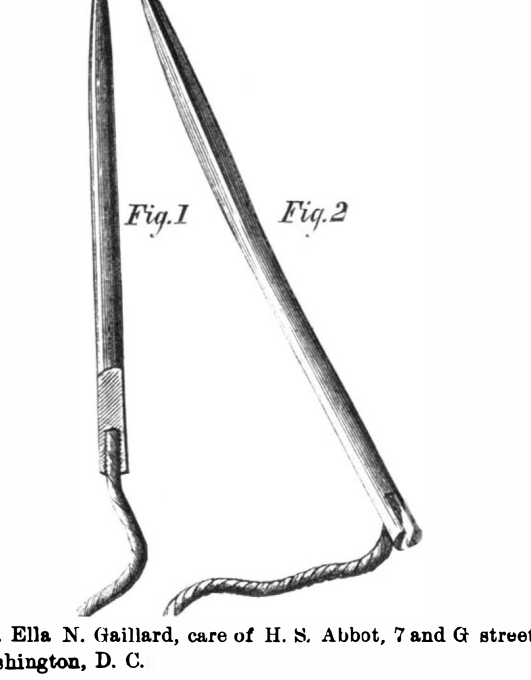
AMONG the objects which attracted the greatest attention at a recent soirée of the Civil Engineers, London, was the Whitworth steel cylinder cover for Her Majesty's ship Rover, having a diameter of 6 feet 4 inches, a depth of 4 feet 9¼ inches, and a thickness of 1¾ inches. Its weight is three tuns, and tensile strength 44 tuns to the square inch, the elongation of the metal extending to 27 per cent before breaking.

A NOVEL NEEDLE.

The novelty in the needle represented in our illustration consists in a hole drilled longitudinally into the head of the implement for a distance of about one quarter of an inch. The interior of this orifice is screw-threaded, so that a wire, sinew, or thread may be screwed into the hole, and thus securely attached in the manner shown in Fig. 1. For heavy work, such as sewing canvas or leather, where a palm thimble is used, the usual ears may be formed on the end of the needle, as in Fig. 2, to prevent the thread from cutting.

For surgeons' use, this invention is claimed to be especially valuable, as it allows of the employment of a smaller needle and of a single thread, thus avoiding the pain often caused to the patient, through the enlarging of the orifice made by the needle, by the passage of the double strand. The finest silk thread, we are informed, may be used, with no other preparation than waxing the end.

Patented March 31, 1874. For further particulars address



Mrs. Ella N. Gaillard, care of H. S. Abbot, 7 and G streets, Washington, D. C.

VARIOUS METHODS OF COOLING AIR.

Ice, as a refrigerant, might either be placed within or without the ducts that bring in fresh air. In the first case, generally preferred by the inventors, it melts, and afterwards evaporates in the fresh air. The cold resulting from the fusion and warming of the water produced not being more than a sixth of that due to evaporation, it therefore follows that the amount of moisture introduced into the air is about one seventh—nearly as much as that of evaporation alone.

In the apparatus shown in Fig. 1, the air conduit, C C, passes through a casing, A B, formed of a double lining. The interior space, D, surrounding the air conduit, contains ice. The next space, B, is filled with a non-conductor of cold. A tap, R, lets off the water formed by the melting of the ice into a receiver, M. The air conduit, C C, is fitted with mechanical fly wings, *a b*, which increase the contact of the air with the sides refrigerated by the ice. These metal fly wings are fixed to a vertical axis, and in successive rows, but in different planes, which multiplies the surface over which the air has to pass. This contrivance, which manifests ingenious details of construction, may have been applied with success, but it is far from being sufficiently inexpensive.

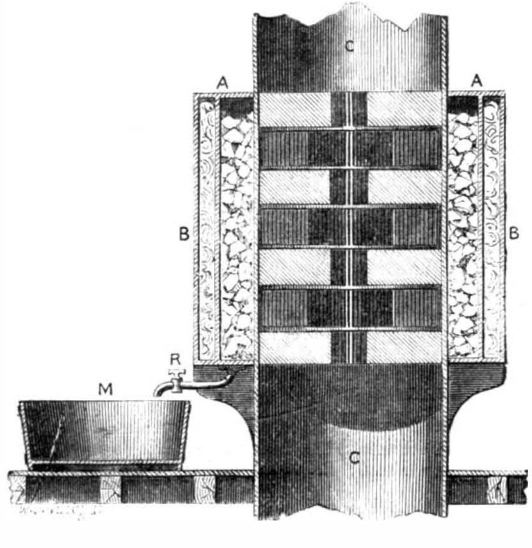


FIG. 1.—ICE REFRIGERATOR.

By causing currents of air to pass through vaults built at a depth of six or eight feet below the surface, they will be perceptibly cooled in summer if they are of any considerable length.

In ascending to the attics of dwelling houses, the immoderate heat developed by the sun's rays is very perceptible, especially in cases where the roofs are covered with metallic substances. Now, the question is, how to turn the heat to account for the introduction of pure air. The mode of doing so is very simple. A ventilating chimney is placed on the top of the building, to which abut side props, forming a double ceiling, and having communication by vents in the cornices. The fresh air coming from the cellars enters the room by hollow pillars or vertical props, according to circumstances; and at night, the natural heat of the sun not being available, artificial heat is employed.

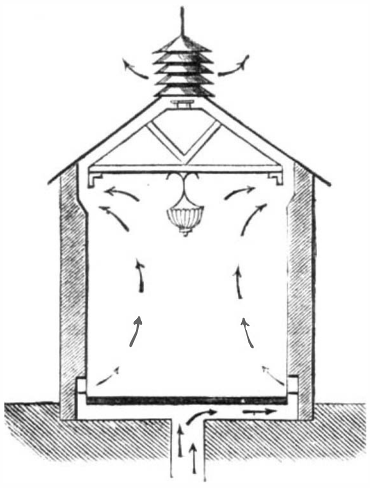


FIG. 2.—VENTILATING CHIMNEY.

Another method is the imitation of the effect of rain; it is susceptible of being used almost directly to most edifices and dwellings. Water applied in the morning and during the heat of the day not only obviates the heating of roofs, but, as long as the temperature of the water is less than that of the air, it can maintain the interior walls at a temperature far inferior to the latter, and it cools the air ascending to the attics.

COOLING THE AIR BY MEANS OF AMMONIA VAPOR.

The apparatus represented in Fig. 3 is intended to produce a cooling of the air. It is composed of a chimney, A A, the hight of which is variable, at the top of which is vertically placed the tubular generator, B, containing a solution of liquefied ammonia to the line, *b b*. This perfectly isolated receiver is in direct communication with the serpentine condenser, E, by the two pipes, F, G; the receiver, E, is also perfectly isolated. Around the serpentine circulates well water. No matter what the temperature may be outside the apparatus, it is evident that the interior pressure would be superior to that of the atmosphere; the ammonia would therefore vaporize as well in the chamber, *b b n n*, as in the tube, *m m m*. The gaseous current being thus formed, sweeping through the interior atmosphere of the tubes and serpentines, would carry before it the air, which would be expelled by turning the tap, *l*. By means of an india rubber pipe placed upon the nozzle of this tap, this current would be received in a vase containing water. The air would escape, the ammonia would remain in the water, and, when the absorption was complete and no more bubbles were formed on the surface, it would be seen that all the air had escaped; it would then be necessary to close the tap, *l*. This being done, nothing would remain in the interior but the liquefied ammonia, the vapor of which, immediately attaining the maximum of tension, would at once fill the space left empty by the expelled air. If, then, by any accident, the temperature of the generator, B, became higher than that of the condenser, E, vapor would at once be formed in the receiver, B, which would proceed to condensation in the receiver, E, until the balance of temperature was restored. This action would be all the more rapid in proportion to the rapidity with which the vapor is induced in the vacuum; and would be also in proportion to the condensation. Thence there would be a relation between the force of the condensing action in E, the promptitude of vaporization in B, and the energy of refrigeration of the body passing in the tubes, *x x*, and round the casing, B. Now, this body is no other than the atmospheric air freely entering at the orifice, A, and penetrating the tubes, *x x*, drawn by the increase of density communicated to it by refrigeration, and causing it to descend the chimney. If the surfaces are sufficient the temperature will remain equal between B and E; therefore if the water which reaches the condenser is at 50° Fah., the air which emerges at the lower part will have that temperature; descending the chimney, A A, this air passes by the conduits, S S, to freely distribute itself in the localities where it is necessary to produce a cooler atmosphere. This arrangement is ingeniously conceived but complicated.

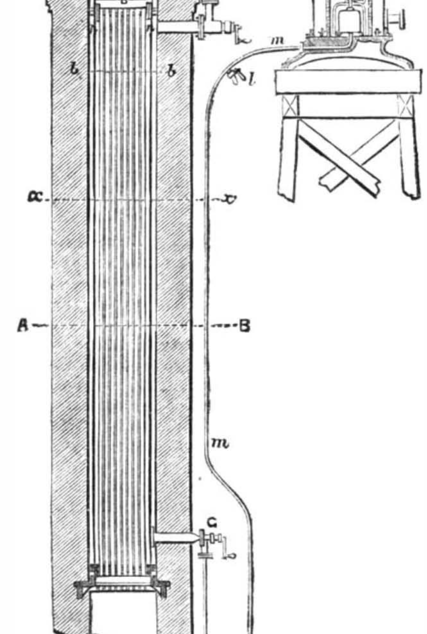


FIG. 3.—AMMONIA REFRIGERATOR.

COOLING THE AIR BY MEANS OF WATER VAPOR.

An apparatus, upon which has been bestowed the name of hydro-atmospheric condenser, has lately been devised by MM. Nézeraux and Garlandat. It is composed of two distinct parts, the condenser, A, properly so called, and the refrigerator, B; the condenser is a series of tubes assembled between two plates, forming part of a cylindrical casing hermetically closed, a pump which serves at once for circulation and evacuation, and a chimney, K, by which the air, saturated with water, escapes (Fig. 5). The refrigerator is formed of a metal plate pierced with holes of small diameter, and of a ventilator, the current of which passes through the orifice, I. The steam escaping from the cylinder penetrates to C, disperses through the space between the tubes, condenses itself by contact, and produces a vacuum. The water, which has just condensed the steam, passes above the perforated plate, B, upon which a current of air is continually in action from above and beneath, which divides the water and instantly cools it; it falls into the tank, D, whence it is pumped by means of the tube, M, and brought back by E; thence it passes uniformly through all the tubes over the whole extent of the refrigerating surface by means of little fluted plugs, or similar contrivances, at the base of the apparatus at H, by means of a pump, to be restored to the feeding tank. Applied to ordinary condensers, the refrigerator effects a considerable economy of water, and produces other advantages, which it is unnecessary to mention here, not concerning the subject under consideration.

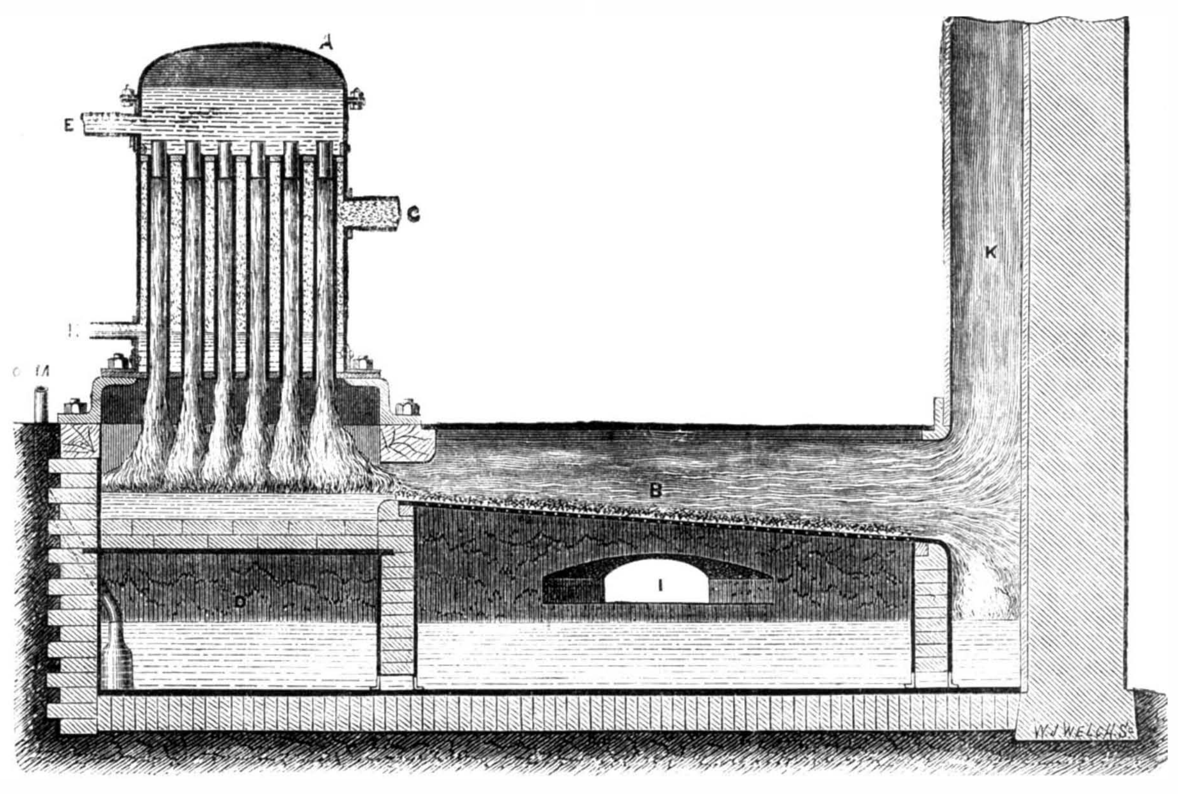


FIG. 4.—AIR REFRIGERATOR.

If the steam boiler and steam be suppressed in this apparatus, and the perforated metallic plate and ventilator be only retained, the apparatus shown in Fig. 5 is made.

Through the perforated plate, either of metal or some other material, P, from beneath to above, the ventilator, V, set in motion by the hand, or, in the case of a more considerable application, by some mechanical motor, keeps up a current of air which passes through the numerous holes of the plate. Above this plate cold water is introduced by the pipe, T, furnished with a regulating tap; the water passes into a water pipe, whence it issues in a uniform manner over the plate, which is slanted in such a manner that the thickness of water shall not exceed certain limits; in some cases ice or chemical solutions, as those of phenic acid, may be substituted, according to the application of the apparatus. The pressure exercised by the propelled air suffices to maintain the water on the surface of the plate, and prevents it passing to the lower part. The water flows slowly on to the plate, and, after having passed over and given its coolness to the air which pene-

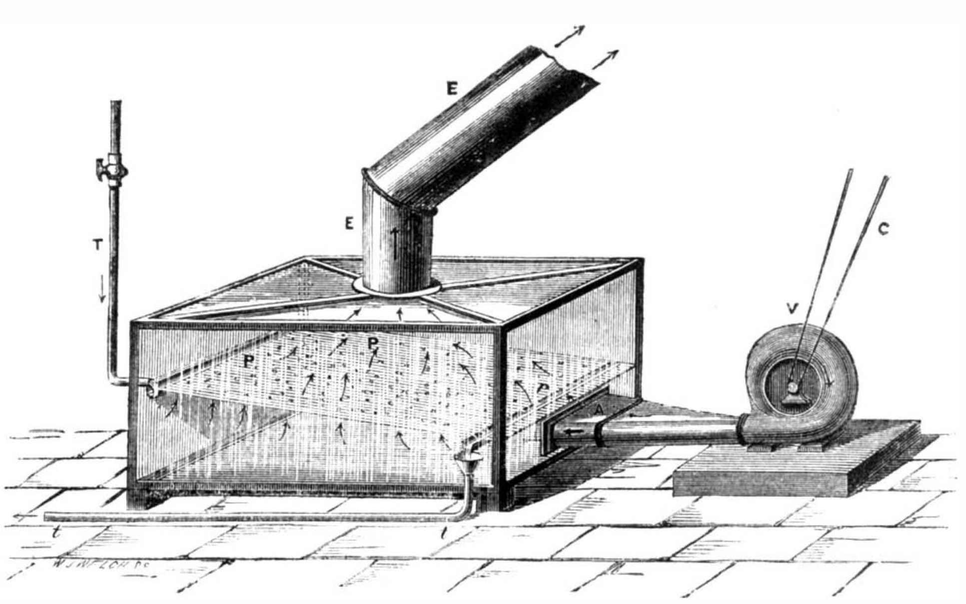


FIG. 5.—VENTILATING APPARATUS.

trates it, finally reaches the other pipe, by which it runs to the issue at t; in most cases this water is again useful for other purposes. As to the cooled air, it penetrates into the upper part of the apparatus, escaping by the tube, E, and reaches the places where it is wanted.

MEDICAL NOTES.

An Antidote for Mercury and Lead Wanted.

It is well known that the doctors of the regular or allopathic school insist on the free use of mercury, especially in secondary syphilis, that dreadful scourge of civilized countries. Many of our Western and Southern doctors pour in the calomel and blue pill for almost everything, as freely as the profession used to do in former times. Since this is so, and since the other medical schools have not yet furnished a practical substitute for mercury, the great want in medicine is a counteractor for a remedy often as bad if not worse than the disease. Chemistry and experiment must help the doctors, and still more the sufferers from mercurialization, if it be possible. Chemists and physiologists long ago found two, and only two, efficient agents, capable of rendering mercury in the system harmless; and these two substances, namely, iodine and sulphur, happened also to be the best neutralizers of another common cumulative poison, lead. But the difficulty was and is to cause the assimilation of iodine and sulphur, or either. Sulphur is nearly insoluble in any menstruum capable of being taken into the stomach. Iodine is very soluble in alcohol, oil, etc., and even in water to some extent, but largely soluble as iodide of potassium, a drug now used to excess. Unfortunately this iodide, also the tincture, are but slightly assimilated, passing off by the bladder. The small amount of iodine contained in that well known organic substance, cod liver oil, would be likely to prove more effective as an antidote to lead and mercury than a large quantity of iodide of potassium, because the organic oil enters into the blood and tissues. We put forth the suggestion that some vegetable may be found which is rich in iodine, also other plants, and harmless ones, may contain sulphur in an assimilable shape, for sulphur is an exceeding ly common element of organisms in general. If we could have strong extracts of such plants, the object spoken of would be accomplished. In that case, our calomel givers could salivate their patients to their hearts' content, and have them live through a dozen courses of mercury, a matter of profit and pleasure to every regular doctor.

Thousands of cases of chronic rheumatism, as well as consumption and other fatal diseases, have been traced to the use of mercury. Lead poisoning has become alarmingly prevalent of late years, producing colic, constipation, hardened liver, neuralgia, nervous dyspepsia, and paralysis, which sometimes attacks people even in the prime of life. We will not discuss the question of lead in water pipes farther than to observe that every decent chemist knows that pure water acts on lead with astonishing quickness. To have water pipes, as used at present, coated internally with a sulphide or sulphate seems to be the only good practical preventive of lead poisoning. But in the case of lead pipes kept for weeks in hogsheads and barrels of ale and cider, there the solubility is certain and its effects destructive or pernicious to no small degree. Such dangerous nuisances should be abated by law. Again, soda fountains where the water, highly charged with carbonic acid, acts on lead, and sometimes on copper in old fountains, are things deserving of legal attention. Many of the hair dyes in market, and some of the cosmetics, are well proven poisons.

Ice as a Medicine.

The great value of ice in certain diseases is not fully recognized by the medical profession, or by the public. Many years ago, it was found by one of the best English physicians—we think Dr. Marshall Hall—that small pieces of ice thrust into the rectum proved a safe and speedy remedy in cases of dysentery, where opiates and sugar of lead had been tried without effect. Very recently, that distressing complaint to which old people, travelers, and others are liable, retention of urine, has been relieved by the same use of ice as mentioned above. This plan is due to M. Cazenave. Common experience has shown that the swallowing of ice instead of ice water by people, in hot weather, is perfectly safe.

Effects of Uric Acid.

Dr. Gigot-Suard has given uric acid to dogs in doses of from 3 to 61 grains in 24 hours, and continued it for one or two months. The acid occasioned remarkable morbid lesions, throwing light on a large number of chronic diseases. The alkalinity of the serum of the blood was often diminished, and it contained crystals of the acid and urate of soda. The organs and tissues upon which uric acid exerted its action are, in order of frequency: the skin, mucous membranes and their glands, the lungs, kidneys, liver, pancreas, brain, lymphatic glands, articulations, spleen, envelopes of the spinal cord and heart. Various forms of disease appeared in all these parts. Cancerous and tuberculous degeneration was produced several times in the lymphatic glands. These experiments are very interesting, and may lead to a more accurate view of the cause and cure of consumption and several other grave diseases.

The New Electric Light.

On the evening of the 5th of May, some interesting experiments with MM. Ladygin and Kosloff's electric light were conducted at the engineering works of Messrs. Warner, Euston Road, London. To obviate the difficulty of carbon being consumed when burnt in contact with oxygen, M. Ladygin p'aced sticks of carbon in a closed glass chamber filled with a gas not containing oxygen; but owing to the use of metallic connections, the carbon was subject to fracture. M Kosloff succeeded in overcoming the difficulties by using a special metal of which he forms the holders for the carbon rods, and these are placed in the closed glass chamber.

The lamps which were experimented with were nine in number, six of them having two carbon rods, either of which could be placed in connection with the current of electricity. The carbon rods were all $\frac{3}{4}$ of an inch in length, and one in each lamp was $\frac{1}{12}$ of an inch in thickness, the others being a trifle less in thickness. The other three lamps contained each a carbon rod, three inches in length, $\frac{1}{12}$ of an inch thick, and also connected with the main current. The first experiment consists in burning a carbon rod in contact with the atmosphere, the rod being consumed in a few minutes. The current was then turned on the thicker rod in each of the six lamps, and a brilliant and steady light was produced, which improved as the current was increased in intensity. The reason for lighting the thicker rod first was that it might consume the oxygen in the lamp, by which the rod was slightly reduced. The current was then directed through the second rod with equally satisfactory results in all the six lamps. The three lamps with the longer carbon rods were then lighted and successfully exhibited, changes being frequently from the six to the three lamps and back again. The apparatus used for producing the current was Gramme's magneto electric machine. With the machine running at about 200 revolutions a minute, a moderate light was obtained, which was greatly improved at 300 revolutions, the maximum of intensity being obtained at 450 revolutions. The strength of the light depends upon three things—on the power of the machine and the number of its revolutions, on the length and thickness of the carbon rods, and on the quality of the carbon. The experiments showed that, with the same strength, of current and the same number of revolutions, double the amount of light was obtained with three long carbon rods as compared with the six short ones. The experiments demonstrated satisfactorily the fact that the electric current could be subdivided, and hence, if practice confirms experiment, which it is believed it will, there is a wide field open for the application of Kosloff's system.—*Telegraphic Journal.*

An Unfortunate Discoverer.

W. T. writes to say: "In No. 24 of Volume XXX of the SCIENTIFIC AMERICAN, Mr. John Hepburn, of Gloucester, N. J., states, in his communication on zodiacal light, that he was the discoverer of the glacial epoch theory, which Professor Agassiz only proved to be true. I do not deny that Mr. Hepburn discovered that theory; but it is a fact that Agassiz adopted it from Karl Schimper, the late brother of the African traveler Schimper, who was released by the English-Abyssinian war. Karl died in February, 1868, in Schwetzingen, near Heidelberg, Germany, of dropsy and of the ill treatment by a malicious neighbor. Schimper mentioned this fact to me, and complained that all his discoveries had been stolen from him, and he had no power to defend himself against the lions of Science. In fact, they left him nothing but his law of the position of leaves. When he was dead, a valuable collection of stones, curiously shaped by the action of water, was destroyed. He was trying to find a law for such shapes; but he never told me more about it, for fear I would misuse the information, although I was an intimate friend of his."

THE State of New York has appropriated $50,000 for the erection of a monument at Saratoga to commemorate the surrender of the British army under General Burgoyne to the American forces under General Gates, October 17, 1777. The monument is to be 230 feet high.

THE new aquarium, now in process of construction at Manchester, England, will be a splendid affair. The tank frontage will have a length of 750 feet.

To our Friends and the Public:

After the full statement heretofore published of the difficulty of our firm with the Customs authorities, and the subsequent exhaustive examination of the whole matter by the Committee of Ways and Means, which resulted in the entire remodeling of the "Moiety" and "Seizure Acts," we had not supposed it would be necessary to add anything further in the way of explanation. But in the brutal and cowardly attack made upon us during the closing hours of Congress by General Butler, certain charges were preferred by him in his character as a Representative, upon the floor of the House, against our firm, so definite and with so much of apparent authority that we feel called upon, in justice to ourselves and the public, to make once more a brief statement.

The charges specifically preferred were, in the main,

First. That we had, as a firm, attempted to defraud the Government and evade the revenue by importing metals, in the form of works of art and statuary. In reply to this it is only necessary to say, that the importations to which General Butler referred were made before the firm of Phelps, Dodge & Co. came into existence, and before any one of the present or late members of the firm became connected with the metal importing business; the senior member of the firm, William E. Dodge, being at the time engaged in the drygoods business.

Second. That in the tariff act of April, 1864, which temporarily increased the rates of duty on imports *fifty* per cent, "Mr. Dodge went to the Treasury and had a comma taken out of one place and put in another, and thereby cleared $2,250,000."

The exact facts in respect to this charge are as follows: In the very full revision of the tariff, as embodied in the act of June, 1864 (and not the act of April, 1864, so specifically mentioned by General Butler), it was decided by both Houses of Congress, after full discussion, that an increase of duties on tin and terne plates would imperil the large industries already taxed under the internal revenue in which tin was used for the packing of fruits, fish, and vegetables, meats, and the like, and so tend to reduce, rather than increase, the receipts of the Treasury. At the same time it was decided to increase the duty on sheet iron, galvanized with an admixture of tin, which article had been imported under the name of "tin plates galvanized," and so definitely and distinctly named in connection with and at the same rate as "galvanized iron" in every successive tariff since 1857. The bill was passed on the 30th of June, and went into operation immediately. On examining its provisions, we found that while the duty on "tin and terne plates" remained unchanged at twenty-five per cent *ad valorem*, the addition of a comma after the word "plates," in the clause "tin plates galvanized," rendered the whole paragraph ambiguous if not absurd, and apparently imposed a new duty of 2½ cents per pound, an increase of one hundred per cent on existing duties. Seeing how impossible it would be to enter our invoices at two conflicting rates for one and the same article, we applied at once to the Collector for a decision in respect to the course to be followed. The Collector saw the difficulty, and referred us to Mr. Fessenden, then in New York, and just appointed Secretary of the Treasury. We called upon him, and he immediately stated to us and to the Collector that he had been chairman of the Senate Committee, and also of the Conference Committee which had charge of the tariff bill in question; that he fully remembered the discussion as to tin plate, in which he had taken part; that the full sense of both committees had been that tin plates should remain at 25 per cent *ad valorem*; that the "comma" had evidently been added by mistake in the haste of engrossing, and could not be considered as the true interpretation of the law.

He accordingly ordered the Collector to pass the goods at 25 per cent, and stated that, on his return to Washington, he would issue a special order making the construction official; and this he did under date of July 22d, after taking full time for consideration and consultation with his former colleagues in Congress and the experts of the Treasury Department. As finally interpreted by Mr. Fessenden, moreover, the law was not in our direct favor; but, on the contrary, had the technical error been allowed to stand and to entail a very excessive increase of duties, the advance in the price of stock on hand would have yielded to us, in common with all other importers and dealers, a very considerable profit. The facts, therefore, were exactly the reverse of those stated by General Butler.

Third. General Butler states that, in our large and complicated business, every invoice brought day by day by us to the Custom House, was wrongly stated, and that we were consciously and continually guilty of fraud.

General Butler *knows* this to be untrue. He *knows*, on the contrary (for as the paid attorney of the informer, he has given attention to the subject), that, after a most careful and merciless examination of some thousands of our invoices by Jayne and his experts, aided by our own clerks *bribed* to injure their employers, with the full use of our books and papers, there were found only some fifty that could in any way be made the subject of controversy; and that in the case of some of these, of from twenty to thirty thousand dollars each, the utmost possible loss to the Government could not have been in excess of 80 cents to one dollar per invoice. And furthermore, that the total loss claimed by the Government on all the invoices was only about $1,600, out of an importation of some $40,000,000, and covering the space of five years.

We believe General Butler further knows, but willfully conceals the fact, that the same error and misunderstanding of the intricate law which compelled us, under severe penalties, to invoice our goods both at cost price and at market price, led us, in the case of a great number of importations, to invoice their value above cost, and so resulted in a gain to the revenue and a loss to ourselves immensely greater than the Government claims to have lost.

Finally. Looking at all the circumstances and the character of this speech, its constant falsifications and perversions of truth, and its brutal personalities, we are quite willing to leave the verdict as to its effect, to any who have fairly looked into the matters of which it treats.

PHELPS, DODGE & CO.

New York, June 26th, 1874.

NEW BOOKS AND PUBLICATIONS.

THE BROOKLYN COUNCIL OF 1874. With Documents and an Official Report of the Proceedings. New York: Woolworth & Graham.

SIXTH ANNUAL REPORT ON THE NOXIOUS, BENEFICIAL, AND OTHER INSECTS OF THE STATE OF MISSOURI. By Charles V. Riley, State Entomologist.

This is a document to be read attentively by the scientist, naturalist, and the farmer; and its value is not confined to the enterprising State which publishes it. Professor Riley has a profound and minutely accurate knowledge of the interesting and complicated science to which his life has been devoted; and his reports are part of the contemporary history of our country, and should be circulated everywhere.

THE LAW OF DESIGN PATENTS, with Digests and Treatise. By William Edgar Simonds, Counsellor at Law. Price $4.50. New York: Baker, Voorhis & Co., 66 Nassau street.

The Supreme Court having recently passed somewhat fully upon a design patent cause, the author has deemed the present a fit opportunity to collate cases on the subject of design patents, and to present them digested and supplemented with deductive comments in the volume above named. The *status* of these patents has heretofore not been unattended with doubts; and hence the present work, aiming as it does to cover the entire field, and to give a clear comprehension of the decisions of the courts on the subject, will doubtless meet with a ready welcome at the hands of the profession.

OLD AND NEW. The July number of this admirable magazine, edited by Edward E. Hale, opens a new volume, the tenth. For vigorous thought, entertaining and useful contents, the magazine has no superior. $4 a year. Boston: Roberts Brothers.

TROW'S NEW YORK CITY DIRECTORY FOR 1874-75 gives some interesting statistical information regarding the increase in population of the metropolis. Last year, the number of names contained was 228,161—this year it is 229,503. Estimating each name as the representative of five persons, an augmentation of 7,000 in population is indicated. The volume contains a newly engraved and excellent map of the city, including the two new wards recently added. The arrangement of names, etc., is the same as in former years, and there is a very large number of advertisements of prominent business houses. Published by the Trow City Directory Company, 11 University Place, New York. Price six dollars.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 2 to June 10, 1874, inclusive.

CAR TRUCK AND AXLE BOX.—A. Higley, Cleveland, Ohio.
CLOTHES WRINGER.—T. G. Corliss, New York city.
FOLDING BEDSTEAD.—E. E. Everitt *et al.*, Philadelphia, Pa.
HARNESS.—I. M. Singer (of New York city), Paignton, England.
MAKING PAPER BOXES.—H. R. Heyl, Philadelphia, Pa.
MAKING STENCH TRAPS, ETC.—W. A. Butler, New York city.
MAKING WHITE LEAD, ETC.—A. P. Mevlert, New Britain, Conn.
MILLSTONE DRESSING MACHINE.—S. Dean *et al.*, La Crosse, Wis.
SCREW NUT.—W. M. Van Anden, Brooklyn, N. Y.

Recent American and Foreign Patents.

Improved Car Replacer.

John R. Wilds, Brooklyn, N. Y.—This ingenious invention is something which is much needed upon city horse car lines, where it is a daily occurrence for cars to run off the track, causing vexatious delays to the passengers and very severe work to the horses. The device is simply an iron plate grooved beneath to fit the rail, and having flanges to secure it thereto. From the middle of the replacer an irregular shaped groove inclines downward to the rail in each direction. The plate extends over the outside of the rail, and has two oblique channels which intersect the grooves. This part of the replacer is supported on the pavement. The channels extend from the center of the replacer, and incline downward in each direction so as to terminate at the bottom outside of the "tread" of the rail, to receive the flange of the wheel of the displaced car, and to conduct it up to the center, and then down the longitudinal groove to the rail. By slightly modifying the form of the grooves and flanges on the under side to fit it to the rail, the displaced wheel between the rails may be replaced in the same manner. The invention may be applied to the rails of either horse car roads or to the T rails of locomotive roads.

Improved Watchmaker's Tool.

Julius F. Young, Owatonna, Minn.—The object of this invention is to furnish means for reducing the tension and elasticity of hair springs of watches, so as to vary the time or action of the watch movement from fast to slow, as may be desired. There is an adjustable rest, which is designed to hold between it and a stationary stand any diameter of watch balance wheel with the hair spring and parts connected therewith. This rest is adjusted by a finger screw. The balance wheel with the hair spring being thus confined, the end of the hair spring is taken hold of with a pair of pliers and is gently drawn along under spring clamps which are screwed down. These hold the hair spring flat to the bed, so that, with a scraper of any suitable kind, the hair spring may be reduced so as to alter the running of the watch from five minutes to an hour and a half in twenty-four hours. When the clamps are raised, the hair spring is allowed to slip back by its own tension, so as to assume its former diameter, and is readily recoiled.

Improved Hog Trap.

James M. Overshiner and George M. Overshiner, Elwood, Ind.—This is an improved trap for catching and holding hogs. In using the trap, the end is opened; and the hog being driven into the trap, the lower end of a lever is moved outward to open a space large enough for the passage of the hog's head. As the hog attempts to escape, the lower end of the lever is moved inward, clasping the hog's neck and holding him securely, a pawl locking said lever in place. The hog can now be conveniently operated upon as desired, there being suitable devices for placing the animal in proper position.

Improved Standard for Vehicles.

James J. Martin, Houst n, Tex.—This is a stanchion pivoted in a strong metal box adapted to be fastened to the side of the platform of the car. The box is open at the top and at one end so that the stanchion can be turned down on its pivot by the side of the platform to be out of the way. A spring is arranged in each box to so act on the stanchion as to hold it in the upright positic n; also to hold it when down. The invention also consists of a metal bar on the inside of the stanchion, extending from the platform nearly to the top, and having a screw bolt at each end passing through for clamping side boards to the stanchion when a temporary box is wanted for the platform. This bar draws back into a groove in the side of the post, flush with the surface, when it is not to be used.

Improved Thill Coupling.

Eli Quaintance and Remus D. Hale, Transitville, Ind.—This invention consists in a peculiar mode of supporting the shafts so that the end projection of the plates shall enter and be embedded in the rubber spring. It also consists in a novel mode of holding the rubber by a tongue projecting from the cross bar of axle clip. The ends of a T journal pin form journals in jaws. One jaw of each pair is slotted from the top to the journal hole Iron plates, when the tongue or shafts are turned to an upright position, will pass through the slots and allow the tongue or shafts to be detached. Betwe n the jaws and back of the journal pins are pieces of India rubber which are for the purpose of preventing rattling, and are held in place by means of the tongues of the clip bars and narrow ribs on the back side of the T journal pins. When the tongue or shafts are in use, it is impossible for them to become detached. By raising them to an upright position they are disconnected in a moment.

Improved Saw Set.

Sylvanus Bartlett, Westport, N. H.—The saw set is of the usual shape and material. A U-shaped gage piece is applied around the rear and sides of the anvil, adjusted by a screw bolt and set nut, and is fixed firmly in position by a set screw, so that the sidewise projecting front ends of the gage move forward or backward along the fore end of anvil and hammer till the gage is set to the exact length of the teeth of the saw required to be set.

Improved Railway Rail Joint.

Anson B. Johnsen, Washington, assignor to L. Jonnson, Vincennes, Ind. —The ends of the rails are curved outwardly, and in the space thus formed is placed a metallic tongue. The latter has central projecting shoulders which form a support for the top part of the rails. The top part of the tongue forms a continuous connection with the top part of the rails, and allows the smooth passage of the car wheels, without battering or otherwise injuring the rails. The rails, tongue, and base plate are firmly fastened to the crosstie by spikes placed into grooves of the base flanges of the rails and tongue, in the usual manner, passing through perforations of the base plate.

Improved Washing Machine.

James L. Austin, Little Rock, Ark.—In using the machine, the driving roller is raised out of the suds box by means of levers, and the clothes to be washed are spread upon the exposed part of an endless apron. The roller is then lowered upon them, and as it is revolved the clothes are carried between aprons and two other sets of rollers. The clothes are made to pass beneath the driving roller, and are again carried in between the endless aprons, and will thus continue to circulate until thoroughly cleansed.

Improved Combined Lamp Collar and Shade Holder.

George W. Haddield, Brooklyn, N. Y.—The collar is applied in the usual way. The shade holder is affixed by supports to a base ring, which is made of such a size as to fit upon the collar. Upon the outer surface of the latter is formed a screw thread, into which fits the screw thread cut upon the inner surface of the base ring of the shade holder. By this means the shade holder will be firmly and securely connected with the lamp in such a way as to be entirely independent of the burner, and allow the burner and chimney to be conveniently attached and detached and replaced with new ones without disturbing the shade holder.

Improved Clothes Frame.

Lafayette Magee, Olean, N. Y.—This invention consists of clothes racks adapted to be suspended from a vertical wall, and composed of a series of parallel bars joined by horizontal rods. The two clothes-suspending frames may be set in an inclined position, the upper and overhanging frame being supported on the lower one, and both folding together when not in use.

Improved Hat Ironing Machine.

Antoine Giraux, Orange, and Louis Drovon, Newark, N. J.—This invention consists of irons suspended from balance levers by flexible joints, and of levers arranged on swinging supports in such a manner that the labor of presenting and holding the irons to the work is materially lessened, and the irons can be applied and the pressure regulated to better advantage.

Improved Mitten.

John L. Whitten and J. Hermon Whitten, Burlington, Vt.—The essential feature of this invention is in so cutting the parts as to form the mitten or glove without a seam on the palm or inner side of the thumb, and so as to bring the seam on the outside of the finger, and above the ball of the thumb.

Improved Safety Guard Watch Chain.

Robert A. Johnson, New York city.—This is a useful device for connecting a watch with a guard or chain in such a way that the watch cannot be detached by twisting off the ring from the stem. It consists of a short extra chain, one end of which is attached to the guard near the ring, and its other end is secured to the stem. By this construction, should a pickpocket get hold of the watch and twist off the stem ring, the safety chain will still hold the watch securely connected with the guard, so that it cannot be carried off. This will prove of value to people who are obliged to do much traveling in New York street cars.

Improved Sewing Machine Treadle.

Daniel E. Lillis, Jackson, Mich.—A movable footboard is attached to a cranked rod, so as to shift on it crosswise the length of a slot, in which is a binding screw for holding it in any adjustment. Guide rods attached to the footboard slide thereon. The adjustment is made to allow the operator to so place his feet upon the board as to work it either by a swinging leg movement or by an ankle movement.

Improved Medicine Dropper.

Dennis Warner, London, O.—A rubber bulb clasps the neck of the bottle with its open end, and has a discharge tube placed at one side and near the front end. The latter has walls parallel on the inner side throughout its length, the end being a flat surface or a little concave, and at a right angle to the axis of the bulb. The device drops by pressure, the same sized tube and caliber dropping equally well all degree of fluidity, from sirups to ether and chloroform; it also enables the operator to time the frequency of the drops, so as to make an accurate count.

Improved Excavator.

Ignacio Arcos, San Antonio, Texas.—This invention consists in a scoop suspended in adjustable supports by chains to a crank axle provided with arms, to the extremities of which are attached ropes that are wound around a windlass. Said scoop is raised or lowered through the agency of the arms attached to the crank axle in connection with the ropes and windlass, and the apparatus, as thus described, is supported upon wheels provided with shafts.

Improved Apparatus for Steaming Grain.

William C. Knox and Josiah N. Knox, Evansville, Ind.—In this device, the wheat is subj cted to the action of steam as it passes downward through a cylinder. In the latter is first a hopper, then a conical plate, apex upward, then another hopper, another plate, and so on, through and over which portions the grain passes, alternately contracting and expanding in its flow. In the tube which supports the conical plates are made apertures through which steam is conducted to the interior of the cylinder.

Improved Candlestick for Christmas Trees.

George W. Raessing, Chicago, Ill.—This is a candlestick, the socket of which is composed of a coil and the fastening device of a stem, the latter being arranged to cross the space at the bottom of the coil, to form a support for the candle.

Improved Miner's Candle Holder.

Neils Larsen, Mill City, Col. Ter.—A pin is riveted in one end of a bow spring, and passes through the other extremity so that the spring can spread or move outward freely. An elongated curved end of the spring forms a socket for the candle. Working on the pin, in similar manner to the blades of a penknife, are a hook, an awl, and a blade, so that the miner is thus provided with a convenient combination instrument.

Improved Miter Box.

Calendar Potter, Bloomsburgh, Pa.—The object of this invention is to construct a miter machine which may readily be set to any desired angle for cutting the molding accurately and quickly with a hand saw, and with out loss of time. The invention consists of a pivoted saw guide, which is made reversible by a lever arrangement on the bottom of the bed plate, while a second lever connection, operated from the opposite side, adjusts the stops which define the angle of the saw guide with the central axis for cutting the miters.

Improved Pump.

William Urquhart and John U. Livingston, West Hoboken, N. J.—The pumps may be double or single acting and of any approved kind; but it is essential that they all connect alike with the suction and discharge pipes. They are seated on a plate, which bolts to standards and has a slot through which a suction pipe projects; also branches connecting the suction with the outside pumps, fastening them by a washer and nut applied to the suction from below.

Improved Can for Cooling Milk during Transportation.

George W. Finke, Mount Pleasant, Iowa.—This is an improvement on a milk can patented by the same inventor, March 3, 1874, No. 148,114, by which the ice chamber may be made in smaller size, saving space in shipping the cans, and also the ice consumed be considerably economized. The improvement consists in providing the ice chamber of the milk can with an inside lining of wood at the side wall, top, and bottom of the same, with the exception of the portion of the main can inside of the ice chamber. The inclined false bottom is grooved at the under side for conducting the melted water to the exit opening of the true bottom.

Improved Inking Apparatus.

Gilbert E. Jones, New York city.—This improvement consists in the combination of one or more movable blades with the duck roller. Foreign substances, which find their way into the ink fountain, are apt to collect on the under side of the knife and form pads which press against the roller and wipe off the ink from the surface thereof. The effect of the movement of the blades added between the roller and knife is to dislodge the pads before mentioned, thus insuring the supply of an even film of ink to the roller.

Improved Churn Dasher.

John E. Shelton, Hickman's Mills, Mo.—To a short vertical tube are secured two parallel disks, in which are formed numerous small square holes. The outer edges of the disks are connected by short vertical bars. To the center of these and to the tube are pivoted horizontal radial rods, to which are secured plates, which are made of such a size as to turn freely between the disks. The latter are also perforated. By this means the milk is finely divided, and is thrown into numerous currents and counter currents, bringing the butter in a very short time.

Improved Illuminating Roof Plate.

Niels Poulson, New York city.—This invention is an improvement in illuminating plates for roofing purposes, and consists in providing the shanks of the bull's eyes with lugs inclined upon their upper side, to adapt them to be firmly clamped to a metallic plate in openings in which they are inserted.

Improved Egg Carrier.

William O. Strong, Ypsilanti, Mich.—Egg carriers formed of slitted and interlocked paper strips soon become useless in consequence of the projecting ends of the strips becoming broken. And when the slits of each strip are on one side thereof, instead of being alternately arranged, it is impossible to raise the carriers from the trays in which they rest without disconnecting all or part of the strips. To remedy these and other objections, the inventor connects the projecting ends of the strips to the side of the exterior cross strips by means of linen, muslin, or other suitable fabric.

Improved Plow.

Julius Hartmann, Gilman's Point, Ky.—The moldboards are hinged to the share, which is narrow and nearly vertical. When the share is turned to one side or the other, the moldboards are thereby adjusted at different angles, one to act as a landside, the other to turn the furrow like an ordinary moldboard. These parts are secured in any adjustment by means of a lever and notched arc bar.

Improved Composition for Emery Wheels and Whetstones.

Isaac Butterfield, Weissport, Pa.—This invention consists in the combination of the ashes of bark with a cutting grit and cementing material, in the manufacture of emery wheels and whetstones for the purpose of forming a stone of efficient cutting power, the friable ash performing the mechanical function of, falling out of the interstices as the stone wears away, and thus leaving exposed a sharp cutting surface.

Improved Rub Roll for Condenser Cards.

Alonzo Heaps, Darby, Pa., assignor to himself and Enos Verlenden, same place.—This invention consists of a tube having the feather or spline formed on it, and so constructed that it fits on the spindle of the rub roller nicely. It is secured by a nut or other means, so that it can be readily taken off and another put on. A new feather can also be put on when the old one is worn out, without disturbing the spindle.

Improved Hay Cart.

John Rumrill, Salina, Kan.—This invention relates to means whereby hay, after having been cured in winnow, may be raked and carried to the stack by one continuous operation, thereby greatly lessening the usual labor and the customary waste by hauling it or by dragging it with horses and circumjacent ropes or chains.

Improved Railroad Bed.

George Potts, Uniontport, O.—This invention consists in a continuous elastic bed for a railroad rail, which dispenses with all ordinary forms of fastenings for the same, and allows it free vertical movement. To this end, the iron rails rest lengthwise on wooden sleepers, and are secured by chairs which are bent inward at the top to form flanges that bear on the base of the rail. Thus the rail is confined only between the top of the chairs and the wooden sleepers.

Improved Car Coupling.

Martin Kurtzeman, Crestine, O.—This invention relates to that class of car couplings wherein the coupling pin is held up by a slide until the drawheads of two cars come into collision, and are automatically coupled, the object being to relieve car couplers from the usual peril of their occupation. The invention consists in an uncoupler of a very peculiar construction, and which seems admirably adapted to accomplish its purpose.

Improved Screw Plate.

George D. Dean, New York city, assignor to Frank G. Green, same place.—The object of this invention is to furnish a convenient and efficient means for cutting screw threads on gas pipes, in the operation of putting such pipes into buildings. The invention consists in a screw or die plate, in which are combined all the standard sizes and threads used for the purpose, with a guide for each die, the dies and guide holes being arranged in a convenient and compact form.

Improved Whiffletree.

Harvey M. Kelley, Irving, Ill.—A strong ring fits upon the end of the whiffletree, and has an eye formed upon the one side to receive a hook. Upon the forward and back sides of the ring are formed straps extending along and fitting upon the whiffletree, which have upon their ends inwardly projecting prongs, which enter the wood and prevent the clip from being drawn off. A band is slipped upon the whiffletree, and is designed to fit closely upon it near the ends of the straps and closely confine the same in place. It is secured in place by a screw. The eye of the hook is made open, and with its ends tapering and overlapping each other. The ring eye, and straps are cast of malleable iron, in one piece.

Improved Corn and Cotton Planter.

William H. Griffith, Jones' Mill, Tex., assignor to himself and M. J. Strickland, same place.—The corn part and the cotton part of the hopper are separated by a partition. In the cotton hopper there are two saws on a horizontal shaft, over and partly in the discharge throat, for forcing the cotton seed through and preventing the throat from clogging. By the side of these saws is a spiked conical block, also on the shaft, to work the cotton seed down to the saws. This shaft has a pulley outside of the hopper, on which a belt works from a pulley on the drum shaft, to turn said shaft.

Improved Planter, Cultivator, and Stalk Chopper.

John L. McCaleb, Atascosa, Tex.—In the middle part of the axle is formed a bow, so that it may readily pass over tall plants without breaking or injuring them. Beams are secured to the axle and pass back parallel with each other, and at right angles with the axle for a short distance, and are then bent outward at an obtuse angle. The rear parts are held by an arch, in the top of which the handles are inserted. The rear parts of the handles are held at the proper elevation by a U-shaped brace, the bow of which is secured to the arch. The furrow is opened to receive the seed by the plows, which are bolted to standards which swing upon the axle and the inclination of which, and consequently the depth to which the plows enter the ground, may be regulated at will. In adjusting the machine for use as a cultivator, the furrowing plows, the shafts and hoppers, and their attachments, are detached, and three or more standards, provided with suitable plows, are placed upon each of the beams. To the rear ends of the beams are detachably attached standards, having outwardly projecting journals formed upon their lower ends to receive the small wheels by which the rear parts of the machine are supported.

Improved Horse Power—Improved Baling Press.

Peter K. Dederick, Albany, N. Y.—The first is an improvement on an invention patented by the same inventor, June 25, 1872, which was a plan for arranging the shipping connections within a hollow journal, on which revolves the large drive wheel, having the drum arranged under it. The bore of said wheel was made large and fitted on a hollow stationary center or journal. In the present invention the same plan is made available for, further simplifying such machines, and economizing space by greatly enlarging the central opening or the hollow stationary center circle, so that the drum itself is placed within the hollow journal, and the hight of the machine thus materially lessened. Hence, the invention consists of a stationary circle or hollow center within which the drum is located, and which forms the journal for the wheel. The same inventor has also devised an improved baling press, which is particularly adapted to baling cotton, in consequence of the pressed material being open to receive the cloth after passing from the press box. The cotton is deposited into a hopper, whence it falls of its own gravity into a press box and is forced against a head by a plunger, which is operated by an eccentric through a connecting pitman. Any cotton overlapping the plunger is folded down by a roller suspended by springs in the end of the hopper, and passes behind shoulders, which may be formed with teeth, which prevent its return. This operation is repeated until the bale is built up in sections, having all of its sides clear of all obstructions for putting on the cloth. The bale, after being tied off, is removed by slacking back on the friction head, which is then placed against the front of the press box, ready for the next operation.

Improved Seed Planter.

John Johnson, of Perry, and Luther W. Ingram and John Harper, of Naples, Ill.—This invention improves the construction of the seed planter for which letters patent No. 28,490 were issued to John Johnson, May 29, 1860. The front frame consists of two cross bars, connected near their ends by two longitudinal braces, to the ends of the former of which runners are bolted. The lower parts of the latter are recessed to receive rotary cutters, which cut through roots, sods, and other obstructions, and thus prevent the seed-dropping device from catching upon them. Upon the runners are formed double share plows, by which the furrow is opened to receive the seed, which is introduced through a vertical hole in said runners. The seed then falls upon the wide flat part of the furrow before any soil can fall in. The upper parts of the runners are recessed to receive hoppers, which are pivoted by a rod screwed into the runner. The upper end of the rod passes to the dropper's seat, and is secured by a nut. By suitable mechanism a boy, sitting upon the seat, can readily vibrate the hoppers to drop the seed. The bottom of the hopper has two holes formed through it, of such a size as to contain enough seed for a hill, and is recessed to receive a small circular plate, which has two notches cut in its edge, at a little distance from each other, to allow the seed to pass through to the holes in the hopper bottom. The part of the plate between the notches is placed directly over the hole, through which the seed passes to the ground, so as to serve as a cut-off, to prevent any more seed being dropped at a time than enough to fill one of the holes in the bottom of the hopper. The sides of the furrow are pressed in at the rear of the plows by the concaved rims of the wheels, which press the soil down upon the seed and form a low ridge along the row.

Improved Cotton Planter.

William T. Huff, Atlanta, Ga.—The rear and lower end of a shoe rests in a notch in the upper part of a spout, which passes down between, is secured to, and supported by bars pivoted to the rear uprights. The bars rest in inclined grooves in the sides of the spout, are clamped to the same, and are bent inward and forward, so that their forward ends may be upon and close to the opposite sides of a wheel, and may rest upon the transverse pins, which are passed through the said wheel at a little distance from its rim. By this construction, as the wheel revolves, the ends of the bars drop from one pin to another, which jars the spout and shoe, and causes the seed to pass out regularly.

Improved Churn.

Asa Palmer, La Cygne, Kan.—This invention relates to an oscillating churn box, having vertical spring supports, and secured thereto by clamping devices. A lever is detachably secured to the upper ends of the springs in such a position as to bear upon bars on the cover, and thus hold the latter down, and at the same time hold the cream box in place upon the springs. The dasher is formed of a series of slats, set inclined. In operating the churn, it is moved back and forth, which causes the milk to pass rapidly from one end of the box to the other through the dashe , the inclination of the slats throwing it into numerous currents and into violent agitation, bringing the butter in a very short ti ne. The box is easily oscillated, a slight push being all that is required to keep it in motion.

Improved Folding Cot Bedstead.

Wendell Wright, Phœnicia, N. Y.—The legs at each end are connected by a transverse rail, and are pivoted to the side rails so that they will readily fold back against the inner sides of the side rails. When the bedstead is in use the legs stand bracing, and are supported by the head and foot boards, the end pieces of which have projections which enter mortises in the legs. The foot board is pivoted, so that it will fold down between the side rails. The head may also be pivoted so as to fold in a similar manner. By means of a projection on the head and foot boards, the legs may be more perfectly supported than they would be by the rails.

Improved Truss.

William Shields, Mount Sterling, Ill.—This is a conveniently and easily applied anal truss or bandage for the purpose of treating and curing successfully diseases of the rectum.

Improved Ore Separator.

Pentecost J. Mitchell, Brigham city, Utah Ter., assignor to himself and Joseph E. Gay, New York city.—The vat is mounted on an upright frame, under an overhead frame. The sieve, which is suspended in the vat from a rock shaft, drops, when let fall, on bars supported by springs. Below the sieve the vat is hopper-shaped, with passages through it, having an adjustable gate. Below the vat is a receiver, into which the matters fall to be conducted into the upper compartment of a descending reciprocating car. The materials then pass through a contracted passage, over an amalgamator and into a basin, over the top of the lower end of which the light matters pass off with the water, leaving ores not previously collected deposited in the bottom of the basin. The sieve may be lifted up at any time above the top of the vat by a lever, and be swung forward over the side of the vat and tilted upward to be cleaned of the coarse matters lodging in it.

Business and Personal.

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

Answers to Correspondents

A. G. says: I have a small sectional steam boiler, made of galvanized sheet iron 1-16 of an inch thick. It is made in the best manner, of good iron, thoroughly soldered and riveted. How much pressure to the square inch will it stand? How large a cylinder can I make for my engine, to run 200 revolutions a minute? How large a safety valve should I have? How large a balance wheel should I have? A. The boiler will safely sustain a pressure of 40 lbs. per square inch, if well built. Calculate the number of square feet of heating surface that it contains, and allow 15 square feet for a horse power in the engine. You can then proportion your engine accordingly, by rules that we have frequently given in former answers.

J. B. asks: What is considered a good result as the temperature at which the products of combustion escape into the stack? A. With natural draft, the gases should leave the boiler with about the temperature of the steam. Your other questions can only be properly answered by a manufacturer.

T. J. M. asks: 1. Where is the greatest pressure on a boiler? If I take a barrel and fill it with water, and then put in several pounds of gold in the bottom, and attach a pipe to the top of the barrel, and run it up fifteen feet to the bottom of a reservoir full of water, where would the greatest pressure be? A. On the bottom in each case, that is, if we have the correct idea in regard to the second query.

M. F. K. asks: Will it take any more pickets to go over a mountain 25,000 feet high than it will to go across the base of the same mountain? The pickets are to be the same width at each end, and to be perpendicular over the mountain. A. No.

W. A. W. asks: 1. How, when, and where did the April fool custom originate? A. There are many different opinions on this subject, the most common one being that it originated from a custom of the Hindoos. 2. Can you tell who was the first black man, and where he lived? Was it the climate that made him black, or was the color natural? A. We expect that no tellow can find answers to these questions.

W. J. R. T. asks: 1. Is it known to be true that the moon has no influence upon the tides of our globe? A. No. 2. Has it any on the vegetable kingdom, or in any other respect? A. Not directly. 3. If the former is correct, what then causes the tide in the Bay of Fundy to rise to such a great hight? Is the Gulf Stream the reason of it, by expansion by heat? A. It is on account of the form of the coast. 4. It would shorten the seaway considerably to certain ports of the Pacific Ocean if the Isthmus of Panama were cut through; why has this not yet been done? A. There are many in favor of such action, but, so far, the necessary capital has been wanting.

W. N. J.—Lava in cooling absorbs water. The moon has a very attenuated atmosphere. The tension of aqueous vapor varies with the temperature.

C. B.'L. asks: 1. Are aniline colors poisonous in any way? A. Aniline is poisonous, but its salts are generally considered harmless. 2. I saw in your paper a recipe for keeping glue soft, by mixing a little nitric acid with it; is glue so made in any way poisonous or harmful, when applied to cuts, etc., as described in your paper? A. We think not. As to your other questions, we have repeatedly given rules on the subject, which must now be familiar to all our readers.

D. M. M. asks: Can you explain to me the principles and workings of the hydraulic jack? Can I construct a small one? A. It works on essentially the same principle as the hydraulic press. By addressing manufacturers you can obtain illustrated circulars, explaining the construction. You can construct one, if you do not employ any of the patented details.

C. W. W. says: I am constructing a small flat bottomed sailing boat. If I make the stern quite square, and perpendicular to the surface of the water, that is, like the end of a drygoods box, will the helm act, or will it be powerless unless a portion of the under part of the boat's stern is cut away? A. For an ordinary rudder, you must cut away so that the water can get at it. But if you are very desirous of building the square stern, you can steer with a rudder placed like an oar, so as to act at some distance from the stern.

E. W. R. says: 1. I am tending three engines. One is an 85 horse power, of which the slide valve is beginning to wear. Is this the fault of the engineer, or is it incident to all engines which are in constant use? A. It is not necessarily the fault of the engineer. It may be due to poor construction. 2. In Bourne's "Catechism of the Steam Engine" he says that one cubic foot of steam at a given pressure would just indicate one half the pressure if the space should be doubled. There are here 6 boilers side by side, three in a set; each has three gages of water. I let the fire go out under 3 of them, and blow off the steam. The other 3 have 60 lbs. pressure. I open the connecting valve, allow the steam to gain the same pressure in each set, and the steam gage indicates 48 lbs. in each. Is Bourne right? If so, please explain. A. Bourne's rule is approximately correct. As we understand your mode of making the experiment, three of the boilers are forming steam all the time, having fire in them, and the other three also make some steam, because the water has a greater temperature than that due to a pressure of 48 lbs. per square inch. 3. Comstock's "Philosophy" says that if you stand a pork barrel on end, insert a 2 inch pipe 50 feet high, and fill it with water, it would break the barrel. He said a ¼ inch pipe would do it just as quickly as a 12 inch pipe. Is he right? A. Yes.

H. S. W. says: In your issue of May 30, G. S. F. asks: Why does the point of the needle of a surveyor's compass at times rise and adhere to the glass, and you reply that it is due to magnetic disturbance, and at times to the influence of local attracting forces. I think you have failed in this instance to point out the true cause of this occasional phenomenon. I have known surveyors to be greatly puzzled by it. It has happened often in my own experience, and is due to frictional electricity, produced by rubbing the hand over the glass. It occurs only in dry, cold weather, when there is little moisture in the air and none on the fingers. At such a time, should the surveyor in the woods find any small leaf, piece of a twig, or bark from a tree, fall upon his glass near the point of the needle, he brushes it away. The friction of his hand developes electricity, and he is surprised to find the needle glued fast to the glass, where it will remain for a long time unless he happens to know the cause and the remedy of the trouble. The glass must at once be moistened; and if there is no water at hand, he should spit upon it and rub it all around with the finger, whereupon the needle will be instantly relieved. I have often intentionally electrified my glass in this way for the amusement of the curious. So far as my experience teaches, this is the only cause of the phenomenon, and G. F. S. or any other surveyor can prove the correctness of the solution on any day when the required conditions exist, by actual experiment.

R. asks: What amount of coal is used in 24 hours on board the steamships in the New York and Liverpool trade in ordinary weather? A. It varies from 20 to 60 tuns a day according to the size of the vessel and the power and construction of the engines.

R. L. M. asks: With what force does a weight weighing 50 lbs. strike on falling a distance of 2 feet? What is the rule for finding the force that different weights strike, falling different distances? A. It is proportional to the moving force or the momentum of the weight, which is found by multiplying the weight in pounds by the velocity in feet per second, and dividing by 32·2.

R. W. B. asks: How are tables of logarithms calculated, with 10 as the base of the system? For instance, log. 2=0·301030. By what calculation is the decimal 0·301030 obtained? A. The principle by which such calculations are made is the development into a series, by means of the binomial theorem. It would occupy too much space to give a full explanation in these columns. You will find the matter fully explained in Law's "Treatise on Logarithms," Weale's series.

D. G. asks: Is there any means by which gas can be obtained and used for light while the coal is being used for heating purposes? Is it possible to do it? A. Yes. In the manufacture of gas from coal, the coal remaining after the gas has been extracted (called coke) is used to heat the gas retorts; and the remainder is sold in market as fuel. The gas companies here sell large quantities of coke.

E. W. S. says, in reference to the "blowing up" question: "If the person lying down does not inhale all he can, and hold his breath, and the lifters do not both inhale and exhale (no matter if they do work together) it is impossible to raise him without straining the fingers while lifting: so it is not imagination that prevents the lifters from feeling the weight. If possible, please tell me why we can raise a person by the above means, and by those means only? A. So far as our experience goes, we see no reason to modify our previous answer, believing that the principal benefit of the inflation is to make all the lifters act together.

J. F. asks: 1. Does the outside of a belt run faster than the inside? A. Yes. 2. A friend says that, when an engine is on the up or down center, the piston is not exactly in the middle of the cylinder. I say it must be in the middle of the cylinder when it is on the up or down center. Which is right? A. Your friend. 3. Is the *Science Record* printed every year? A. Yes. As to your engine and boiler question, you do not send sufficient data.

B. B. B. asks: 1. How large a pipe is needed to give a full flow of water through twenty ⅜ inch faucets, from a tank 40 feet above the place supplied, all the faucets to be on the one pipe? A. It should have an area at least at great as the sum of the areas of the separate faucets. 2. What would be the pressure per square inch at bottom of said pipe? Is there a work on this subject that will answer all such questions? A. Divide the hight in feet by 2·3, which will give, approximately, the pressure on the base in pounds per square inch. 3. Is there a work that treats on steam piping and heating by steam? A. We do not know of any works that will give you precisely the information you want. We can, however, recommend Trautwein's "Engineer's Pocket Book," and Tredgold's "Treatise on Ventilation and Warming."

W. H. S. asks: What is a sill level with when you use a correct spirit level on it? A. It is level with the horizon, or the line between sea and sky.

W. T. asks: 1. Is the process of zincography used in America? A. Yes. 2. Is this process patented in the United States? A. No.

J. W. asks: Can a true cylinder be bored with a boring bar (not having a sliding head) on a slide lathe, said cylinder being bolted to the carriage and fed by it, when the boring bar is not in line with the lathe shears? I contend that it can be done only when the bar and shears are parallel. If bored when the bar is not in line, the cylinder may be straight but cannot be round. A. A cylinder bored by a bar out of true with the lathe shears will be true whether the cylinder feeds to the bar head or not, the only result of the bar being out of true is that the cylinder will be thinner at opposite ends on opposite sides; the bore will not be true with the outside of the cylinder but true of itself, nevertheless.

H. W. S. says: We have a boiler carrying 110 lbs. steam. If we put in another boiler of similar size, connected, would 55 lbs. pressure on each boiler do the same amount of work? If so, how would you calculate the horse power of an engine under such circumstances? A. It would not, under ordinary circumstances, with the same engine. We have frequently given rules for calculating the horse power of an engine.

R. Z. J. asks: What kinds of lenses are used in a wonder camera, what is their size, and how many are there of them? What are their focal distances, and how must they be set in the tube? A. Any double convex lens will do. Its size, focal distance, etc., depend upon the desired magnitude of the picture to be thrown upon the screen. How it is fixed in the tube can be seen by inspecting any photographer's camera. The wonder camera is now sold by opticians and in many toy stores, and can be purchased at prices ranging from $8 to $10.

A. B. C. says: I am unable to understand the working of the parallel motion illustrated in your number of June 13, and I beg you to explain further. On making a rough model of about the proportion of the engraving, I find that, as D A is about three times the length of D B, B can never arrive at A, as mentioned in your remarks, and that B can only perform about 1·6 of a circle about J. There is evidently something about it which I do not understand. Will you explain in your answers to correspondents how B can revolve about the center, F, without becoming disconnected from D and E? A. The circles were drawn for the sake of the explanation, and not to indicate that B made a complete revolution. That a circle can be changed into a straight line is manifestly impossible with the device. Its object is simply to do perfectly that which Watt's and other like mechanism does imperfectly, that is, to convert curvilinear motion into rectilinear motion with mathematical exactness.

S. R. asks: 1. What is the new parallel motion used for? A. For changing curvilinear into rectilinear motion, or *vice versa*, in any machine, suitable modifications being made in its form to suit varying circumstances. 2 Is the walking beam still used on steamboats? A. Yes. 3. How is the parallel motion of the piston transmitted to the beam? A. There are various plans. See Bourne's "Handbook of the Steam Engine," or any other standard work on the same subject.

E. W. B. asks: How shall I make a sand wheel for wood? What kind of sand shall I use, and how shall I fasten it on? A. Make an ordinary wood wheel in sections; fasten leather round its periphery, then coat it with glue (about a foot at a time), and cover it with sifted white sand (sea sand will do) while the glue is hot, pressing the glue on with a piece of board. The leather may be recoated as often as necessary.

G. C. U. asks: 1. If the equatorial diameter of the earth is 25 miles more than the polar diameter, why is it that the Mississippi runs toward the equator? A. Because the source is further from the center of the earth's gravity than the mouth. 2. What is used to petrify human bodies? A. See p. 22, vol. 29. 3. Can you give me a recipe for sticking paper together? A. Use a stiff mucilage of gum tragacanth. 4. Who founded the order of Free-masonry, and in what year? A. The origin of the order is too ancient to be definitely known.

L. B.—This cone pendulum is a heavy ball and rod, suspended from a tripod of brass tubes by four bits of watch spring, of which two are at right angles to the others, so that the ball may swing in a circle. The clock has a brake wheel, which is controlled by an electromagnet, so that the pendulum must rotate once in two seconds.

W. F. M. says: 1. I am constructing a small engine with a cylinder 2 inches in diameter x 2½ inches stroke, intending it to run at about 175 revolutions per minute under a pressure of 5 lbs. per square inch. Of what size and weight should the fly wheel be? Are ports ⅛ x ½ inch too large for such an engine? A. It will be sufficient to make it of such a size that it seems to be well proportioned to the rest of the machine. The steam pressure and size of ports will probably answer very well. 2. Is the D valve used in locomotives? A. No 3. Can a perfect cut-off be obtained at any point of the stroke where the D valve is used in connection with link motion, by having a cut-off lever? A. No. 4. Would you have given a different answer to my previous questions, concerning steam engine eccentrics, had I said "being link motion engines in both cases? A. No.

W. H. B. asks: To what depth should I sink an artesian well after coming to water, so that the water will flow out at the top? If I strike water at 40 feet and have 8 feet of water in the well, how deep should the well be? A. No general rule can be given on the subject. It is usually necessary to sink an artesian well to a considerable depth.

G. J. L. says: I am building a small steam fire engine. I have the working part done, and it works smoothly and fast until water is turned on to the pump, then it draws the water until the water cylinder is full, and then stops. This trial was with a block tin boiler, 6x14 inches, over a charcoal furnace. The steam and water cylinders are both the same size, being 1¼ inches bore and 1⅜ inches stroke; both have slide valves alike; it is upright, about 9 inches high, turning a balance wheel 4 inches in diameter. The steam cylinder is at the top. Is it possible for me to get it to throw water at all with both cylinders of the same size? If so, by what means? Could it be run well with a very high head of steam? What pressure of steam would run it? Would a boiler and furnace combined, 14 inches high and 8 inches in diameter, do? The furnace takes up 7 of 14 inches, leaving the boiler 7x8 inches, with 12 one inch flues. The total heating surface of the boiler (not including the top, which would have considerable heat on it, on account of all the heat and smoke collecting there to get to the smoke stack) would be 2 square feet. This is the largest size of boiler I can put to it. A. We suspect that the trouble arises from improper adjustment of the water valve. The present boiler is very small, and so is the one that you propose. Still, you ought to throw some water.

F. J. says: I wish to suggest a change of manufacture of low pressure engines. Pass a stream of water from the tender on the cylinder from which the steam is transferred to the condenser. This will diminish resistance, and the steam will be condensed with less water, which has to be pumped against the atmospheric pressure. Horizontal cylinders would not be unequally heated, and the heat of the outside of cylinder would be disposed of. The cylinder would not contract. The heat of the piston would radiate, diminishing a liability to cleave to the cylinder and reducing friction. A. This would be going back to old practice. It is desirable to prevent, as much as possible, all condensation of the steam while in the cylinder.

M. D. says: I have a vat of 300 gallons of liquid which I wish to keep below 70° Fah. Having a cistern 6 feet square with 3 feet of water, I propose to build a vat of 150 gallons capacity, running a pipe from the vat into the cistern, using between 200 and 300 feet of ⅜ pipe for cooler, running the water from the 150 gallons vat through the pipe, back in under the 300 gallon vat. I can fix a pump to raise this 150 gallons of water, and run it through the pipes, using 2,000 foot lbs. to furnish a continuous stream. 2. We think that this proposed arrangement will answer very well.

J. A. S. asks: What is the best process for bending timber? I have a steam chest which I use, but cannot accomplish a satisfactory job. I often see the most fragile wood which has been bent without the least crack. I have reference to fork handles, shovel handles, wagon tongues, etc. A. It is done by securing the piece to be bent to a template, and bending it little by little, after successive steamings, if necessary.

D. S. H asks: 1. What fraction of a horse power will an average man exert by working a treadle? A. About one seventh. 2. In the description of the new domestic steam engine, p. 386, last volume, it is said: The boiler contains water enough to furnish some 42 foot pounds for 4 or 5 hours. Does this mean $\frac{42}{1000}$ of a horse power? A. Yes. 3. What is the best appliance to prevent belts slipping on a wooden pulley? A. To make the face of the pulley as smooth as possible.

F. M. says: A friend of mine, in speaking of cosmical systems, describes them as machines moving without friction according to the laws of mechanical equilibrium, every part being physically connected with the rest. That, for instance, two bodies would form a couple, each moving with a force in the inverse ratio of mass and distance round their common center of gravity. Whereas, in our solar system, there are many bodies, the moving force of each is one of a couple, the other being the mass of the primary on the opposite side of the center of gravity; there being, however, a common center for the system as a whole. Is this a correct representation? A. Yes, substantially.

J. W. C. asks: How can I stick the bottom of a glass goblet to the bottom of a glass globe so that the goblet will make a standard for the globe, and the joint be waterproof? A. Use some of the cements sold at the drug stores for cementing glass.

J. C. W. asks: Can salt be used more than once in making ice cream, or does contact with the ice chemically change it into a different article from chloride of sodium? A. It is not changed. The salt could be recovered by evaporation and used again.

J. D. L. asks: With Mr. Ericsson's floating ball, if a great mountain could be suddenly placed by the side of it, would it not draw the ball over to that side of the cup next to the mountain? A. We think so.

F. M. F. asks: 1. Can you give me a recipe that will preserve a minnow, so that it will be flexible, to be used for bait? A. Try dipping it into glycerin. 2. Will mineral water keep if carefully sealed? A. Yes.

L. M. asks: Is there a material, a good non-conductor of heat, that is suitable for covering glass blowers' tools? A. Porcelain is used for purposes similar to that mentioned.

J. E. L. asks: 1. What will be the best method for refining solder? A. Re-melting. 2. What is a recipe for gas fitters' cement, such as is used on iron pipe? A. 4 parts black resin, 2 parts brick dust.

B. W. S. asks: 1. Is the atmosphere heavier or lighter on a cloudy, damp day? A. The latter. 2. Why is it that smoke arises so much more slowly on a damp day? A. Because the weight of the column of air which issues from the chimney and contains the smoke is equal to or greater than the weight of an equal bulk of the surrounding atmosphere.

M. E. W. asks: Does the increase of the thickness of ice, when freezing, occur on the upper or lower side of the ice? A. On the lower side.

J. A. H. says: An almost insuperable objection to the use, in Southern waters, of steam barges by parties for their private use and pleasure is the requiring, by government officials, of the employment of licensed engineers and pilots. Is there such a law? If so, why does it not apply equally to New York as to Georgia and Florida? A. If the boat is used by the owner alone, it is not necessary to employ a licensed engineer. But if passengers are carried, or the boat is let to other parties, the case comes under the United States law.

F. H. A. asks: How is the gilding put on spelter trimmings for gas fixtures? A. With tin solder, fill all the holes and defects, and scour the piece by passing for a few seconds in a boiling solution of 100 parts water with 5 or 6 caustic soda, and rinse in fresh water. Then steep for half a minute in a pickle of 1 part sulphuric acid in 10 water, and rinse with boiling water. Then put in a cold or warm electro-bath of copper or brass until it is covered with a metallic coating, which will be the work of a few moments. If the deposit is black and dull, scratch-brush it, and dip again into the bath.

H. J. F. asks: Can you give me a recipe for removing medicine stains from white linen without injuring it? A. When we know the character of the medicine, a recipe can be given for removing the stain which it makes, but no general recipe can be given for removing all medicine stains.

H. A. B. asks: How can I soften finished machine work without discoloring or spoiling the polish? A. Place the finished work in a box made airtight with clay, and pack around the work shavings and turnings of the same metal as the work itself; let the box be kept in a furnace sufficient time to heat the work to a dull red, when the furnace fire may be allowed to go out, and hence the box to cool gradually; or otherwise, take the box from the furnace and cover it with ashes, lime or sand, so as to cool gradually, and your finished work will be softened without losing its finish.

F. C. B. asks: 1. How large should the core of an induction or Ruumkorff coil be to produce the best effect? The coil is to be 8 inches in diameter. A. See p. 379. vol. 30. 2. What is a commutator? A. A commutator serves to break contact or send the current in either direction. 3. How long a spark should a coil 8 inches in diameter and 6 inches long give? A. This depends upon the size and quality of wire used, also upon the construction of the coil.

A. asks: Please give me a method of mixing walnut graining color in oil, so as to allow pencilling in imitation of the growth. I cannot get the white shade behind the pencilling. A. Grounds for graining are made of white lead colored to suit the special purpose.

T. A. P. asks: How can I bronze tin or any white metal? A. Try the following: Take 1 pint strong vinegar, 1 oz. sal ammoniac, ¼ oz. alum, ¼ oz arsenic; dissolve the three last in the vinegar, and the compound is fit for use.

H. W. D. asks: What is good for a pain in the lower part of the back? I have a friend who has been afflicted with a pain in the lower part of the spine for about eight years. Would not electricity, applied by a good operator, be good? The spinal marrow and nerves appear to be affected. Would not electricity tend to irritate and excite the nerves? A. Electricity under the direction of a physician skilled in these matters, is frequently applied with benefit in such cases.

J. S. asks: How can I bend glass tubing? A. By heating the tube, slowly revolving it at the same time, in the flame of an ordinary gas burner. It should be held in the same direction as and not across the flame. When it softens take it out, and bend very gently. Repeat until the proper curvature is obtained. This method gives a beautiful curve. When cold, wipe off the soot.

O. A. Jr. says: Several of my neighbors own a spring of water together. Said spring is some 10 feet higher than my outlet. The main pipe runs up and into the reservoir in my kitchen, and makes a turn out and downward and goes on to my neighbors below. In the bend in the pipe a small hole is made from which I receive my share of water. In order to have the water run out of the hole, I put in a straight compression cock, in the pipe leading from the tub: and closing said cock would back up the water and make it run as I desired for a few days, then sediments of some kind would collect and partially stop up the hole in the cock; then I would get more than my share of water. The water in the spring is clear, and there is a good copper strainer at the spring. Can I make a filter of some kind to put in at the spring, which would be better than a strainer, to prevent foreign matter in the pipe? A. Probably you can overcome the difficulty by using a valve which will give the full opening of the pipe.

T. M. J. asks: 1. Water is composed of 8 parts oxygen and 1 part hydrogen gas. Can these gases be separated? A. Yes, by the galvanic current. 2. Are ginger drinks injurious to the health? A. No, if not taken immoderately.

G. B. S. asks: In your answer to L. E. R., for a polish for walnut, you say: "Melt 3 or 4 pieces sandarac of the size of a walnut, and add 1 pint boiled oil and 1 dram Venice turpentine," etc. You must use something else besides sandarac, as it will not melt in oil. You can dissolve it in alcohol or turpentine, but it will all curdle up as soon as it is mixed with the oil. A. Melt your gum separately, and then mix with boiling hot oil.

P. S. asks: 1. Will it do to run lightning rods into a cistern of water outside a house? Would it injure the walls of the cistern? A. The walls of your cistern would probably remain intact until the lightning struck. 2. Will it do to have 4 points of lightning rods all drawn together and down one rod to the cistern? A. There would be nothing gained by multiplying the points in the way you speak of. The safety of these rods consists mainly in their stoutness.

P. says: I have a piece of machinery with polished iron shafts. It stands in a damp place. What varnish will effectually prevent rust, without injuring the polished surface? A. It will be your best plan to buy some transparent varnish from a manufacturer.

P. V. J. asks: 1. In working a telegraph, the keys and receivers of which are ¼ of a mile apart do I need an intensity or a quantity battery, and how, is each made with a Bunsen battery? A. Connect your zinc of one cell with your copper or platinum of the second cell. 2. In what proportion should I mix sulphuric acid and water for a Grove battery? A. About seven of water to one of acid.

D. H. H. asks: 1. Is the black lead known as German lead (not plumbago) found anywhere else than in Germany (Bohemia)? A. Yes, in many places in this country. 2. Is it supposed to exist in sufficient quantity to supply the large demand for it for foundry facing, polish, etc.? A. Yes, in sufficient quantities to last many years.

F. E. W. says: Some time ago I noticed among queries the question: What will remove Indian inkmarks? Your answer was, I think, that you knew of nothing. I have just come across the following: Rub well with a salve of pure acetic acid and lard, then with a solution of potash, and finally with hydrochloric acid. Sometimes these marks may be obliterated by blistering the skin and keeping the blister open for a while. When the new skin grows the marks will have disappeared. A. These remedies are a good deal worse than the Indian ink stains. They amount to an absolute removal of the skin.

R. F. L. asks: 1. What preparation can I apply to large wooden friction wheels to prevent silvering up on the face? A. There is no effective method of preventing the silvering of large wooden friction wheels. 2. What kind of paper is used for small friction wheels, and how is it used? Is it clamped between flanges, with or without glue, or is it put on in layers with glue? A. Paper friction wheels are of thick brown paper, put together in layers without glue, under hydraulic pressure.

F. H. L. asks: Will you give me a rule for computing the length of a pendulum rod for any clock in any part of the world, as clocks require longer or shorter rods according to locality? A. We suppose you refer to the length of the seconds pendulum. Its length in feet = 3·26058 − 0·008318 × the cosine of twice the latitude of the place. Having found the length of the seconds pendulum, that of any other can readily be calculated by observing that the vibrations made by two pendulums, in a given time, are inversely as the square roots of their lengths.

S. R. L. asks: What sized boiler shall I use for an engine 3¾ x 2½ inches? What should be the weight and size of the fly wheel? A. Calculate the probable power from the proposed speed and pressure, and allow from 15 to 20 square feet of heating surface per horse power. Make a fly wheel from 12 to 15 inches in diameter, weighing from 50 to 60 lbs.

F. H. asks: I am using a powder, for welding steel rails into frogs, which I believe is composed of caustic soda and borax. What does caustic soda add to the welding properties of the powder? It is very bad for the health of those using it; and if you could inform me of some flux that I could use for welding steel rails at a very high heat, to keep them from cracking, I would be thankful. A. There are several patent compounds in the market, but we know very little in regard to their merits. If you insert a notice in our "Business and Personal" column, you will probably hear from the manufacturers.

A. A. W. says: I am running a pair of 18 inch engines; they both exhaust into one pipe. Would there be any difference in power if each engine had a separate exhaust, and does not the exhaust of one engine throw a back pressure on the other? A. It depends a great deal upon the size and arrangement of pipe. If properly proportioned, one pipe will answer as well as two. As to your query on water pipes, you do not send sufficient details.

G. A. N. asks: Will a boiler 10½ inches diameter x 26 inches high, with 26 one inch tubes 12 inches long, made of 3·6 iron with flue sheets ¼ inch thick, be of sufficient capacity to drive an engine of 2 inches bore x 7 inches stroke? What pressure would such a boiler carry with safety? A. The boiler is rather small.

W. H. S. says: In an argument on cannons, an Englishman asserted that the largest guns in the world were made in England. This the American would not admit, saying that the 20 inch guns at the Ripraps or Fortress Monroe, were the heaviest. A. We believe that some 20 inch guns, the largest of which we have heard, have been made in Europe.

G. F. T. & Co. ask: Please give us the best manner of cleaning gilt frames. A. Use a sponge moistened with urine or oil of turpentine.

E. W. says that W. E. M. can bleach tallow without injuring it, as follows: Heat the tallow to 120°, keep it hot at least 50 minutes, then dash water into it, and stew the water and tallow for a few moments. If correctly done, the tallow will be in small lumps like shot, or butter when it first comes in the churn. Skim the tallow and melt it again, remove all the water and stir the tallow while cooling; this makes good tallow for some purposes. I do not know much about an engine cylinder; but for launching a ship, the tallow must be freshly rendered beef tallow. Five per cent of mutton tallow will spoil launching tallow. Mutton tallow will not slip like beef tallow. Tallow can be heated until it will scorch a feather without apparently injuring it; but it will not slip after that, but will dry like linseed oil. For friction, use beef tallow rendered before decay commences, with but little boiling; for belts and the like, mutton tallow is best. For paint or making a hard surface, superheated tallow is best, because it will not slip.

J. H. J. says, on the subject of draining a cellar, p. 379, vol. 30: My cellar is sunk in clay ground, and after heavy rains would be flooded with water coming in below the wall. In such a case the cellar wall should be built on a trench filled with broken stone, with a tile or a broken stone drain to an adjoining low ground. My walls not having been so built, I proceeded thus: I made a slight trench at the inner foot of the outer wall, so as to catch the drainage, which was all brought to the front and carried under the wall. I then made an outside drain, five feet deep to one foot deep, in which I laid a brick drain (brick on edge covered with cross brick) and refilled the trench. This was 35 years ago. Occasionally I am told that water is standing in the cellar floor. By way of instruction, I take my informant to the outfall of the covered drain and, with my cane, remove a few leaves which had gathered upon the opening, and forthwith a bright stream of water would flow out. At the same time when I made these drains, I dug a well in one of my cellars to the gravel bed below (12 feet) walled it with bricks and covered it securely. Into this well are made drains, 10x12 inches, filled with broken stone and covered with earth, which keep every apartment dry. I have no need of cement and prefer the dry clay. Beds of solid clay have drainage seams in them, which would not be suspected. Many years ago I purchased a lot adjoining my own grounds; this lot had on it a small brick house, under which was a cellar so frequently filled with water that the family occupying the house used the cellar as a cistern. Within my own grounds I made a large cave, covered with logs and earth, for storing vegetables in winter. At times the bottom of the cave would be almost filled with inflowing water. To remedy this, I dug and walled a well in one corner of the cave down to the gravel. The remedy was complete, and after that the cellar spoken of, distant sixty feet from the well, was drained and dry.

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

W. S. V.—No. 28 does not contain tellurium. It contains silver, copper, arsenic, and antimony, and the green color is due to the second and fourth of these substances. No. 26 is a variety of the rare mineral orthite, having a specific gravity of 3·74. No. 27 is a variety of serpentine of unusual hardness and high specific gravity (2·74), and is probably to be referred near the variety bowenite; No. 29 is prehnite.—P. S.—No. 1 is amphibole. No. 2 is ferruginous sand rock. No. 3 is quartz. No. 4 is quartzite with yellow ocher. No. 5 is minute rock crystals on bluish quartz. No. 6 is peacock coal. No. 7 is magnetite imbedded in quartz. No. 8 is magnetic oxide of iron.—D. B.—An analysis of the clay shows silica, silicate of alumina, and lime (very small quantity). It will not burn to a stone when kept at white heat for 10 minutes. What was done to it to make it burn to a stone?

S. C. H says: I have a drawing in Indian ink on tracing cloth. I wish to mount it by pasting on a paper background, and then varnish the surface. What kind of paste and varnish should be used?—W. C. says: In your last issue E. H. R. asked: In the driving wheel of a locomotive, where does natural philosophy place the fulcrum, the power, and the weight, respectively? I think that the axle bearings are the fulcra, the pressure of steam in the cylinder the power, and the locomotive the weight. [This general idea is correct, but some modifications are required. Perhaps one of our readers will point them out.—EDS.]—J. A. asks: What is the *modus operandi* of putting on the seed bag on well tubing to stop water in rock boring? The bore of the present hole is 5½ inches diameter and 500 feet deep; we are going to bore 500 feet more of 2½ inches diameter.—W. Z. asks; Can you give me a formula for a jet black stencil ink that will not rub off when handled or exposed to the weather?—F. W. M. asks: How can I stain bamboo and rattan a black color?—M. J. S. asks: How can ink ribbons for hand stamps be saturated with inks of different colors, and how are the inks prepared?—R. S asks: How can I take the moldiness out of hams? What will prevent a ham from molding without injuring its taste?—W. H. G. asks: What will protect gold jewelry from the stain caused by heat of the blaze while soldering? The trouble with borax is that it runs the solder in the wrong place.—J. S. W. says: We all know that, when a fresh green board or plank is first exposed to the air, it will shrink from its original size. Now if a hole be drilled in the middle of it, say of an inch in diameter, will the hole remain of the same size? Will it shrink longitudinally or transversely with the shape of the plank, or both?—W. F. W. asks: How can I glaze earthenware jugs, also the snuff jars used in tobacco stores?—O. P. B. asks: How can I paint an outside door so as to prevent its blistering, cracking, and peeling?

COMMUNICATIONS RECEIVED.

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

On Railway Earthwork. By J. B.
On the American Log. By S. B.
On Cobalt and Nickel. By G. W. B.
On Raiding Ants. By J. S. D.

Also enquiries and answers from the following:

C. W.—W. N. W.—H. W. D.—F. W.—F. H. D.—G. T. B. S.—G. S. R.—J. H. W.—R. A.

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.

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

June 9, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Fire kindler, Long & Coates	151,707
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Window sash, cast iron, S. J. Meeker	151,897
Yoke, neck, G. C. McMullen	151,790

APPLICATIONS FOR EXTENSIONS.

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:

30,023.—ROCK DRILL.—L. M. Gilmore. Aug. 26.
30,076.—WOOD SAW FRAME.—W. H. Livingston. Sept. 2.
30,168.—SADDLE TREE.—S. E. Tompkins. Sept. 9.

EXTENSIONS GRANTED.

28 644.—PUMP.—N. S. Bean.
28,670.—RAILROAD BRAKE.—N. Hodge.
28,681.—CORN PLANTER.—D. C. Myers.

DESIGNS PATENTED.

7,483.—WIRE CORD.—G. W. Kingsley, Buffalo, N. Y.
7,484 and 7,485.—OIL CLOTHS.—C. T. Meyer *et al.*, Bergen, N. J.
7,486.—IRON FENCE.—W. Snow, Detroit, Mich.
7,487.—CARPET.—W. F. Wait, Auburn, N. Y.
7,488.—FRAME.—G. F. Beebe, Quincy, Ill.
7,489.—FOOT SCRAPER.—C. W. Reed, Chagrin Falls, O.
7,490.—ORGAN CASE.—G. S. Shepard, Lebanon, N. H.

TRADE MARKS REGISTERED.

1,821.—TOBACCO.—S. M. Bailey, Richmond, Va.
1 822.—WHISKY.—C. Rebstock & Co., St. Louis, Mo.
1,8 3.—SHIRTS.—H. Wallach's Sons, New York city.
1 824.—MOWERS, ETC.—F. Bramer, Little Falls, N. Y.
1 825.—SPECIAL MEDICINES.—J M. Connell, S. Francisco, Cal.
1,826.—SMOKED MEAT.—L. W. Drake & Co., Buffalo, N. Y.
1,827.—RUBBER.—Goodyear's I. R. Man. Co., Naugatuck, Ct.
1,828.—STOVES, ETC.—Perry & Co., Albany, N. Y.
1.829.—IRON WARE.—St. Louis Stamping Co., St. Louis, Mo.
1,830.—LARD.—W. J. Wilcox & Co., New York city.

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
On application for Extension of Patent	$50
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

MAY 29 to JUNE 10, 1874.

3,498.—I. Atkinson, Hamilton, Ont. Improvement in curing and packing meats, called "Atkinson's Improved Process of Treating Meat by Compression." May 29, 1874.

3,499.—E. McCoy, Ypsilanti, Washtenaw county, Mich., U. S., G. G. Roby, and C. G. Ward, Detroit, Mich., U. S. Improvements on lubricators for steam engines, called "McCoy's Steam Lubricator." May 29, 1874.

3,500.—T. Lalor, Toronto, York county, Ont. Machine for locking cells and other gates, called "Lalor's Simultaneous Locking Apparatus." May 29, 1874.

3,501.—A. E. Salisbury, Martin, Ottawa county, O., U. S. Improvements on barrel heaters, called "A. E. Salisbury's Barrel Heater." May 29, 1874.

3,502.—J. Lydiatt and E. R. Kent, Hamilton, Ont. Improvements in glass furnaces, called "Lydiatt's Improved Glass Furnace." May 29, 1874.

3,503.—A. B. Smith and G. H. Comer, Oakland, Brant county, Ont. Improvements on hasp locks, called "Smith's Hasp Lock." May 29, 1874.

3,504.—J. Bradley and J. Nicholas, Gomer, Allen county, O., U. S. Improvements on combined thrashing, grain-separating, and clover-hulling machines, called "Bradley's Oscillating Board." May 29, 1874.

3,505.—L. K. Drew, Magog, Stanstead county, P. Q. Improvement on carriages, called "Drew's Improvement on Carriages." May 29, 1874.

3,506.—William Humphrey, Sharon, Walworth county, Wis., U. S. Improvements in artificial marble, called "Alpine Artificial Marble." May 29, 1874.

3,507.—H. Cottrell, Newark, Essex county, N. J., U. S. Improvements on machinery and tools for cutting, turning, molding, sawing, and polishing stone, called "The Cottrell Diamond Stone Cutting Machinery." May 29, 1874.

3,508.—S. P. Olney, Detroit, Wayne county, Mich., U. S. Improvement on a machine for gumming saws, called "Olney's Saw Gummer." May 29, 1874.

3,509.—H. A. Howe, Detroit, Wayne county, Mich., U. S. Improvements on harvesters, called "Howe's Eureka Harvester." May 29, 1874.

3,510.—E. A. Street, Lynn, Essex county, Mass., U. S. Improvements on hydraulic hose, called "Street's Hydraulic Hose." May 29, 1874.

3,511.—E. E. Wheeler, South Norwalk, Fairfield county, Conn. Improvements in wheels, called "Wheeler's Improvements in Wheels." May 29, 1874.

3,512.—G. Wilkinson, Aurora, Ont. Improvements on the construction of gang plow frames, called "Wilkinson's Gang Plow Frame." May 29, 1874.

3,513.—J. H. Blessing and F. Townsend, Albany, Albany county, N. Y., U. S. Improvements in steam traps, called "Blessing's Steam Trap." May 29, 1874.

3,514.—E. Evans, Lynn, Essex county, Mass., U. S. Improvements on attachment to gas burners, called "Evans' Gas Burner." May 29, 1874.

3,515.—J. L. Sprague, Hermon, St. Lawrence county, N. Y., U. S. Improvements on milking stools, called "Sprague's Combination Milking Stool." May 29, 1874.

3,516.—William West and P. West, Toronto, York county, Ont. Improvements on the manufacture of burial cases, called "West's Improved Burial Case." June 8, 1874.

3,517.—A. D. Cable, Montreal, P. Q., assignee of G. Murray, Cambridgeport, Suffolk county, Mass., U. S. Improvements on faucets, called "Murray's Improved Faucet." June 8, 1874.

3,518.—A. D. Cable, Montreal, P. Q., assignee of L. Dauze and E. H. Boyce, same place. Improvements on lifting jacks, called "The Young Samson." June 8, 1874.

3,519.—E. M. Jones, Brockville, Leeds county, Ont. Improvement on tucking devices, called "Jones' Tucking Device." June 8, 1874.

3,520.—J. Absterdam, New York city, U. S. Improvements on the manufacture of steel, and welding steel and iron, called "Absterdam's Process of Manufacturing Steel and Welding Steel and Iron." June 8, 1874.

3,521.—T. J. Reynolds, Irvington, Washington county, Ill., U. S. Improvements on railway switches, called "Reynolds' Railway Switch." June 8, 1874.

3,522.—W. M. Wiswell, Portland, Cumberland county, Me., U. S. Improvements on car couplings, called "Wiswell's Canadian Automatic Benefactor." June 8, 1874.

3,523.—R. Litster, Halifax, N. S. Improvements on coffer dams, called "Lister's Improved Coffer Dam." June 8, 1874.

3,524.—J. S. Ellis, Washington, D. C., U. S. Improvements on locking nuts or bolts, called "Ellis' Lock Nut." June 8, 1874.

3,525.—L. Gill and E. S. Coon, Watertown, Jefferson county, N. Y., U. S. Improvements on spring bed bottoms, called "Gill & Coon's Improved Bed Bottom." June 8, 1874.

3,526.—G. L. Eason, Des Moines, Polk county, Iowa, U. S. Improvements in corsets, called "Eason's Improved Corset." June 8, 1874.

3,527.—H. Gross, Cincinnati, Hamilton county, O., U. S. Improvements on mail bags, called "Gross' Mail Bag." June 8, 1874.

3,528.—F. W. Beckwith, Merrickville, Leeds county, Ont. Improvements on washing machines, called "The Queen Washer." June 8, 1874.

3,529.—J. Bennett, St. Johns, N. B. Improvements on paper files, called "The Parallelogram Paper File." June 8, 1874.

3,530.—B. Ward, Dundas, Wentworth county, Ont. Improvements in spring needle circular knitting machines, called "Ward's Improved Presser for Circular Knitting Machines." June 8, 1874.

3,531.—E. Newcomb, Westbrook, Cumberland county, Me., U. S. Car replacer, called "Newcomb's Car Replacer." June 8, 1874.

3,532.—J. Bradley, New York city, U. S. Improvements in apparatus for ventilating railroad cars, steamboats, dwelling places, and other like places, called "Bradley's Improvements in Ventilating Windows." June 8, 1874.

3,533.—J. W. Meaker, Detroit, Wayne county, Mich., U. S. Improvements in hatchways for hoistways in stores, factories, and other buildings, called "Meaker's Improvement in Hatchways." June 10, 1874.

3 534.—S. Scholfield, Providence, R. I., U. S. Improvements on saws for logging, called "Scholfield's Logging Saw." June 10, 1874.

3,535.—J. Dawson, Greenwood, McHenry county, Ill., U. S. Improvements on machines for cutting bolts, called "Dawson's Improved Bolt Cutter." June 10, 1874.

3,536.—A. C. Rand, Minneapolis, Hennepin county, Minn., U. S. Improvements on gas retorts, called "Rand's Improved Gas Retort." June 10, 1874.

3,537.—E. W. Barker, Portland, Cumberland county, Me., U. S. A new car coupling, called "Barker's Improved Car Coupling." June 10, 1874.

3,538.—F. Hungerford, Rochester, Monroe county, N. Y., U. S. Improvement on furnaces for burning oil and other liquids for generating steam, called "Hungerford's Oil Burning Furnace." June 10, 1874.

3,539.—G. G. Felland, Hudson, St. Croix county, Wis., U. S.—Improvements in automatic registering grain meter, called "Felland's Improved Automatic Registering Grain Meter." June 10, 1874.

3,540.—G. J. Colby, Reading, Hillsdale county, Mich., U. S. Improvements on washing machines, called "The Colby Washer." June 10, 1874.

PATENTS

The publishers of the SCIENTIFIC AMERICAN have acted as solicitors of patents in the United States and foreign countries for more than a quarter of a century. More than FIFTY THOUSAND inventors have availed themselves of their services. All patents secured through this agency receive a special notice in the SCIENTIFIC AMERICAN, which frequently attracts purchasers for the patent.

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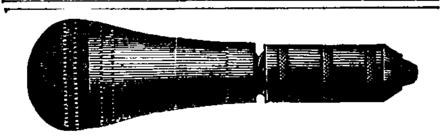

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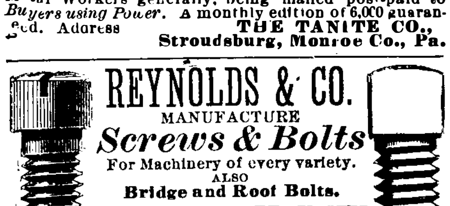

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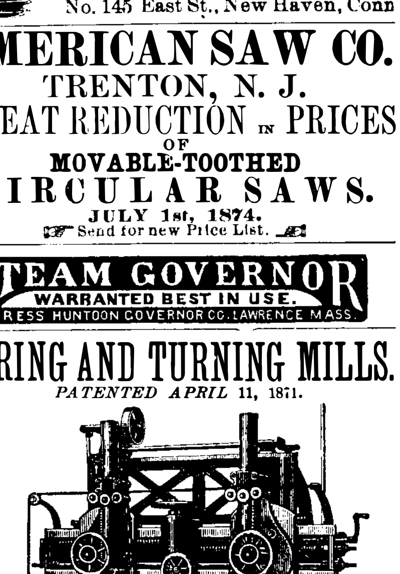

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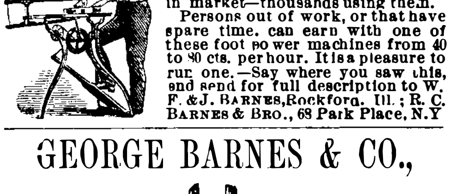

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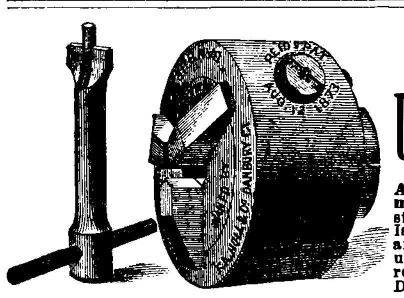

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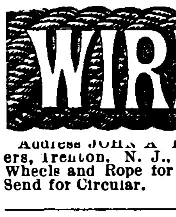

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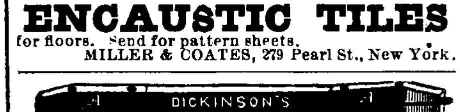

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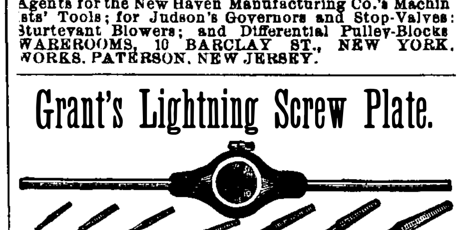

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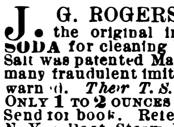

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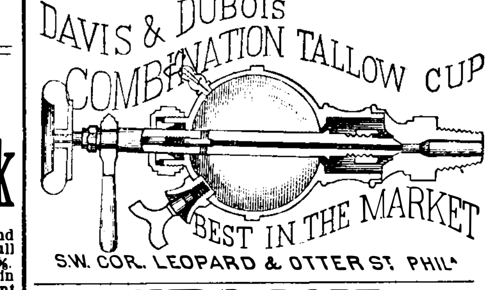

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