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ASCHENBRENNER'S IMPROVED SUGAR-MAKING PROCESS.

There is no process of chemical industry in which the waste reaches greater proportions than in that of sugar manufacture. Dr. Scoffern estimates the loss as nearer two thirds than one half, while another authority emphatically characterizes the proportion as enormous. The weight of the contents of a hogshead of sugar—according to an article on this subject recently published in *Iron*—is about 2,128 lbs. To obtain this quantity of sugar, 3,500 gallons of cane juice are often used, of a strength say of 9° Baumé. Each gallon at this average density contains 1.81 lbs. of sugar; hence 2,500 gallons contain 4,525 lbs. But the planter, as above noted, gets but 2,128 lbs.; hence the amount lost, or 2,397 lbs., is actually more than the maker has to sell. Of this loss 426 lbs. is molasses drained off, while the balance is waste of saccharine matter lost by caramelization; while ordinary processes have the still further defect of evolving, by the boiling of the cane juice, gases which impair the quality of the sugar.

With a view of overcoming these obstacles, the invention we herewith illustrate has been devised. According to the claims of its originator, the largest possible quantity of dry, pure, and naturally white sugar in marketable shape is produced. The importance of such an apparatus, if thoroughly efficient, cannot be overestimated, not only as influencing a vast industry, but as directly affecting every consumer of the staple; and hence no further introduction will be needed to bespeak for the following description the careful consideration which its subject deserves.

The course of the juice, as it emerges from the grinding mill, is through the trough, A, in which, at B, are arranged two inclined filters of different degrees of fineness, the liquid of course passing through the coarse one first. These filters are placed in two sets of grooves so that one pair can be removed for cleaning, leaving a second couple continuing to act, so that the operation need not be interrupted. The object of these appliances is to stop the passage of mechanical impurities floating in the juice. The conduit, B, discharges into a flannel, bucket-shaped receptacle, C, which it also so arranged over a tank, D, as to be

readily removed for cleaning and another quickly substituted, which serves to finish the initial filtering process.

The liquid is next conducted to three open kettles in succession. Each kettle has a double bottom so as to be heated by steam. In these receptacles, the juice is precipitated by means of lime and magnesia, a process facilitated by the high temperature imparted by the steam, after which the sediment is drawn off by suitable tubes at the bottom. Thus purified, the liquid passes away through the siphons, E, to another filter, F, which removes the last vestige of foreign substance which may still remain held in suspension. This apparatus consists of a metal case, in which is placed a second case, having two perforated ends and two perforated partitions, forming three compartments. The first is filled with sponge, and the second with bone black, and the third with charcoal. At each end is an empty space for the entering and emerging juice. The inner case is provided with handles to admit of its being lifted out of place for cleaning.

The pump, G, then lifts the juice into the sulphur box, H. This latter portion of the apparatus is of wood, encloses a paddle wheel which is actuated by the steam engine of the mill, and is fed with sulphurous fumes from the adjoining sulphur furnace, I. The revolving paddles throw the fluid into rapid agitation, so that it is thus more thoroughly exposed to the action of the gas and caused, it is claimed, to leave the box in a perfectly bleached condition. The emerging stream, which is of about two thirds of an inch in diameter, passes at once upon a long trough of sheet metal, J, which, heated interiorly and underneath by steam supplied through the pipes shown, serves to raise the temperature of the liquid to a degree not exceeding 194° Fah., by a condensation of 32° or 33° Baumé. Beneath this trough, at K, is arranged suitable apparatus for altering its degree of inclination at pleasure, thus hastening or retarding the flow.

Passing next through a connecting canal, the juice, in a stream half an inch in diameter, exits upon a second trough or box, L. This conduit is arranged similarly to the trough, J, and the liquid is here heated up from 212° to 220° Fah., and thereby condensed to 40° or 45° Baumé. When it reaches the lower end of the incline, occupying from 10 to 12 minutes in the transit, the stream has a thick-

ness of one third of an inch. At this point, in order to carry off all the vapor, hasten condensation, and prevent the boiling of the juice, a steam fan, M, is produced. By the effect of this appliance, together with that of the processes to which it has already been subjected, the liquid becomes so thick as to necessitate the use of a scraping apparatus, N, which consists of an endless band, passing over pulleys and provided with transverse blades, placed at suitable distances apart. This is set in motion by the engine and serves to convey the material to another inclined plane similar to those already described, where it is acted upon by a second fan, O. Finally the sugar, now in a crystallized condition, is removed by hand into the last receiver.

When it is desired to produce molasses, a small percentage may be obtained by making the incline of the troughs steeper, thus hastening the process and preventing the perfect drying of the sugar by the action of the two ventilators. The molasses thus made is said to be of the best quality and of the finest color. The entire period of time occupied by the juice in passing through the apparatus is stated to be in the neighborhood of forty-five minutes.

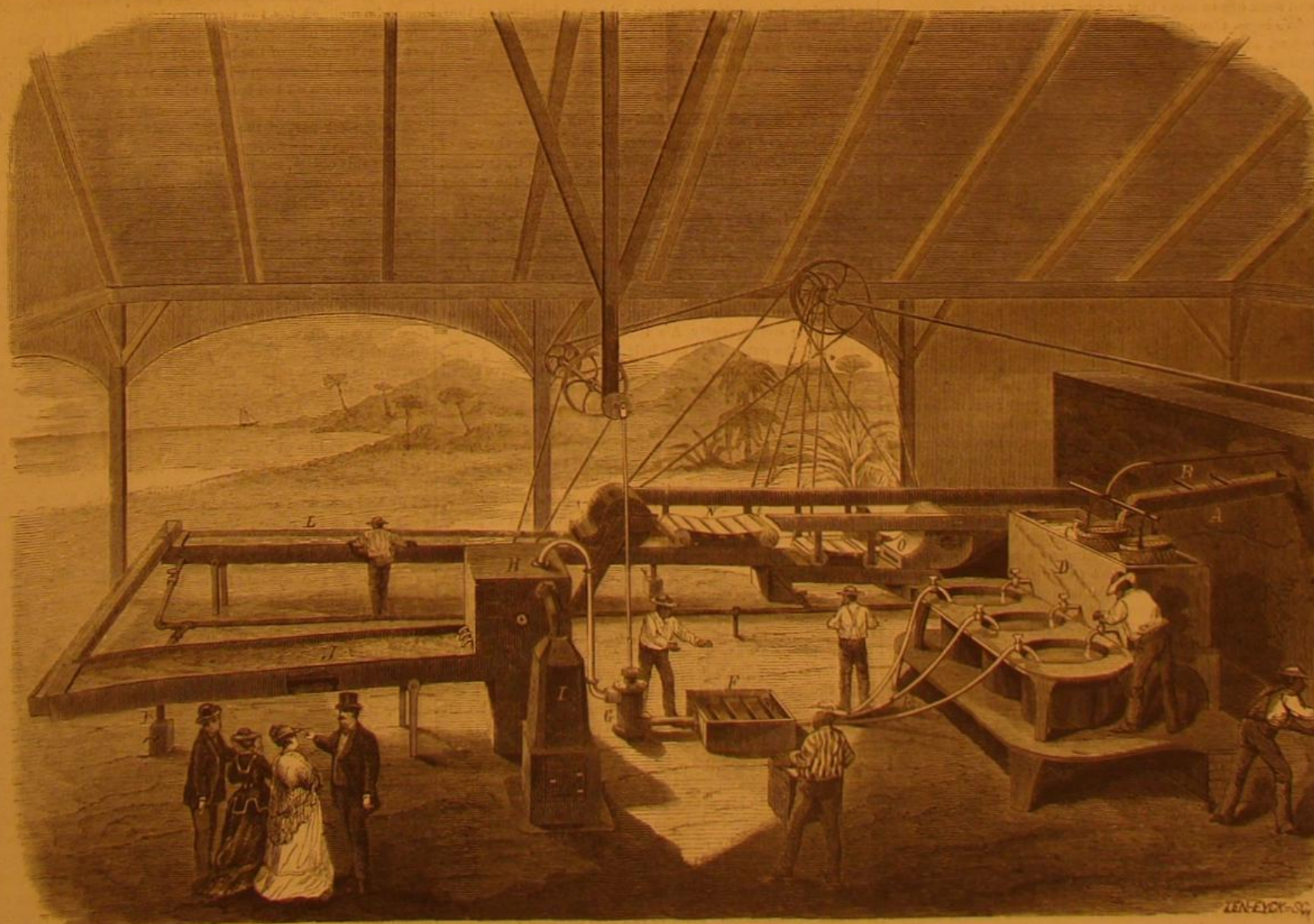
As regards economy, we are assured that the percentage of fuel saved is remarkably large—a fact which may be justly inferred from the advantageous and ingenious arrangement of heating surfaces, etc.

The patent for this invention, the credit of which is due to Dr. H. M. Aschenbrenner, is now pending, in the United States, through the Scientific American Patent Agency. For further information, address Mr. T. Masac, care R. Matthies & Co., 525 Apartado, Havana, Cuba.

Depression in Railway Bonds.

Fifty-five railroad companies in the United States are now reported as in default for non-payment of interest on their bonds. The total amount of these bonds is \$217,959,311, or about thirteen per cent of the whole amount of the railroad bonds now outstanding.

With but few exceptions, the cause of the delinquency is due to the tightness of the money market and not to any inherent defect in the roads or their management, and the difficulty, therefore, will be only temporary.



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A WORD TO OUR SUBSCRIBERS.

Many of our subscribers will observe, printed in red ink on the wrapper covering this week's copy of the SCIENTIFIC AMERICAN, the announcement that in three weeks their subscription will be exhausted. The year and the volume thus expire, and we give notice a little in advance, and solicit a prompt renewal of all subscriptions, in order that our readers may experience no stoppage in the receipt of the journal, and that we may not miscalculate the quantity of paper to print at the commencement of a new volume.

The plan of discontinuing the paper when the time expires for which it is prepaid, we think preferable to the course adopted by many publishers, of continuing their paper indefinitely and collecting afterwards. The latter course is too much like having a bill presented for a suit of clothes after it is worn out. We shall be gratified to have every old subscriber renew, and doubly grateful if each will send one or more new names with his own.

We hope those of our subscribers whose term is about to expire, as admonished by the notice on this week's wrapper, will not delay in remitting for a continuance of the paper. The safest way to send money is by postal orders, bank checks, express, or draft on New York, payable to the order of Munn & Co. Little risk is incurred in sending bank bills by mail, but the above methods are safe beyond any contingency.

BETTER TIMES.

The feeling of insecurity with regard to financial matters, which for the past two months has clogged the business interests of the country, is becoming rapidly dispelled, and people are beginning to realize that after all the hue and cry the panic is but a specter, mainly due to their own imagination. It was, in fact, a gigantic scare, a veritable panic, as baseless as the frantic rush of a crowd in a building on the shout of "fire," while its victims may be likened to such of the hapless bystanders as are trampled beneath the feet of the surging multitude.

Like all great storms, this one has left its ravages, which will doubtless be felt for some time to come; but in the main the horizon is clear and there is every prospect of a speedy return of business to its former channels. The subject has been freely discussed, theories innumerable have been ventilated, and dismal forebodings indulged in to an unlimited extent, until, as a sensation, the novelty of the excitement has died out. The talkers, therefore, having had their say, the workers, cool headed and far seeing business men, are striving to act; and while the former are now devoting their oratorical talents to the Spanish complications, the latter are busily endeavoring to repair the damages of the disaster.

Marked signs of improvement are exhibited in the reports from various quarters of the country, and notably so from the New England States. Total suspension, says an authority, is, in the majority of cases, being modified to half or three quarter time, and hands thus furnished employment are receiving wages enough to keep want well away from their doors. Collections are generally easier, and the record of protests of commercial paper and of suits in involuntary bankruptcy is largely diminished.

The mines of Pennsylvania have been kept open, although working hours have been reduced. The men have cheerfully accepted the situation, believing that small wages were better than absolute idleness. The iron masters, it is said, will shortly resume operations, although many have suffered very severely, notably for the cessation of orders for railroad supplies. Their renewal will necessarily assist the coal trade. Among the manufacturers there seems to be a general impression that the trouble is past, and we note that resumption of

business are extensively in progress, although in many cases it has been found necessary to continue reductions of time and wages. The tobacco interest has suffered but little. The jewelry manufacturers had experienced a stagnation in their trade, but this is reported to be gradually passing away. The knitting mills of the northern part of this State are rapidly receiving orders, and improvements in buildings and machinery are progressing as usual. It is expected that the great establishments in Cohoes, N. Y., will start on full time again as soon as the water is let on in the canals. The safe dealers have reduced prices and sales are said to be brisk. The dry goods trade is recovering, and a good holiday business is anticipated.

The war contingency, while serving to divert the popular mind from the financial stress, is becoming the means of supplying work for large numbers of men. We note the following important contracts, which indicate brisk business for several of the largest machine shops in the country: John Roach is to build engines and machinery for one new sloop of war, to cost \$630,000; for two similar vessels, at \$80,000; to repair four monitors, at \$720,000; and to build two engines for \$366,000. Quintard & Murphy are to construct engines for two sloops of war; the Delamater Iron Works, to repair the "Dictator;" Atlantic Works, of Boston, to repair two vessels; Hartford Iron Works, engines for sloops of war; Wright & Co., of Newburgh, similar work; Cramp & Sons, of Philadelphia, are to overhaul four monitors; the Harlan & Hollingworth Company are to repair three ships of the same type, and it is stated that the Navy Department has more contracts yet to issue.

The effects of the disaster had been severely felt in the eastern States before the magnitude of the panic had become fairly comprehended in the West. In spite of this fact, however, the work of recuperation seems to be as rapidly advancing in that section of the country. The iron interest of Cleveland was embarrassed for a time; but as a rule, we learn that there has been scarcely any reduction either of force, wages, or time in the factories and shops of the city. In Cincinnati, of the 12,000 workmen there employed, it is stated that hardly five per cent of the total have lost their places; while from Dayton and Columbus comes a similar report. Local journals go so far as to state that this is even an improvement on the usual condition of affairs at this time of year. From Chicago, St. Louis, and Louisville, advices are generally encouraging; and the same is true of recent reports from Baltimore.

We regret to notice reductions of wages on some of the railroads, notably on the Delaware, Lackawanna and Western. We hardly think that the best interests of these great and wealthy corporations are served by such a course, and consider that it would be wiser to exhaust every other means of retrenchment prior to diminishing the incomes of those whose labor they employ.

Altogether the feeling manifested throughout the country is encouraging, and the general condition of business is uniformly quoted as sound. There is an abundant demand for our products, enough to maintain all our industries; so that, we believe, it will involve only the length of time required for the excitement completely to die away before trade will be resumed, with even an increased vigor.

ON THE PURCHASE OF PATENTS.

Complaints of fraud are sometimes made by purchasers of patent rights, who pay their dollars and receive their deeds, only to find out that the latter are defective and the money lost.

Example 1. A buys from B one half of all B's right in a certain patent, and takes it on the supposition that B owns the whole patent, but without instituting any examination to ascertain if such is really the fact. After the purchase, A employs an attorney to examine the records, and finds that B, at the time of the sale, was the owner of only one half of the patent; consequently A's title secures to him only one quarter of the patent, not one half as he supposed. A simple examination made before the purchase would have saved A from the loss.

Example 2. A contracts verbally with the patentee, B, for the exclusive right to make, use, and sell an invention during the lifetime of the patent, pays the money, receives the deed; and without examination of the document, supposing it to be right, places it on record and closes the transaction. Thereafter, on examination, it appears that the words, *the exclusive*, were omitted from the deed, the latter *a* being used in place. The deed, therefore, only conveyed a right to make, etc.; leaving to B the privilege of granting as many other rights as he might choose to the business competitors of A. Had A taken the precaution to employ an experienced attorney to examine the deed before paying the money, he might have really secured what he bargained for.

Example 3. A buys a patent, supposing it to be the only one ever granted for the special improvement claimed. It bears the genuine official marks of government origin, looks straight in all its forms, and appears to him to be all right. Without making a search, he pays the money, takes the deed, and proceeds at once to manufacture the article. After much labor and the outlay of several thousand dollars for mechanism, he succeeds in putting the goods on the market, when, to his astonishment, he is served with legal papers as an infringer of some prior patent; and only gets clear of the trouble by paying damages and buying an interest in the first patent. He is thus compelled to pay twice for the same article, which he might have avoided had he employed the services of proper persons to examine as to title and infringements prior to the first payment.

Example 4. A contracts for a patent, supposing that the

device is a new thing. Surely, he thinks, the government of the United States would not issue a patent for an old device. He therefore concludes that it must be all right, pays the money, and receives a deed. Infringers make their appearance. He brings suit, and then, to his surprise, discovers that the invention is a very old one and the patent utterly worthless. The Patent Office is far from being reliable in its grants. The only safe way, where interests of value are at stake, is to have careful searches made by competent attorneys as to the validity of the patent.

The same remarks apply in respect to the scope of patent claims. The purchaser is too apt to suppose, in buying a patent, that the claim is broader than it is, and covers the manufacture of an article so as to exclude all competitors. He therefore goes extensively into the business, exhausting money and energy, only to find out, what an attorney's examination would have quickly revealed before hand, that the scope of the patent claim is very narrow, and the patent of little value.

CONCERNING A TELESCOPE OF UNLIMITED POWER.

In volume I, number 3, of the *Mathematical Monthly*, for 1858, may be found an article written by Professor George R. Perkins, then of Utica, N. Y. It relates to a fluid parabolic mirror; and the problem is demonstrated that "if an open vertical cylinder, containing a fluid, be made to revolve with a uniform motion about its axis, the upper surface of the fluid will assume a perfect concave parabolic form." A table is appended which gives the focal distances corresponding to different velocities of rotation; and these have been deduced from actual mathematical calculation.

If mercury be used as the fluid, we shall obtain a concave parabolic mirror which will be theoretically perfect. We think it possible to make use of this kind of mirror for astronomical purposes; for all rays of light falling upon it parallel to its axis will be reflected to the focus of the parabola, where could be applied the ordinary magnifying apparatus, after the method employed in the Newtonian reflecting telescope.

Now it is necessary to reduce our theory to practice. The cylinder containing the mercury must revolve with a uniform motion; and it is our opinion that the mechanics of the present day are fully adequate to the construction of machinery which shall impart a uniform motion to a vessel of mercury many feet in diameter. This problem of uniform motion has been successfully solved: the astronomical instrument known as the chronograph is made to move almost perfectly uniformly; and the heavy clockwork which is employed in moving large refracting telescopes, in a direction contrary to the diurnal rotation of the earth, is often so perfect that a star, from its rising to its setting, can be kept almost exactly in the center of the field of view. Now certainly, since we have attained so perfect a uniformity of motion as this, machinery can be devised and constructed which shall impart the required uniform motion to an immense vessel of mercury. It is evident that gravity would not permit this mirror to be inclined for the purpose of viewing objects which are not directly overhead; and since this is true, it is also evident that the value of the mirror of mercury would be somewhat lessened by reason of the fact that a celestial object would soon pass off the field of view of a stationary mirror. So that we must devise some method by which the rays of light from any part of the visible heavens may be thrown vertically upon the mercurial surface. For the accomplishment of this object, the principle of the philosophical instrument well known as the heliostat could be employed, and thus the rays of light coming from any heavenly body could be continually reflected vertically upon the mercurial surface.

As to some of the manifest advantages which this instrument would possess: The liquid mirror would not be distorted by a change of temperature; thereby being far superior to reflecting telescopes with solid mirrors. Again, there is no limit to the size of mirrors constructed in this way; and this fact will allow the use of eye pieces which will afford unlimited telescopic power. The speculum surface, also, of mercury is almost perfect, absorbing a much smaller amount of light than the polished surface of the metal used in ordinary reflectors. And the specific gravity of mercury is such that, after it has once assumed its position of equilibrium in rotation, it will be quite stable in its form. It will also be readily perceived that the principal thing about the mercurial telescope is its machinery; which can be much more easily and accurately constructed than the great lenses necessary for an immense refractor.

Now this plan for the construction of a large telescope certainly possesses advantages sufficiently great to warrant the expense of all experiments for testing its practicability. The essential thing in the execution of a large telescope consists in the requisite funds. The million dollar telescope, so earnestly talked about by some of the correspondents of the SCIENTIFIC AMERICAN for several months past, calls for a considerable sum of money; the mercurial telescope, offering far greater power, calls for a far less sum of money. And again, the entire lifetime of an optician would be barely sufficient for grinding and polishing and correcting a pair of lenses large enough for a million dollar refracting telescope; whereas an immense mercurial telescope might be constructed inside of two years; indeed it might be easily completed before the Centennial of 1876, at Philadelphia, if it is desired that it be used on that occasion. Such an instrument would add indefinitely to our knowledge of physical astronomy; and, moreover, the great amount of light which a large mercurial mirror would collect, even from exceedingly faint celestial objects, would be particularly favorable for spectroscopic observation.

This method seems, at present, to be our last resort for

the construction of a large telescope. Definite action in regard to this matter should be taken immediately. Let some one take hold and do something; success is almost certain. Amherst College, Mass. D.

REMARKS BY THE EDITOR.—The suggestion here made by our esteemed correspondent for the construction of a reflecting telescope of unlimited power is novel and ingenious. It is, moreover, theoretically correct. But when we come to consider the difficulties which beset astronomers in using their present large instruments, though these are small as compared with the gigantic machines intended by our correspondent, we confess his idea seems to us to be impracticable.

Whoever has attempted so simple a matter as the adjustment of the wires of a three inch transit instrument, by looking through it upon a small plane mercurial mirror, knows how considerable the difficulties are. Even the insensible pressure of the wind, upon the exterior of a solid stone building in which the adjustment was attempted, has been known to produce such vibrations of the surface of the mercury, although it was insulated by elastic supports, as to render the work of adjustment impossible; and success is only attained during an almost perfect calm. If these difficulties attend the use of a mercurial mirror of only a few inches in diameter, are we not justified in believing it to be impossible, in the present state of human mechanical skill, so to arrange a plane mercurial mirror of several feet in diameter that it shall remain free from vibration? But granting that it could be done, can we conceive of any method by which the rotation, necessary to produce the requisite concavity of the mirror, could be imparted and maintained without inducing vibration? We will grant that the motion could be sufficiently regulated, though an absolutely accurate clock has never yet been made.

But we will suppose the mirror to be complete, and the objections mentioned successfully overcome. The instrument necessarily occupies a horizontal position; it is, we will say, twenty feet in diameter, and we now wish to use it to the best advantage. For this purpose, two plane mirrors, equal in size to our mercurial mirror, will be necessary; and whether they are made of glass or metal, the difficulties connected with the final polishing of their surfaces into a condition of proper accuracy are seemingly as great as the maintenance without vibration of the rotating mercurial mirror.

We are of opinion that it would be considerably less difficult to construct a concave mirror of speculum metal or other solid material, of the dimensions stated, than to produce either of the other mirrors; while the speculum concave, by its capabilities for change of position, would render the use of the two plane mirrors unnecessary.

We should be glad if our correspondent, and other writers who desire, would point out the particular methods that may occur to them, by which the objections we have suggested might probably be overcome. The subject is one of much interest, and its further discussion may lead to profitable developments.

THE PROTECTION OF PLANTS BY ARTIFICIAL CLOUDS.

The practice among gardeners of protecting vegetables from the effects of frost, by lighting fires at such points that the wind will carry the heated air and smoke over the plants, is not new, and in some countries is one of the commonest agricultural operations. In Chili, where large vineyards exist upon the slopes of the Cordilleras, the plan has been found of the greatest value in saving the vines from the cold wind which sweeps down from the mountains; and it is stated that even the tenderest shoots are defended from the frost, at temperatures as low as 21° Fah.

The most recent experiments in this direction, and perhaps also the most extensive of late date, have been carried on by M. Fiabre de Rieunègre, one of the largest vine growers in France. It may be remembered that about a year ago we briefly adverted to this subject, and said that it had elicited commendation from a congress of vintners in the above mentioned country. Since then, however, M. de Rieunègre's experiments have been made, and with such remarkably good results that the matter is invested with a new and, at this season of the year, timely importance to all engaged in the cultivation of the vine in our Northern States. The investigator in the record of his researches considers that fires of tar or heavy oils are not suitable, notably from the fact that cheaper and more efficacious material can be obtained, and also that, in order to keep the former burning over a considerable period of time, an amount of attention is required which eventually becomes very onerous. Wheat chaff, he says, answers the purpose better than any substance he has used, as it burns slowly, produces large quantities of smoke, and costs but very little. Moss, saw dust, or worthless hay may be employed when chaff is not conveniently obtained. The material is piled in heaps of about eight feet diameter and forty feet apart. Three fires thus disposed are sufficient to protect two and a half acres of vines.

In describing his mode of experimenting, M. de Rieunègre says that, having selected a night when the thermometer appeared to be rapidly falling, he collected all his laborers, together with a large concourse of neighbors from the surrounding country. As soon as the mercury fell to 33° Fah., a signal was given and the match was applied to three hundred heaps of chaff and straw. The flames were carefully kept under; and in a very few minutes, a dense cloud of smoke had settled over a plain of 800 acres. The fires were continued until the thermometer had risen above the freezing point of water, but were renewed within twenty-four hours, when one of the coldest nights of winter set in, with a

strong breeze blowing from the northeast. New heaps were kindled in the direction of the wind, the great cloud was again formed; and although, it is stated, the vineyards of the surrounding country presented after the frost a scene of desolation, those protected by the smoke were unharmed. Thirty thousand dollars worth of plants were saved by the operation, at the sole expense of a quantity of worthless chaff and straw.

ELOQUENCE AND PATENT FUEL.

When we have subjects to write about which call for beautiful displays of rhetoric (and it may be remarked that the editorials of a scientific journal are not popularly supposed to sparkle with such brilliant coruscations of literary genius), we think, by sufficient study, we might prove equal to any ordinary requirement; but we doubt if, under the inspiration of so prolific and poetic a theme as "patent fuel," we could evolve from our inner consciousness anything approaching the following, with which a writer in *Les Mondes* introduces that topic. The quotation is remarkable in that it broaches an entirely new theory of the origin of fire, the peculiar ingenuity of which will doubtless commend itself to all scientific minds:

"The world was born yesterday. One day an unknown meteor rushed with the wind (!) upon the summit of a forest. The horizon reddened, trees burst in flames, the leaves driven by a breath of summer whirled in torrents through the atmosphere: birds driven from their nests uttered cries of distress, panthers fled howling away, reptiles writhed upon the cinders, and crocodiles plunged into the lagoons. Alone, immovable and erect, man regarded with mute astonishment the bloody shadow of the new guest. Suddenly he felt a gentle heat penetrate his fibers, as the prescience of a novel destiny. Fire was found. Then braved he the frost, drove back the night, and caused the grain to leap from the bosom of the earth. Lighting the forge, he melted, molded, and mastered metal; and metal, vibrating under the orchestra of the forge, sounded the chant of the victory of humanity." And after two pages of this to descend to the advantages of a patent fuel!

THE SUPPRESSED MEMBER.

Of all tyrants, the most tyrannical is custom. As capricious as the King of Dahomey, she is as inexorable as Mrs. Grundy. There is no king or kaiser whose rule is so burdensome or so meekly endured, the secret of her power lying in the delusion of her subjects that they are wholly free. Her laws are the only laws that perpetuate themselves; and though originally mere freaks of barbaric fancy, or usages of some forgotten stage of social development, they have shaped the lives of so many generations that they have become part of the social framework, and are harder to shake off than Sinbad's old man of the sea. Our heaviest taxes are those we pay to custom, her tribute takers, with fernseed in their shoes, finding their way into the innermost recesses of our daily life and controlling our conduct where we least suspect it.

A thousand illustrations might be given; but just now our wish is to call attention simply to one: our habitual and unreasonable suppression of a member whose cultivation would immensely increase our executive power, and prevent our being utterly disabled by certain accidents which all are liable to. The oriental custom of restricting education to the male half of the race seems to occidental minds at once unprofitable and absurd. What then would we think of a custom which should effect the systematic repression, not of the girls merely, but of half the boys; requiring number one of every pair of boys to be trained to the utmost strength and skill, and condemning number two to awkwardness, inaction and weakness? Worse than that: allowing him to do nothing not directly and necessarily subservient to number one, yet requiring him always to take number one's place in case he should meet with an injury. Such unprofitable servitude to other customs than our own would certainly be accounted ridiculous in the extreme; but after all, is it so much worse than our careful repression of the sinister half of each boy's working members?

"Don't use that hand" and "Use your right hand" are injunctions that the child hears from the very first; and before he is old enough to understand the spoken words, the outstretched left hand is put back and the coveted toy given only to the right.

"Why?" he asks as soon as he is old enough to demand a reason for the slight put upon the unoffending member.

"Because," replies mamma, sagely, "it is awkward," or, "it isn't polite."

Why it should be awkward or impolite to use the left hand, mamma never thinks to enquire. That the exigencies of military discipline in some fighting age of forgotten barbarism made it necessary that all men should give preference to the same hand, or some other equally wise and potent reason established the custom at a time when one skillful hand was enough for one person, mamma neither knows nor cares; nor does it occur to her that times change, and that a good rule for one generation may be a bad one for another. Grant that social convenience is favored by the uniform use of the right hand for certain purposes, that is no sufficient reason for subordinating the left hand in all things, especially when the conditions of our lives and occupations make it very frequently imperative that the untrained left hand shall learn to do the work of the disabled right hand.

From the nursery the boy goes to school, and here the same unreasonable prejudice awaits him. Through instinct, accident, or caprice, he grasps his pen or pencil with his left hand, and his knuckles are sharply rapped for it. Why should he not be taught to write and draw with both hands?

It would take but little if any more time; and if it did, it would only keep him busy during moments which he would otherwise devote to idleness or mischief. The acquisition would never be worthless, and it might be of immense convenience to him. He might never have occasion to use his double capacity after the fashion of the popular scientist and teacher whose two-handed black board sketches are such a delight to his auditors, and who is said to pursue his microscopic studies with a pen at one side and a pencil at the other, drawing with one hand and writing with the other as the development of his subject may require; nevertheless his two-fold skill would ever be a possible source of satisfaction and advantage to him. He would be free at any moment to rest a hand exhausted by protracted use without any interruption of his work; he would be less likely to be disabled by trifling hurts; and in case one hand were stiffened by heavy labor, the other might be kept in readiness for delicate manipulations, for writing, drafting and the like.

We have seen more than one ambidextrous artisan whose ability to handle tools with either hand, as occasion demanded, gave him constant advantages over his one handed mates, not only in the avoidance of fatigue, but in the performance of nice work and the overcoming of difficulties, hard to come at by those restricted to the use of a single hand. The right handed man who can use a hammer or a knife readily with his left hand, or can tie or untie a knot when his right hand is otherwise engaged, will find frequent use for his skill. Indeed the advantages we miss through the non-cultivation of the neglected member are infinite in number and of incessant recurrence. They are among the taxes we pay to custom.

It would be useless to recommend the mature to undertake the culture of their left hands. They have been "left" unused and untrained too long; and the proper time for such work is in childhood and youth, when the muscles are tractable and time abundant. But need it be useless to urge parents to encourage such training on the part of their children, or, at least, not to discourage it?

SCIENTIFIC AND PRACTICAL INFORMATION.

EUROPEAN RAILROADS.

According to the most recent statistical data, the total length of all the railroads in Europe is 58,650 miles. The largest number of lines is in Great Britain, aggregating 15,351 miles; Germany is next with 10,739 miles, then France, 10,511, Austria, 4,492, Russia, 4,758, and Belgium, 1,892.

ADULTERATION OF TEA IN ENGLAND.

The *London Globe*, in an article on the above topic, says that the ill effects, often attributed to tea drinking, in the majority of cases are not due to the properties of the leaf itself. Adulteration has become so common that out of 183,000,000 pounds which passed through the British Custom House in 1872, during the month of July alone a Sanitary Commission found 10,000,000 pounds utterly unfit for human consumption. In a single chest a magnet brought out 43 per cent of the whole in bits of iron, colored green. This wholesale rascality is done by the Chinese before exportation.

RED AND WHITE MUSCLES.

M. Ranvier points out that the red and white muscles of a body,—very clearly seen by removing the skin of a rabbit— which exist mingled in the same region, are different both in structure and properties. On applying the electric current, the white portions contract almost instantly, and respond even to rapid and continuous shocks. The red portions, on the contrary, are much more sluggish; it requires a certain time for them, apparently, to feel the excitement, while, on quick interrupted discharges of electricity being administered, they simply assume permanent contraction. It is believed by the author that the latter are involuntary and of the nature of the muscles of the heart or other portions relating to the animal existence; the former, however, he thinks, are controlled by the will.

NEW DERIVATIVES FROM CAOUTCHOUC.

While recently investigating the properties of Gaboon caoutchouc, M. Aimé Girard has succeeded in isolating a white crystallizable substance which, on analysis, became resolved into methylic ether and grape sugar. In a second series of researches, the same author, with Borneo rubber, has found another material analogous in aspect to the first, and containing the same elements, but differing in that it contained grape sugar condensed, in other words, answering to the formula $C^{12}H^{12}O^{12}$ instead of $C^6H^6O^6$, as in the former instance. Continuing his studies to Madagascar caoutchouc, still another substance appeared, of which the sugar gave a molecule containing $C^{18}H^{18}O^{18}$, or doubly condensed.

The series thus determined also has regular relative difference in physical properties. Thus the first derivative melts at 414° Fah., the second at 418°, and the third at 453°, the temperature rising with the degree of condensation, thus conforming to established laws. As regards optical properties, the first component is inactive on polarized light, the second turns the plane of polarization 32° to the right, the third determines a rotation of 79° in the same direction. M. Girard has therefore discovered an intimately connected series, representing others of which the acids are isomeric forms of grape sugar.

Instead of an edition of sixty thousand of the "special" as promised to advertisers, we shall print of this number seventy-five thousand to commence with, and probably a second edition of twenty-five thousand before the first of next January.

THE IRON WORKS AT MERTHYR TYDVIL, SOUTH WALES.

Among the rival iron districts which now pour out their millions of tons annually all over the world, Merthyr Tydvil, was one of the earliest in the field, its product being celebrated long before the Staffordshire mines were opened. The principal works at and in the neighborhood of Merthyr are Cyfarthfa (Mr. Robert Crawshaw, the subject of our portrait), Pen-y-darren (Messrs. Fothergill & Co.), and the Dowlais Iron Company's. The first of these has as many as 5,000 hands on its pay roll, and the last 16,000.

The name of Crawshaw has been identified with the Cyfarthfa works for three generations. The first ironmaster in the family was (in the words of one of his grandchildren) the son of a most respectable farmer in Normanton, Yorkshire. At the age of fifteen, father and son differed. "My grandfather, an enterprising boy, rode his own pony to London, then an arduous task of some fifteen or twenty days' travelling. On getting there he found himself perfectly destitute of friends. He sold his pony for \$75. He hired himself for three years by paying the \$75, the price of the pony. His occupation was to clean a counting house, to put the desks in order, and to do anything else he was told. By industry, integrity, and perseverance he gained his master's favor, and was termed 'The Yorkshire Boy.' The trade in which he was engaged was a cast iron warehouse. By honesty and perseverance, he continued to grow in favor. His master retired in a few years and left my grandfather in possession of his cast iron business in London, which was carried on on the very site where he ended his days—in York Road. My grandfather left his business in London and went to Merthyr Tydvil. Who started with humbler prospects in life than my grandfather? No man in the works is so poor but that he can command \$75. Depend upon it that any man who is industrious, honest, and persevering, will be respected in any class of life he may move in."

There is a sort of ancestral and patriarchal feeling at Cyfarthfa which seldom exists elsewhere. There are many men who have grown gray in the employment of the Crawshays, who have never changed or would wish to change their place. They have begun as children, perhaps only fetching and carrying small articles, for a few shillings a week, and have gone on to earn, as firemen and puddlers, their three pounds. There is not the same intense pressure to produce here as in other districts. The owner, having inherited a few loose millions, can afford to take things considerably and calmly. If you take the manager of a company, with his \$25,000 a year salary, and wanting to make another \$25,000 a year by his commission and percentage, you have, of course, a very different set of circumstances; he is anxious to produce as fast as possible; but the owner of Cyfarthfa is reported to have once truly said that he could afford to shut up his works for fifty years.

Mr. Robert Crawshaw is the owner of Cyfarthfa Castle; the unique character of the stern rough place, fit residence for an iron king, impresses you strongly. Some iron rails, a kind of tramway, come almost to the front door. The place might be a fortress, a mill, a lunatic asylum, unless you knew to the contrary. A somewhat steep ascent leads you to the gardens behind the house, with conservatories and ferneries. Some of the hothouses are very rich in their contents. The flowers might be the glory of any conservatory, but even in looking at the flowers you could not get rid of the idea of iron and coal.

Mr. Crawshaw is also well known as an amateur photographer, and his liberal encouragement of the art, by giving valuable prizes for specimens of portraiture, has already been commented on in our columns. He has recently executed a portrait of Mr. Justice Grove, F.R.S., the eminent philosopher and jurist, which the *Photographic News* describes as "nearly faultless."

THE BABY HIPPOPOTAMUS' BIRTHDAY.

The interesting fact of the first annual celebration of the birthday of Miss Guy Fawkes is announced by *Land and Water*. The individual bearing this much execrated name is an infantile hippopotamus in the Zoological Gardens in London, who, just one year ago on the fifth of November, was ushered into existence—a circumstance duly noted in these columns at the time. Mr. Frank Buckland, the well known naturalist, called upon the young lady with the usual felicitations and wishes of "many happy returns of the day." He arrived at about breakfast time, and found the object of his visit deeply absorbed in partaking of a breakfast from nature's fount, under water. He describes the condition and behavior of the babe, as follows:

"The water in the bath was as clear as crystal, and I was able to observe everything that went on. The mother lay herself down on her side, turning over like a huge bacon pig asleep. The young one stood on all fours at the bottom of the tank, and took her food very much after the fashion of a calf. She stayed under water from half a minute to a minute and three quarters; she then came to the surface, took a deep inspiration, and sank again, as quietly as a frog. It was very interesting to see with what little splash or noise

when it is moist and wet, she and her mother are let out into the bath outside; when it is dry and frosty, they are kept in the house, as the frost would crack and parch their delicate skins. When in her morning bath, she is very playful and plunges about like a porpoise. The pair of hippos sleep on the straw all night, but they spend a great portion of the day in their bath in the house in a sort of semi-sleep. They float up to breathe apparently without an effort, like corks rising to the surface. When under water, they keep their eyes wide open after the manner of crocodiles.

When the mouth of the young one is wide open, it will be seen that the tongue is arched directly upwards so as to form a compact valve, which prevents the water going down the gullet. The old father in the next den talks to his wife and child by means of sonorous grunting, and they answer him. The father's face is much longer and sharper than that of his wife, and his eyes and nose are much more prominent. I understand from Mr. Bartlett, who kindly allowed me a private interview with the hippos, that another baby is expected about next April, and that Barnum is most anxious to obtain it. I doubt if he will; let him go and catch a wild baby hippo for himself."

Prismoidal Railway.

In our last volume, we gave a drawing of the Prismoidal Railway of Mr. E. Crew, of Opelika, Ga. Messrs. Lafferty Brothers, of Gloucester City, N. J., have lately constructed a four ton locomotive on this novel plan, which is thus described in the *Philadelphia Ledger*:

It is built for a street railroad company in Georgia. This engine can with propriety be called a velocipede, as it rests upon two wheels, one following the other. The rail or track upon which it is to run, a sample of which is laid in the yard of the builders, is styled a "Prismoid, or one track railway," and is composed of several thicknesses of plank, built up in the style of an inverted keel of a vessel, with a flat rail on the apex. Upon a trial of speed, about 12 miles an hour was attained, and the inventor and patentee claims that the speed can be almost doubled on a lengthened track.

Mr. E. Crew, of Opelika, Ga., is the inventor and patentee of both tracks and engines, and he claims that his inventions demonstrate a tractive power superior to anything in the locomotive line, of equal weight. The capacity for running on curves is very much greater than the two rail system. The track upon which the trial was made contained 36 feet of lumber and 18 pounds of iron to the lineal foot, proving itself equal to a span of 20 feet, remaining firm and unyielding under the pressure of the engine as it traversed the road. The revolving flanges attached to the engine, and which run on the outside of each wheel, Mr. Crew claims, absolutely lock the rolling stock to the prism, and obviate the necessity of so much heavy rolling

stock in light traffic at a high rate of speed. It is also claimed that a prismoidal railway built with a base of 14 inches and angles of 45° can be built at a cost of \$3,000 per mile.

The inventor is of opinion that his engine and track are particularly adapted to the propelling of canal boats, and will compete successfully with horse power on canals without necessarily interfering with the use of the latter, but he does not state in what way. The engine will shortly be shipped to its destination, Atlanta, Ga., where it goes into operation on a street railroad, built at an elevation of twelve feet above the sidewalk.

ELECTRIC INDICATOR OF VITIATED AIR.—A solution of palladium chloride is so connected with a battery that, as long as no metal is precipitated, no current passes; but as soon as carbon monoxide occurs in the atmosphere, metallic palladium is precipitated, which establishes a current, and rings a bell to give warning of the presence of the noxious gas.—*La Gaceta Industrial*.



MR. ROBERT CRAWSHAY OF MERTHYR TYDVIL, SOUTH WALES.

these gigantic creatures can lift their heads to the surface of the water. After she had finished her breakfast, Prescott, the keeper, enticed Guy Fawkes and her mother out of the water; the little one is as tame, playful, and docile as a kitten. We made her out to be about six feet four long, and two feet ten at the shoulders. Her back is a slaty black color, but her cheeks, chest, and legs are of a lovely pink salmon color. We calculated her weight to be nearly one ton, and her mother would make and weigh about three little hippos. She eats and sleeps well; and besides her natural nourishment, her meals consist of chaff, bran, mangold wurzel, scalded oats, biscuit, and sugar. She is very fond of anything sweet. She has already learnt to beg for food; she puts her head out between the bars, opens her mouth, and pricks up her little ears when she wants to beg. The gape of her mouth is about eighteen inches, she has already a most lovely set of white teeth, and the tusks begin to project out of her pink gums. Her mother is very watchful over her, and, if she thinks any one is about to disturb her child, hisses loudly like a big snake. Every morning

FLAX AND ITS PREPARATION.

It has been asserted that flax is, in Great Britain, the most profitable crop that an agriculturist can grow, and yet, of late, whole districts which used to be under this crop are turned over to other uses. There has been, as the *Practical Magazine* informs us in a thoughtful and exhaustive article, a great difficulty in finding machinery suitable for the preparation of the fiber (which needs the most careful treatment), capable of being managed by field hands. "Every farmer," says our contemporary, "ought to have his own scutch mill. The object to be aimed at is the economy of fiber. The saving of labor, the combination of more than one process in the same machine, and every other economic or mechanical desideratum ought to be secondary to the capability of the machine in clean scutching; in giving the largest possible yield of flax ready for the hackle from a given quantity of 'mannered' straw. The system of scutch mills as we find them in Ireland is the best that has been adopted as yet. Hand scutching is too tedious, and the flax so manipulated can never be properly cleaned—short of an amount of labor which would add too much to the cost of production. But the scutch mill working for a number of farmers only suits Ireland, or elsewhere where the farms are small. In England and Scotland, where the farms are large, every farmer ought to have his own mill, either worked at the farmstead by the engine which works the threshing and other machinery of the farm, or by water power, when it may be had on the farm. The scutch mills ought to be in sets of three stocks, so as to give the flax the chance of 'a buffer,' 'a cleaner,' and 'a finisher,' to every streek. The 'buffer' may be an unskilled man if only careful not to allow the 'blades' to break his hand; as he holds it across the stand of the stock. A careless scutcher will waste his wages in a quarter of any day he is allowed to work. The 'cleaner' ought to be not only careful, but an orderly man. If flax is treated like hay, the loss is incalculable. Assuming that the man at the 'rollers' has not allowed an uneven 'beet' to pass through his hands, and has not made some stalks to ride on others before he presented the charge to the rollers, and that the 'streekers' have done their work carefully, and that the 'buffer' is not a sloven, the cleaner will then be enabled to place the streek on the 'finishing' board so orderly that not a fiber will be awry. The 'finisher' must not only be a skilled laborer, but also an orderly minded man, possessing a good taste; and if he has those qualities he will show his pride in the orderly condition, the clearness from shove, and the general finish of every streek, which are necessary to good and economic scutching. But with bad machinery, neither the 'roller' nor the scutchers get fair play; and the owner of the flax pays for all in a serious curtailment of profits. The mill should go steadily whether by steam power or water power. The motive power should always be under such easy control that, according to the condition of the flax (hard or soft), the motion of the mill should be easily regulated."

We give herewith a self-explanatory view of a flax-breaking device which is now being introduced abroad for the purpose of enabling farmers to prepare this valuable but troublesome fiber for manufacturers' use. We believe that it will be of interest to the agriculturists in many portions of our country, who greatly need the introduction of a new industry. Possibly it may pay to grow flax in places where corn is burnt for fuel because it costs too much to get it delivered into the centers of population.

THE OREODOXA REGIA PALM.

The splendid and luxurious flora of Brazil produces nothing more graceful than the lofty palm known to botanists as the *oreodoxa regia*. Straight and slightly tapering for over sixty feet in height (when fully grown), the tree then separates into a frond of remarkable beauty, as complete in form as the capital of a Corinthian column. A grove of these trees (represented in our engraving) is to be seen in the public botanic garden at Rio de Janeiro, and it is difficult to imagine an object more beautiful to the eye of a lover of Nature. The trees are said to be between forty and fifty years of age. The trunk of each of them is about four feet in diameter at four feet from the ground, and it goes on tapering gradually to a length of more than fifty feet, when it becomes united with another smooth thinner trunk, from ten to twelve feet in height, formed of the bright green foot stalks of the leaves, which again measure some twenty feet or more.

In young vigorous trees the leaves are considerably longer. The great beauty of this palm is its elegance and cleanliness of aspect; no ragged leaf beats about in the wind, even at that great height; the over ripe yellow leaves unsheath themselves of their own accord, and the trees look as clean as if they had been trimmed by hand. The color of the stem is a whitish gray, like that of light stone in dazzling sunshine; and although from top to bottom it is covered with lichens of all the colors of the rainbow, yet so small are they that you only perceive them by approaching the tree closely.

In the same grounds, says *The Garden*, to which we are indebted for the illustration, exists the parent of these palms, which was planted during the last year of the last

with the appearance of this avenue, which is unrivalled for its regularity, extent, and beauty. It forms a colonnade of natural columns, whose graceful bright green capitals seem to support an overarching dome of bright blue sky.

Property in Patents.

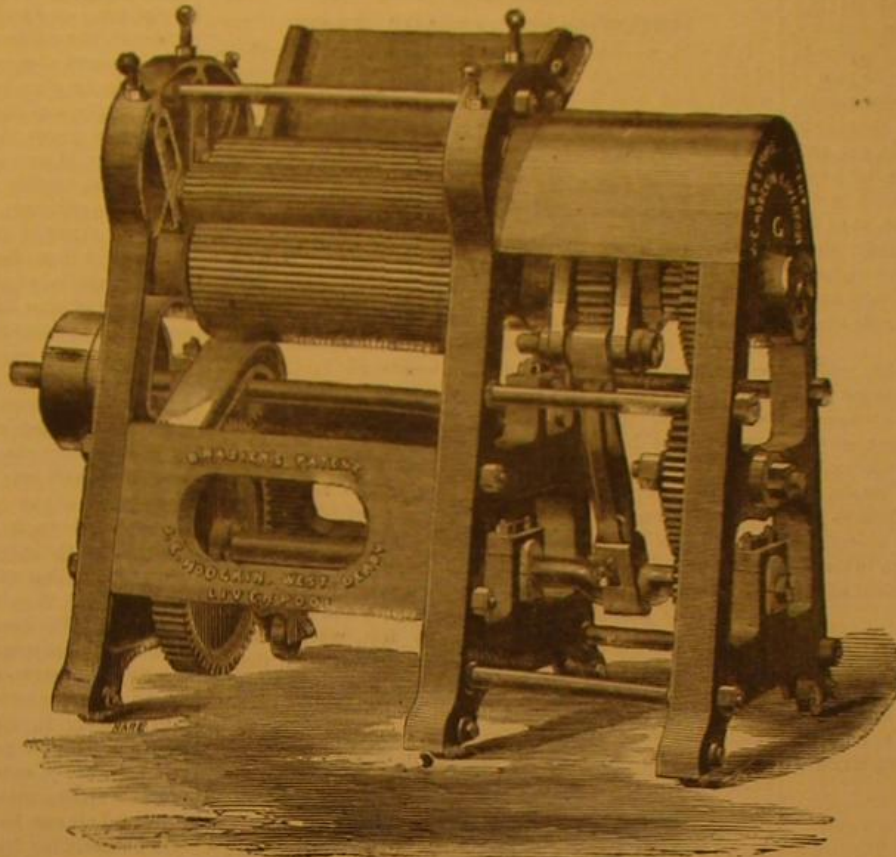
"The Nature of Property in Patents," was the title of an interesting society paper lately read by Mr. E. M. Quimby, of Orange, N. J., in which were set forth some of the difficulties attending part ownership of patents where there is no agreement regulating the use of the joint privilege, and the importance of preserving the title to the patent in its entirety demonstrated. Mr. Quimby thus formulated the legal question: "Patent property consists of an assignable privilege, having originally an exclusive character, which may or may not be preserved at the pleasure of the grantee. If the grantee assigns an undivided interest in his patent without the precaution of an agreement regulating the use of the privilege assigned, he by that act divests himself of the sole power of exclusion which he theretofore possessed, and the common property thenceforth is simply a common privilege, the free exercise of which by either part owner cannot be held to be an invasion or infringement of the rights of the other part owner."

Mr. Quimby suggested that the whole interest might be assigned to a trustee empowered and directed to administer the patent for the joint account of the several owners *pro rata*.

In discussing the moral effect and relative scope of patents for analogous inventions, it was remarked that the grant of a patent by no means establishes a commercial value for the invention, or even necessarily indicates that it may be used without invasion of the rights of others. To determine these points, it must be ascertained by further investigation whether the subject matter of the patent in itself infringes, or whether its use involves the concurrent use of devices which infringe upon principles claimed in prior existing patents, or described so as to be claimed in possible reissues of such patents.

Slag as a Building Material.

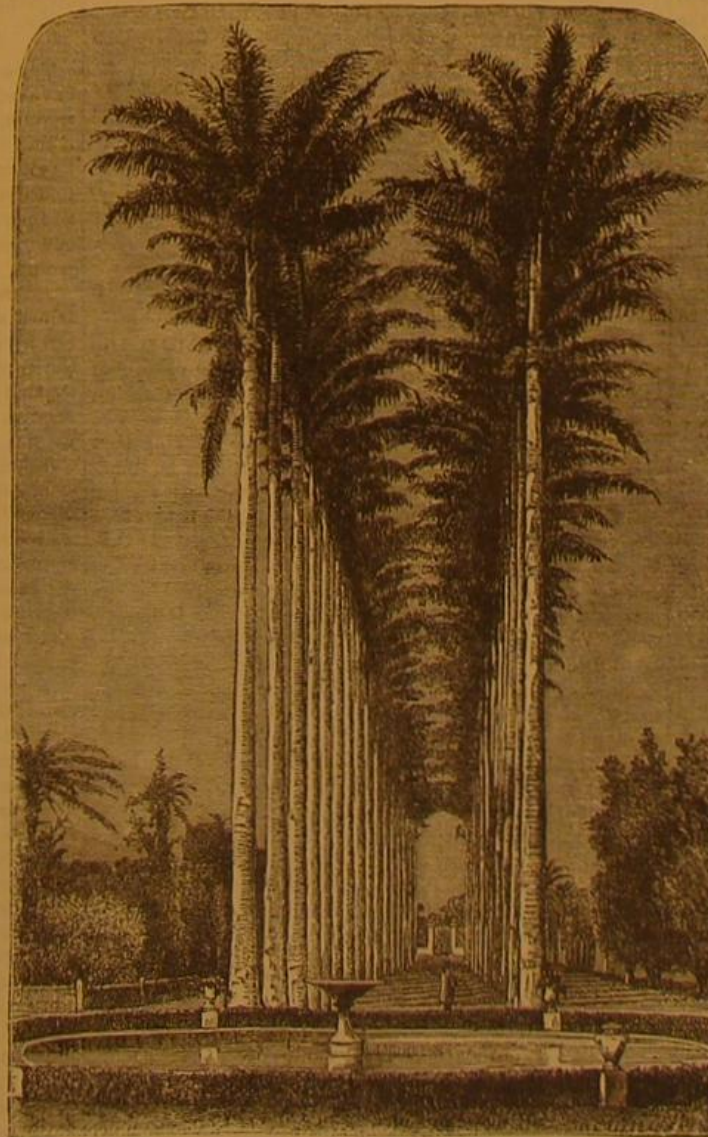
At a recent meeting of the Society of Engineers, London, a paper was read on the economic use of blast furnace slag, by Mr. Perry F. Nursey. The author commenced by noticing generally the history of the utilization of slag. In that condition it was first used for the beds in pig iron foundries, and afterwards in producing fine castings. It was also mixed with lime in certain proportions, and then pressed into bricks and made into concrete and cement. Slag sand was also used in making mortar with very good results; it was further utilized as ballast on railways, and had also been adopted in the manufacture of glass. In England, the author stated, it had also been similarly applied, and systems of machinery for its utilization had come into practical operation. The machinery of Mr. C. Wood, of Middlesborough, and of Messrs. Bodmer, of Hammersmith, was then described by the author by the aid of diagrams and models. Mr. Wood's machines, he explained, were of two kinds, one of a horizontal revolving table, and the other a vertical revolving drum. By the first machine the slag was cooled with a stream of water as it left the furnace, and, becoming disintegrated, was broken up and pushed off the table at a certain point by scrapers into trucks placed beneath. In that state the material was in a suitable condition for making concrete for building purposes. The second machine was for reducing the slag to a finer condition. It was run from the furnace into the drum, through which a stream of water flowed. The drum had screens placed within it, and as it revolved the slag became reduced to a fine sand, and was delivered in that condition into trucks. The sand was utilized in making bricks, cement, mortar, and for other similar purposes. Messrs. Bodmer's plan consisted in the use of a pair of rolls, through which the slag was run from the furnace on to a traveling band, which delivered it wherever required. The sheet of slag thus produced was readily broken up for use in concrete-making or ground into powder for bricks, cement, or mortar. For some purposes Messrs. Bodmer ran the slag into water, but for bricks and cement they produced it dry. They had also a special system of machinery for the manufacture of slag bricks, which was worked by hydraulic power, and which was described by Mr. Nursey. Samples of sand produced by both processes were exhibited, as were also bricks, concrete, and cement made from them. The satisfactory results which the author showed had followed the extensive use of blast furnace slag in the form of building materials leads to the hope that the enormous heaps of slag in the iron districts will become a source of profit and will provide good building materials at a low cost.



FLAX BREAKING MACHINE.

century, and is now above 120 feet in height. It is a noble tree, and, as it stands singly and at a considerable distance from other plants, its beauty and height can be seen to the best advantage.

Strangers from northern countries are invariably struck



THE OREODOXA REGIA PALM TREES.

Correspondence.

Electricity vs. Yellow Fever.

To the Editor of the Scientific American:

I have been an observer, since the epidemic of 1853, of certain phenomena for which I am unable to account, not being a scientist; and I will therefore recount my observations for the benefit of others. I have observed that, for some time prior to the breaking out in southern latitudes of the terrible scourge of yellow fever, rains fall, unaccompanied by thunder and lightning. During the prevalence of the epidemic, lightning is scarcely ever seen, no matter how often it may rain. The weather may be cloudy ever so long, yet the rains are not accompanied by the lightning flashes and thunder peals ordinarily common in this latitude (31° N.). When no yellow fever visits this portion of our country, thunder and lightning accompany every rain. There was, about in the middle of September of this year, one peal of thunder heard in this county (Jefferson) and in Stow county, Miss.; and none from then till the evening of October 26 following. We never have a killing frost, that is, one that destroys all the vegetation liable to be killed, till after a rain accompanied by a good deal of lightning. In 1855, in the county of Madison in this State, I remember that, at an examination of a female school in July of that year, there could not be generated a sufficient amount of electricity to perform the simple experiment with the electrical apparatus. The yellow fever made its appearance shortly thereafter in the town of Canton, and raged terribly.

I have drawn this conclusion from the facts that yellow fever does not prevail when the atmosphere is charged with electricity; and when it does prevail, there is an absence of that subtle fluid. May not scientific men be able to treat yellow fever cases electrically? As to the *modus operandi*, I have nothing to say; but it strikes me as being reasonable that there is some property in electricity antagonistic to yellow fever or the miasm that produces it; and if electricity can and does destroy the germ of that fatal disease in the atmosphere, why may it not do the same in the patient afflicted with the virulent poison?

I make these suggestions hoping that scientific men may give the subject investigation; and if there be anything beyond mere coincidence in the facts as above stated, electrical statistics will be able to verify it, if a call be made upon those whose duty it is in the various localities to note the changes of the weather.

Fayette, Miss.

Trees as Historians of the Past.

To the Editor of the Scientific American:

It may have taken a French savant years to ascertain what is a matter of common knowledge with wood cutters. I have understood for more than 30 years that a thin ring indicated a cold season, and a thicker one, a corresponding warm season. Another point which I have observed (and which is not mentioned in the Gros article) is this: In trees that are in an open field, or even in the forest where there is no particular protection from the north wind, the rings will be thinner on the north side than on the south side of the same tree. The heart of the tree is very seldom found in the center of the body. I have no doubt that you would find that a tree cut 4 or 5 feet from the ground will give a true record of the general meteorological conditions of each year of its life. I have often sat down by a newly cut stump of a tree, to count the rings, to note the difference of thickness, and to point out the thin rings to those with me, as indicating a cold year.

While speaking of trees, I will mention another fact, which I have not seen in print, but which I got from an old gardener. It is that all trees that are not trained out of natural shape will exhibit a profile in exact correspondence with the fruit. For extremes, take the greening apple and a long slim pear. The leaves, even, have a general resemblance to the fruit.

Bridgeport, Conn.

Snake Poison.

To the Editor of the Scientific American:

With reference to the article published in No. 3 of your current volume, I wish to mention that the poison of the rattlesnake (*Cobra casaca*) has been used in this country for about 20 years by several physicians, upon the homoeopathic principle, under the scientific name of *crotales casacella*, and with very good results, chiefly against neuralgic complaints and against nervous trembling. It is described as a most powerful specific in such cases, and to operate with great rapidity.

Pernambuco, Brazil.

Prizes for Scientific Experiments.

The following subjects for prizes to be awarded in 1874 have been proposed by the Batavian Society of Experimental Philosophy:

1. To discover if there exists, in the molecular state of bodies, modifications other than those caused by temperature, which are such as to give for the same body different spectra. The society wishes that this inquiry should bear chiefly on the magnetic condition of bodies.

2. To find out by new experiments if the vapor of water exercises on radiant heat an absorbent effect much more powerful than dry atmospheric air, as Mr. Tyndall maintains; or if there exists no difference in this respect between dry and moist air, as M. Magnus maintains. The society desires that the new experiments which it asks for be conclusive, and enable it to decide between the two opinions.

3. To determine what influence the pressure which is put upon an electrolyte has on electrolysis, and how far in this case is the principle of conservation of energy confirmed. It is wished that this inquiry bear on three liquids at least, to be chosen by the competitor.

4. To determine the resistance of the liquid amalgams of zinc and gold to the galvanic current. Six at least of each of these amalgams, in various proportions, ought to be examined.

5. A prize is proposed for new experiments which will enable a certain decision to be come to on the opinion, advanced by M. Gauguain as probable, namely, that voltaic electricity is propagated by matter, while induced electricity is propagated by ether.

COMPLETION OF THE HOOSAC TUNNEL.

It is with much pleasure that we chronicle the completion of the bore through the Hoosac Mountains, Massachusetts, which work was accomplished on the 27th of November. The back volumes of the SCIENTIFIC AMERICAN contain accounts of the progress of this great work from its incipency up to its completion, together with engravings of the various kinds of mechanism, that have, from time to time, been employed.

When the Hoosac Tunnel was authorized, no such railway work of equal magnitude had ever been undertaken, and the project seemed almost impracticable, for lack of suitable mechanical means. The method of hand drilling through the mountain rocks, for a distance of five miles, made the job seem almost interminable; and calls were made for the invention of new and special machinery, whereby the work could be expedited. This was in 1858. The ingenuity of the Yankee was not long in responding to the call; and in the course of a few months, the contractors had the satisfaction of setting at work, against the face of the mountain, an enormous machine composed of a great wheel faced with steel cutters, by which they expected, at one operation, to cut a finished tunnel of twenty-five feet diameter in the most rapid manner. But in this they were doomed to disappointment. The machine began its revolutions, and cut its way into the rocks very nicely for a few feet, when it broke down, and gave such evidence of impracticability that it had to be abandoned. The builders lost a large amount of money, and complications followed which practically suspended the work, although, from time to time, up to 1868, some progress was made by hand drilling, and paid for by State funds. Other inventors had in the meantime succeeded in constructing new and improved drilling machinery, of an effective nature, and in 1868 Messrs. W. and F. Shanly signed a new contract, guaranteeing to complete the tunnel by or before July, 1874. They set vigorously to work, employed the pneumatic drilling machinery, and have now successfully pierced the mountain. Their portion of the work will be finished in advance of the period fixed by their contract.

The work extends from the Hoosic river, at North Adams, Mass., on the west, through the Hoosac Mountain to the Deerfield river on the east; and when completed, will open a new line of railway travel, by easy grades, from Boston and the northerly portions of Massachusetts to the Hudson river.

The tunnel has a length of 25,031 feet. Its dimensions are 24 feet in width and 20 feet in height above the railroad track when laid, with a central covered drain two feet square. Its form is a rough semicircle, the variation being such as to give greater height at the sides than could be given by a true semicircle. It has cost, principal and interest, a little more than \$12,000,000.

IMPROVEMENTS IN THE VENTILATION OF THE UNITED STATES SENATE CHAMBER.

The Senate chamber is 113 feet in length and 80 feet in width, by 36 feet in depth, which gives 325,440 cubic feet in solid measure. The galleries, coat rooms, and corridor, however, reduce its capacity to 250,000 cubic feet. The proper ventilation for this apartment, where thinking men sit through long sessions and important business is transacted, has been deemed a matter worthy of the most serious consideration. Previous to November, 1870, the Senate hall was ventilated in the ordinary way, and was excessively bad. Persons with weak lungs found it impossible to breathe the poisonous atmosphere for the few hours occupied by the daily sessions, without headache or more serious indisposition. A new system for ventilating this chamber was devised, and has been gradually put into operation by Mr. H. F. Hayden, Chief Engineer of the Senate wing. A description of the old method and the new will perhaps be interesting to builders and designers of public halls.

The apparatus, as first constructed and operated, for heating and ventilating the chamber, worked by drawing in a quantity of external air by means of a fan, and passing it over coils of pipe heated by steam, then forcing it into the chamber through risers and registers in the floor. It was supposed that the impure air would be forced out through the doorways and opening in the ceiling, by the continuous flow of air. No exhausting power was employed to assist in its removal.

The forcing fan for the chamber is 14 feet in diameter, and is moved by an engine of 16 horse power, will deliver 500 cubic feet of air at each revolution, and is capable of being run up to 80 revolutions per minute, which is the maximum velocity for summer ventilation. But owing to defects and contraction of the main air channel and the various avenues for ingress of air, the quantity of fresh air demanded for healthful ventilation could not be supplied without pro-

ducing powerful currents on the floor. Therefore the speed of the fan had to be reduced accordingly, which gave only about one fourth the quantity of pure air required. The first improvement was the introduction of two large fans in the basement, and an engine of 25 horse power to operate with them for the removal of vitiated air at the ceiling, by exhaustion. The fans referred to are capable of removing 30,000 cubic feet of air per minute, when run at ordinary speed. The vitiated air is drawn through the perforations in the ceiling into the illuminating loft above, then through two descending shafts into the exhaust room, and discharged by the fans into an ascending one leading to the open air. The capacity of the descending shafts is 36 superficial feet. Both the descending shafts and the ascending one are of equal capacity. It will, therefore, be seen that, if the supply of pure air had been equal to the amount that could be removed, the entire atmosphere in the chamber would have been changed once every ten minutes. But the pressure of the air in the chamber was reduced on account of an insufficient supply, and the impure air from the surrounding corridors was drawn in through the doorway to make up the deficiency. A new air shaft of ample dimensions has been constructed, leading from the heating chamber in the basement to an air space under the seats in the galleries. The seats and risers of the same have been freely perforated, so that nearly three fourths of the supply will enter without causing injurious currents. This air can be tempered independently of that for the floor, so that, when the chamber is crowded, the temperature can be regulated to any degree desired. Another improvement is in the construction of a vaporizing apparatus in the main air duct, by which the proper amount of moisture can be added to the supply of air, after it has been heated, and the amount of moisture is regulated by hygrometers placed in the chamber. The inlet for fresh air for the hall was located between the wing and the old Capitol. Coal gas and smoke from the flues above were often forced down by counter currents, and carried into the chamber by the supply fan. At the suggestion of the engineer, a resolution was offered in the Senate last winter to extend the inlet from the Senate wing to the Western Park, a distance of 220 feet. An appropriation was made for the proposed improvement, which will be completed before the meeting of Congress. The air for the chamber will then be drawn from the level of the Western Park into a clean passage, coming in contact with nothing that can vitiate its purity until it has performed its functions of ventilation. It has been fully determined, by experiment, that with the present arrangements 30,000 cubic feet of pure and well tempered air can be supplied per minute, and ample provision be made for its diffusion: which is 25 cubic feet per minute for each individual, assuming the number of persons in the chamber to be 1,200. The efforts that have been made within the past three years by the engineer to improve the ventilation of the Senate chamber, have not been based on theory alone, but on well established principles, which experience and observation have rendered necessary.

The improvements here referred to will be readily understood by referring to page 73 of our last volume, where a diagram of the Capitol, in elevation, is given.

THE USES OF NICKEL.

The manufacturers of the alloy known as German silver have recently submitted a petition to the Parliament of the German Empire, praying against the introduction of nickel money into that country. They state that the cost of nickel has increased at the rate of from one to three dollars, and that German silver in a single month has gone up nearly \$12 per 220 pounds. In England, the price of the metal in one year and a half has risen from one to four dollars per pound.

Although but a short time has elapsed since nickel has attained any important position in the industrial arts, it is already a fact that the demand is considerably in excess of the supply. The annual production may be roughly estimated in the neighborhood of 600 tons, of which aggregate English industries alone, it is stated, use fully one half. It is used as money in this country, Belgium and Switzerland; and hence it is argued, with much truth, that if Germany should decide to issue a similar coinage, the necessary drain upon the supply would seriously affect the manufactures in which nickel is employed. It is very probable that abundant uses could be found for quantities far exceeding the amount now produced. In its resistance to tensile strain it is nearly one third superior to iron, a metal which in many respects it has similar features, while it is much less subject to oxidation in air or water. German silver, as is well known, is nothing more than brass to which one sixth or one third part nickel is added, in order to give the alloy the color of silver and at the same time a superior resistance to the action of various chemical agents. The alloy is superior to copper as a basis for silver-plated ware, as, when the deposit of silver wears away, it does not expose a red or yellow metal beneath. German silver has also been lately used as a deposit upon other substances; an employment to which it bids fair to be largely devoted.

The increasing demand for nickel will doubtless stimulate research for new deposits; but until such are discovered, it seems desirable that the metal should not be used for coin. Some idea of its rarity may be obtained by comparing the production as above given with the amounts of other metals. Thus copper, for example, is mined to the extent of 65,000 tons per year, and the iron production, it is said, reaches the enormous aggregate of 10,000,000 tons in the same period. Platinum is obtained probably in smaller quantities than any metal in industrial use, only about two tons being the yearly yield throughout the entire world.

THE SAVINGS OF SCIENCE.

Doubtless many of our readers have perused Dickens' excellent novel "Our Mutual Friend," and hence are, in a measure, familiar with the London dust heaps. Perhaps it will be remembered how the great writer describes their contents, and, in his inimitable style, sketches the queer people who often spend their lives among them in seeking for treasures. Those patient searchers are creations of the past. Their toilsome occupation is gone; for Science, with her inventions and processes, has extended her sway even to the worthless dust heaps, and from the filthy waste brings out the shining gold. The ordinary waste of a single household may be roughly estimated at a barrelful per day, and London, it is said, contains five hundred thousand houses. Hence, the reader may form some idea of the wonderful ingenuity which contrives to utilize the enormous aggregate of one hundred and eighty million barrels of refuse in the course of a single year.

The local authorities of London sell the privilege of removing dust and garbage from each district to a contractor, who carts it away to a large yard in the suburbs. There hill women, sieve in hand, separate the mass, by a rude analysis, into component portions. The most valuable of the latter are the waste pieces of coal, and the breeze or coal dust and half burnt ashes. The amount of waste of the latter may be measured by the fact, that, after selling the larger pieces to the poor, the refuse breeze is sufficient to bake the bricks that are rebuilding London. The material is used by the contractors who generally combine the builder's trade with their regular calling, for the purpose of imbedding the newly made bricks into compact squares. The coal dust having been fired, the mass burns with slow combustion for two or three weeks, aided by the circulation of air which is kept up by the method of stacking. The other constituents of the dust heap are separated by the sifters with the utmost rapidity: bones, rags, paper, old iron, glass, and broken crockery, and even bread, as they are eliminated from the mass being piled in separate heaps. The bones are put to a score of different uses. Of the several tons of bones that are picked out of the dust in the course of a week, some go immediately to the boiling houses, where every portion of fat and gelatin they can yield is extracted; the former substance is bought by the soapmaker, the latter is utilized to make the patent preparations employed in cookery, photography, etc. The larger bones are used by the turners and are converted into hundreds of knick-knacks, so that the bone you may have picked at dinner again enters your mouth, after many changes, as a toothpick or toothbrush, while the smaller pieces, for aught you know, have been calcined, and form the very charcoal toothpowder on your toilet table. Fragments that cannot otherwise be employed are ground very fine, and treated with sulphuric acid, constituting an excellent artificial fertilizer. Bone dust is also sometimes used by bakers for purposes of adulteration, so that the poetical remark of the giant in the fairy tale,

"I'll grind his bones to make my bread,"

is fulfilled both figuratively and literally. Another important product extracted from bones is phosphorus, for which there are an endless number of uses; and, finally, the fat that is saved in the process of boiling, is employed to make the commoner kinds of soap.

Scraps of paper abound in the dust heaps. These are all carefully sorted, the white from the colored and the printed. The soiled pieces, which cannot be profitably remanufactured, are used to make *papier maché* ornaments, dolls' heads, etc.; the clean paper is returned to the mill, and even the printed paper has the ink discharged from it, and goes again into circulation. Old rags, of course, are valuable to the paper maker, although the discovery of other materials renders this form of waste not quite so important as formerly. Greasy dish cloths cannot go to the mills again, so they are sent to the hop grower, to whom they are valuable as fertilizers. Woolen rags, if they happen to be dyed scarlet, are treated for the recovery of their cochineal, which is used as a dyeing material; and other valuable colored rags are ground up to make flock paper.

The great markets for all old woolen fabrics in England is the town of Batley and its neighborhood, in Yorkshire, the great shoddy metropolis. A writer says, regarding this manufacture: "Reduced to filaments and greasy pulp, by mighty toothed cylinders, the much vexed fabric re-enters life in the most brilliant forms, from the solid pilot cloth to silky mohairs and glossiest tweeds."

Cotton and woolen rags are both valuable when separate, but of late years it has been the custom to weave the cotton and woolen together, the warp being made of the latter material and the weft of the former; thus mixed, however, the fabric cannot be converted into paper or cloth. Many endeavors have been made to effect a separation, and at present the rags are placed in a closed receiver and subjected to steam at a very high temperature. The result is that the cotton comes out pure and fit for the paper maker; the wool is reduced to a dark brown powder, known as the ultimate of ammonia, and is employed to enrich manures which are poor in nitrogen.

A very important constituent of the dust heap is the old iron, battered saucepans, old pails, rusty hoops, horseshoes, and nails from the road. All soldered articles have the solder extracted from them, as it is more valuable than the iron, and the cheaper metal is then melted. The horseshoe nails are not mixed with the common cast iron, as they are much sought after by gunmakers for the purpose of making stub twist barrels. Scraps of iron, it is found, may be made very useful in securing the copper in the streams washing veins of copper pyrites. Pieces of battered iron are placed in tanks, into which these are collected; the copper quickly

incrusts the iron, and in process of time entirely dissolves it, so that a mass of copper takes the place of the iron. The residuum, in the shape of a colored deposit, is at times taken out, dried, and smelted.

The savings of science, however, are not all made in the dust heaps of London, though in the brief outline we have given, of the mode of utilizing some of the constituents of the waste of the great city, a vast economy is indicated. A singular and recent French discovery is that sheep draw a considerable quantity of potash from the land on which they graze, much of which is ultimately excreted from the skin with the sweat. It was pointed out by Chevreul that this peculiar potash compound (*suint*) forms no less than one third of the weight of raw merino wool, while of ordinary wools it constitutes about 15 per cent of the weight of fresh fleece. As the *suint* may be extracted by mere immersion in cold water, it is easy for the manufacturers to produce more or less concentrated solutions from which the potash may be recovered by appropriate treatment. The development of this new industry is principally due to MM. Maumène and Rogelet, and their process consists in evaporating the solutions, which are sent to them, until a perfectly dry and somewhat charred residue has been obtained. This is placed in retorts and distilled very much in the same manner as coal at gas works, and the result is that, while much gas is evolved which can be used for illuminating the factory, and much ammonia is expelled which can be collected and utilized in many ways, there remains a residue which chiefly consists of carbonate, sulphate, and chloride of potassium. These three salts are separated by the usual method, and then pass into commerce. Curiously enough, they are remarkably free from soda.

The wool manufacturers of Rheims, Elbeuf, and Fourmies annually wash the fleece of 6,750,000 sheep, and the amount of potash, reckoned as carbonate, which these fleeces would yield if all were subjected to the new process, represents a value of \$400,000. The by-products of gas works are so valuable now that factories are actually set up beside such establishments for their utilization. The most important is alum, which, like sal ammoniac, once came, at a great cost, from Egypt, but is now mainly procured from an aluminous shale, which forms the roofs of coal mines, and which has to be brought to the surface before the coal can be gained. This was for a long time a perfectly refuse material, covering acres of ground, like the scorine and cinder heaps; but chemistry has found it out, and now obtains the product by setting fire to the shale, the carbon and sulphur which it contains being sufficient for the purpose. The friable porous residua are afterwards heated in iron pans with sulphuric acid, to which is added the ammonia from the gas liquor, and the three bodies combine with water to make common or ammoniacal alum.

Nearly every article of the toilet bottle or the *sachet* is made from waste, sometimes from foully odorous matters. A peculiar fetid oil, termed fusel oil, is formed in making brandy and whisky. This fusel oil, distilled with sulphuric acid and acetate of potash, gives the oil of pears. The oil of apples is made from the same fusel oil by distillation with sulphuric acid and bichromate of potash. The oil of pineapples is obtained from the product of the action of putrid cheese on sugar, or by making a soap with butter and distilling it with alcohol and sulphuric acid. Oil of grapes and oil of cognac, used to impart the flavor of French cognac to common brandy, are little else than fusel oil. The artificial oil of bitter almonds is prepared by the action of nitric acid on the fetid oils of gas tar. The wintergreen oil of New Jersey is artificially made from willows and a body procured from a distillation of wood.

Dyes, like perfumes, are often derived from the most repulsive sources. The waste heaps of spent madder were formerly a great nuisance. It is now found that this hitherto waste can be used, and at least one third can be saved by treating it with hot acid. Prussian blue is made from pieces of horse hoofs or refuse woolen material by fusion with iron and alkali.

Perhaps the most important refuse product that can be mentioned, as proceeding from a systematic manufacturing process, is that known as soda waste. Large quantities of this substance are rejected as useless by most alkali works, and it has been, for many years, a problem and a reproach to chemistry. It is a great loss; and, if we can but recover it, no small victory will be achieved.

Dry Plate Photography with Gelatin.

Place seven grains of Nelson's gelatin and seven grains of isinglass in cold water for several hours until soft and swollen; then drain off the water, and put them into a two ounce bottle, which place in hot water until the gelatin and isinglass are dissolved. Add thirteen grains of bromide of potassium, dissolved in a dram of distilled water; and in another dram of distilled water dissolve fourteen grains of nitrate of silver, and add it by degrees, in the dark, shaking well between each addition. Now add half a dram of a saturated solution of nitrate of baryta, and two drops of muriatic acid. There will be a froth on the top of this emulsion from the shaking, and in order to get rid of this it may be strained through muslin; or, if left in the hot water, it will gradually subside.

This will form sufficient emulsion, at a cost of about two pence, to coat over one dozen quarter plates, which, as coated, should be laid on a flat surface until the film sets, which will take about five or ten minutes, when they can be put away in a box to dry. The drying will take about forty-eight hours (unless they are placed in a current of dry air), or they may be exposed at once. An exposure of thirty seconds, with alkaline developer, should give a negative of sufficient

printing density without any intensifying. The plates should be placed in cold water for about a minute previous to developing.

Emulsions prepared with the silver in excess caused the plates almost surely to fog, and the image to be very thin and faint.—*Br. Jour. of Photo.*

The Tricks of Magic.

Professor Hartz, the magician, has lately been giving a series of performance here, some of which are as surprising as they are entertaining and amusing. One of them is as follows: A common empty packing box, with a lid hung by iron hinges, is placed upon the stage, and a com. nittee from the audience asked to examine it. They report that it is a firmly made packing box. After a thorough examination, outside and inside, they take a rope and tie it up, passing twice around the ends and sides, passing it through the staples for the two padlocks, and then tie the ends firmly, and seal them with sealing wax. They then envelop the box in a canvas, which covers all six sides, when another rope is added, tied and sealed. Surely the box is safe from any attempt to get into or out of it without removing the ropes!

Professor Hartz's assistant then comes forward with a canvas sack, open at one end. This is examined by the committee and by the audience. It is then placed over the head of the assistant, and tied below his feet and the knots sealed. He is then laid on the box, and the box surrounded by a screen. In two and a half minutes the sack is thrown over the screen, the knot and seals untouched. The screen is instantly removed, and the committee, after examining the seals and finding them unbroken, commence untying the ropes and removing the canvas. The box is opened and the man found inside!

Reward Offered for Improved Cattle Cars.

The Committee of the Royal Society for the Prevention of Cruelty to Animals, London, in order, if possible, to mitigate the cruelty to which animals are subjected in railway carriages during their transit from place to place, offer a premium of \$500 for a new cattle truck; also a premium of \$500 for alterations of, or additions to, cattle trucks at present in use; also an additional premium of \$500 to each prizeholder, so soon as he shall have induced a railway company to build fifty of his improved trucks, and to bring the same into actual use on their line for the transport of cattle.

The other conditions are that the improved truck shall be suitable in gage, dimensions, construction, material, etc., for the same purposes for which cattle trucks are now used; the truck shall be roofed, and provided with springs, buffers, and axle springs, or other appliances to prevent injuries to animals during shuntings and sudden startings and stoppages. The truck shall be provided with appointments for the supply of food and water to animals in the carriage during the time when the train is in motion or when it is stationary at a platform or siding, so as to avoid the necessity of removing the animals from the truck for refreshment; the cost of the truck shall not be greatly in excess of the cost of cattle trucks now in use; and the truck shall be satisfactory to the judges.

The limit of competition is for December 1, 1873, and unless the time is extended, American inventors will not be able to compete. But the publication of the offered reward will be of interest as showing a special call for improvements.

Rheumatism.

A correspondent in the *English Mechanic* gives the following remedy for curing rheumatic gout, of which he had long been a sufferer. He insulated his bedstead from the floor, by placing underneath each post a broken-off bottom of a glass bottle. He says the effect was magical, that he had not been free from rheumatic gout for fifteen years, and that he began to improve immediately after the application of the insulators. We are reminded, by this paragraph from our English contemporary, of a patent obtained through this office for a physician some twelve or more years ago, which created considerable interest at the time. The patent consisted in placing glass cups under the bedposts in similar manner to the above. The patentee claimed to have effected some remarkable cures by the use of his glass insulators, but we have not heard from him for some time. We cannot vouch for any merit in the idea, but it is one easily tried; and as no harm can arise from the experiment, we hope some one will test it and give us the result of his experience.

Tongueless Speech.

The reputed miracle wrought in the case of the African Bishops and certain other Christian martyrs, who retained the power of speech after having their tongues cut out, has lately been the subject of a somewhat heated controversy. The fact of their being able to speak after they had lost their tongues was not questioned; it was only claimed that there was no miracle in the matter, or anything to warrant the inference of Divine interposition because of their peculiar sanctity. They may have been most worthy characters, but their tongueless speech was no proof of such a fact, since the same phenomenon had been observed where there could be no claim to saintliness.

An interesting illustration of the truth of the latter position has just occurred in the Royal Free Hospital in London, the case being reported in the *Lancet* for November 8. To remove a cancerous ulcer, a patient's tongue was wholly cut out, leaving the floor of the mouth entire. Recovery was rapid, and within a week the patient could speak with sufficient distinctness of articulation to make himself understood, saying: "I feel easy," and "I should like some more beef tea."

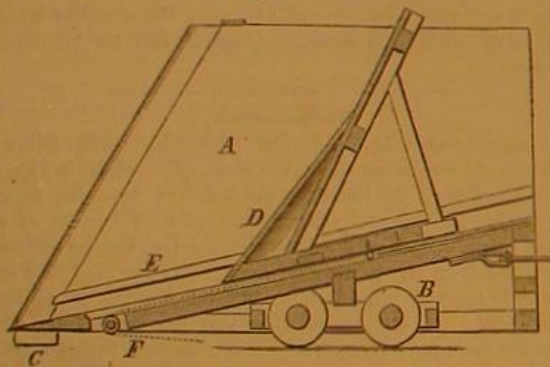
COMBINED SNOW AND EARTH SHOVEL AND PLOW.

An efficient railway snow plow, by means of which a locomotive may be enabled to push its way through heavy drifts, is unquestionably an invention for which there is a great necessity. Not a winter passes but that scores of trains are blockaded, and hundreds of passengers subjected to prolonged inconvenience, by the tedious delay incident to digging out the tracks by hand shovels; while, in some instances, as that of a construction train on one of the Pacific railroads last year, people are placed in actual peril from starvation or continued exposure to the inclemency of the weather. Snow plows of the ordinary construction are moderately efficient in light drafts; but when attempts are made to force them through banks that have become packed or heaped up by the wind as high as the body of the locomotive itself, they speedily prove their inadequacy for the severe work.

The apparatus to which our engravings refer is claimed to combine the advantages of both plow and shovel, together with the merits of efficiency, simplicity, and cheapness. Its especial adaptation is to clearing snow from tracks, but we are informed that it may also be used in loose sandy soils for removing earth in the construction of railways, or for taking up snow from street car rails in cities, and carrying the same to a convenient dumping place.

Fig. 1 represents the device attached to a locomotive and in action. From Fig. 2 a clear idea of the working parts will be obtained. A is the shovel, the bottom of which is made slightly wider at the rear than in front, and which is provided with flaring sides. The front edges of the latter, as well as the corresponding portion of the bottom, are plated with steel. B is a truck which supports the rear part of the shovel, the front portion of which rests upon steel shoes, C, which fit over the rails. At D is the plow, the shape of which is clearly indicated, provided on each side with a cleat, E, running in a groove formed in the side of the shovel, so that it is thus prevented from being raised up by the snow or other cause when being pushed back or pulled forward. To the under side of the plow is secured a rope, F, which runs forward in a groove in the bottom of the shovel over a pulley, and thence back under the shovel to the engine.

Fig. 2



Ordinarily, the track being clear, the weight of the apparatus is borne by the truck, B, and the front end of the shovel does not touch the rails. As soon, however, as a drift is encountered, the snow presses down the shoes, C, raising the shovel almost off its truck, and guiding it into the bank. When the locomotive stops and immediately begins to back out, owing to the latter movement, the rear end of the apparatus settles down, thereby raising the front extremity sufficiently to break off and detach the snow in the shovel from the drift. The backing continues until a suitable point is reached, at which the contents of the shovel are discharged; as while this retrograde motion is in progress, the rope, F, connecting with a ratchet wheel on the front axle of the locomotive, is being pulled, thus drawing the plow along to the front of the shovel, and, of course, forcing the contents of the latter out upon the track. The engine then starts forward, when the plow, now in front, throws the snow clear of the rails. The drift is then again butted, when the snow pushes the plow back in the shovel to its original position (or the plow can be drawn back by a reverse tension of the rope, F), and the same operation is repeated until the obstacle is overcome.

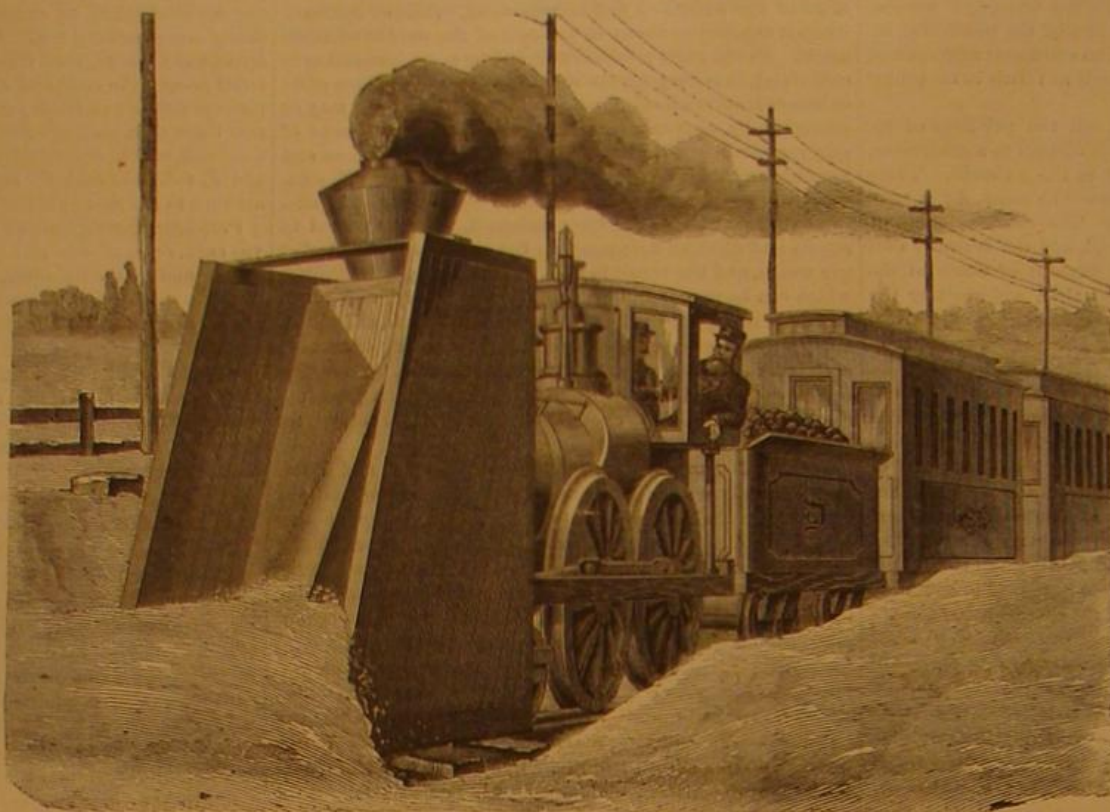
A suitable jet of steam or water, sufficient in freezing weather to form a coat of ice, may, it is stated, be arranged in connection with the inside of the shovel and with such parts of the plow as come in contact with the latter, in order to facilitate the action of the plow in forcing out the snow.

The dimensions of the apparatus are 16 feet high, 23 feet long, and 10 feet wide; and allowing for the space occupied by the plow at the back, it has a cubic capacity of 3,500 feet. As the machine compresses the snow while excavating this large quantity at every ram, it is probable that there are few snow banks which it would not speedily demolish.

Patented July 8, 1873. For further particulars relative to sale of rights, etc., address Lieutenant Colonel W. F. Baker, Decorah, Winnebago county, Iowa.

To Clean Files.

A correspondent, L. D. D., sends us the following recipe:

**COMBINED SNOW AND EARTH SHOVEL AND PLOW.**

"Boil the files in a solution of water and saleratus until they are thoroughly cleansed of outside dirt; after which, wash them in warm water. Put a pint of warm water in a wooden dish, in which stand as many files as the water will cover. Add to this, 2 ounces of borax and 2 ounces of blue vitriol finely pulverized together. Stir up the files well, and add 2 ounces of sulphuric acid by weight, and then $\frac{1}{4}$ ounce of vinegar. The files will turn red at this point in the process. When they again resume their natural color, take them out and wash them in cold water; after which, oil with sweet oil, and wrap singly in brown wrapping paper, which will absorb the oil from the files.

The files will be clean by this mode, in about half an hour after they are put in. Large mill files can be cut by making more solution, and using a dish narrow and tall, so that the files can stand on the shank to let the scales fall away from them."

DUNNING'S IMPROVED PIPE COUPLING.

This invention, perspective and sectional views of which are represented in the annexed engravings, is claimed to provide a simple and cheap union or coupling for gas, steam, and water tubes, which may be applied even in long lengths of continuous straight pipe. It will also serve as a sliding or compensating joint to allow for contraction and expansion, and will, besides, prove useful when it is desirable to con-

Fig. 1

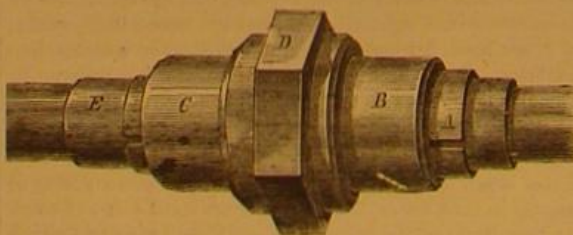
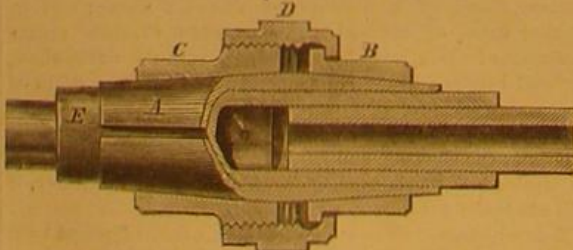


Fig. 2



nect the ends of pipe in situations where threads cannot be conveniently cut thereon.

A is a conical sleeve, cut from end to end, as represented in Fig. 1, or, if desired, divided longitudinally into two separate portions. It is bored out somewhat larger toward the

center, so as to insure a bearing at the ends around the pipe when closed by the collars, B C, which are also bored to correspond with the conical shape of the sleeve. The collar, B, is flanged to receive the threaded coupling ring, D, to which it is swiveled, as indicated in the sectional view. Collar, C, is provided with a thread upon which the ring screws. The joint between the ends of the pipe is thoroughly packed by a section of rubber, E, or other suitable tubular packing.

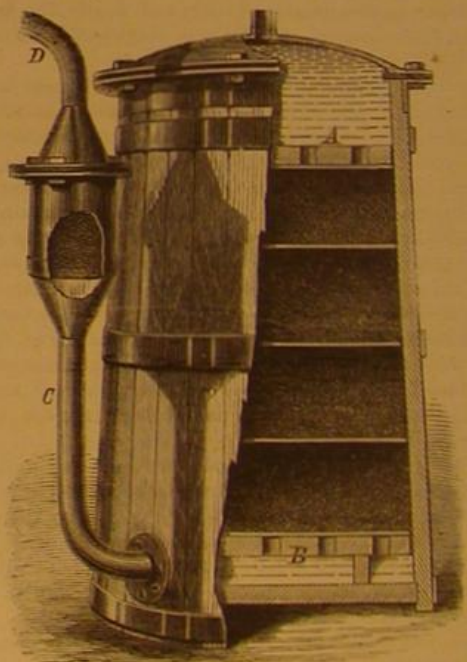
To adjust the device, the extremities of the tube are thrown out of line, and the sleeve, A, containing the packing, E, and upon which the collars and ring have been placed, is applied to one end. The pipe is brought in line, and the rubber tube, with the other portions, is brought over the joint so as to overlap the two extremities equally. The ring, D, is then screwed up, drawing the two collars together upon the inclined surfaces of the conical sleeve, thereby compressing it firmly against the packing.

This coupling can be manufactured very cheaply of malleable iron, as all the parts can be cast of the necessary form and size for different pipes, and require no finishing or fitting except cutting the screw. It is claimed to cost no more than the ordinary union coupling, except the expense of the pliable hose for the packing. It makes a perfect slip joint as well as a good coupling, and will be found very useful for plumbers in repairing split pipe in places where a die cannot be used to cut threads on the pipes, or where the latter are close to the walls or among joists in buildings.

Patented September 30, 1873. For further particulars regarding sale of patents or rights under the same, address the inventor, Mr. Wm. B. Dunning, New York Central Iron Works, Geneva, N. Y.

APPARATUS FOR FILTERING AND RECTIFYING SPIRITS.

Mr. Christian W. Ackerman is the inventor of a novel device, herewith illustrated, for filtering and rectifying spirits, by means of which he claims to effect a saving of material from the usual loss by evaporation, a more perfect elimination of fusel oil, and also that by the apparatus a greater quantity of spirits can be treated in a given time than by the old process.



A receptacle of the form shown in the engraving is provided with two inner diaphragms, A and B. The lower one rests upon joists, and may be made in halves, to admit of easy removal when desired. Upon it is laid a circular piece of blanket of one thickness, then a stratum of powdered charcoal, equal to one fourth the distance between the diaphragms; then a double thickness of blanket, and so on for two more layers of coal and blanket, until the upper partition, A, is reached, beneath which a single piece of blanket is placed. The charger, which should be placed in the upper part of the building, communicates with the apparatus by the pipe at the top. The spirits therefrom enter with sufficient force to penetrate down through the diaphragms, which are perforated, and the layers of charcoal and blankets, leaving in the latter the fusel oil and other impurities. Finally, emerging beneath the false bottom formed by B, the liquor escapes by the pipe, C, and passes into another and smaller receptacle, in the interior of which are two wire gauze screens, the intermediate space being filled with cotton batting and blanket. Here the last rectification takes place, and the fluid, in a pure condition, is led away by the pipe, D.

THE COCUYO.

The cocuyo is a variety of firefly which abounds in Cuba and in some countries of South America, and which emits a light much more brilliant than that given off by the small insects common with us during the summer months. Its form and size are well delineated in the engraving herewith presented. At about the end of April it is found in damp and wooded places throughout Cuba, emerging from its hiding place at twilight, but rarely pursuing its nocturnal rambles for a greater length of time than two or three hours.

The brilliant radiance of the cocuyo is emitted from its ventral region, where there are three phosphorescent organs which the insect can expose and render luminous at will. It is believed that a substance accumulates slowly in the cells of these members, and is discharged voluntarily. As soon as this principle is set free it manifests itself by the production of light alone, without heat, and in a manner similar to that caused by the accidental decomposition of tissue, mucus, sugars, etc.

The insect lives in hollow trees and under dense shrubbery, subsisting on young leaves and similar vegetation. At about the end of July it disappears, though it may be kept until September or October. Occasionally importers of sugar from Havana, in this city, receive specimens of cocuyos from their correspondents, and we have ourselves obtained several in this way. They live for about a fortnight if supplied with brown sugar, though they prefer fresh sugar cane. By placing a few on a table, in a dark room, a curious and interesting effect is produced by the traveling points of light as the bugs run around the surface. Two or three cocuyos in a bottle will emit sufficient light at night to render a letter easily read or the face of a watch distinguished. They are often thus used by hunters, and Captain Mayne Reid, in one of his interesting juvenile works, makes use of this fact in describing how some surprise party of soldiers, in the Mexican war, managed to read important orders when they had no means of illumination, and, besides, could not have used the same for fear of discovery by the enemy. The cocuyo shows his light best while flying, but it can be forced to shine by dipping it in water for an instant. It is inoffensive to man, but a quarrelsome customer among its own species. When a number are confined fearful battles ensue, in which the claws form powerful weapons. Mutilation of the members is almost always the result, although the insect often lives for months after severe maiming.

The most recent application of the bug to useful purposes was its proposed utilization for lighting the interior of the car of the transatlantic balloon at night. The idea, it is needless to add, was never carried out.

THE BRIGHTON AQUARIUM.

The Brighton aquarium, while emulated by several buildings of a similar nature in different parts of England and the continent, still holds its own in being on a scale of magnitude hitherto unsurpassed, more than one of its tanks, in illustration of this, being of sufficient size to accommodate the evolutions of porpoises and other small cetacea. The works were commenced in the autumn of the year 1869, but owing to various interruptions the building was not formally thrown open to the public until August 1872.

The area occupied by the aquarium, says the eminent naturalist Mr. W. Saville Kent, in *Nature*, to which we are indebted for the engraving, averages 715 feet in length by 100 feet in width, running east and west along the shore line. The building internally is divided into two corridors separated from one another by a fernery and considerable interspace. The approach to the first or western corridor is gained through a spacious entrance hall supplied with reading tables, and containing, between the pillars which support the roof, portable receptacles of sea water for the display of small marine specimens that would be lost to sight in the larger tanks.

The tanks for ordinary exhibition commence on the left side of the western corridor, and follow in consecutive order round the two corridors, the last immediately facing No. 1. The smallest of these tanks measures 11 feet long by ten feet broad, and is capable of holding some 4,000 gallons of

water; while the largest, No. 6, in the western corridor, and the subject of the accompanying engraving, presents a total frontage, including the two angles, of 130 feet, with a greatest width of 30 feet, and contains no less than 110,000 gallons. Every gradation of size occurs between these two extremes, the depth of the water in all ranging from 5 to 6 feet. Supplementary to the foregoing, a series of half a dozen shallow octagonal table tanks occupies a portion of the interspace between the two corridors, these being especially adapted for the exhibition of animals such as starfish, anemones, and others seen to best advantage when viewed perpendicularly through the water. Flanking one side of this same inter-



THE COCUYO.

space are several ponds fenced off for the reception of seals and other amphibious mammalia and larger reptilia, while at its further or eastern extremity artistic rock work runs to a height of 40 feet, thickly planted with choice ferns and suitable exotic plants, and broken in its course by a picturesque waterfall and stream. Tanks 12 to 17 in the eastern corridor, in addition to the stream and basin beneath the waterfall, are set apart for the exclusive exhibition of fresh water fish, the remaining tanks being devoted to marine species. The bulk of water thus utilized in the fresh and salt water tanks collectively amounts to 500,000 gallons, and in addition to this several smaller store tanks in the naturalists' room, adjoining the eastern corridor, afford accommodation for reserve stock, or for new arrivals before their display to public view.

The style of architecture dominant throughout the building is Italian and highly ornate, the arched roof of the corridors being groined and constructed of variegated bricks, supported on columns of Bath stone, polished serpentine marble, and Aberdeen granite; the capital of each column is elaborately carved in some appropriate marine device, while the floor in correspondence is laid out in encaustic tiles. The divisions constituting the fronts of the tanks are composed each of three sheets of plate glass, each plate having a thickness of one inch, and measuring six feet high by three feet wide, separated from one another and supported centrally by upright massive iron mullions; in the smallest tanks the front is represented by but one of these divisions, while that of the largest, No. 6, consists of as many as eleven. Among other conspicuous structural features of the aquarium demanding notice are the huge masses of rock entering into the composition of the tanks and fernery.

The system adopted at the Brighton aquarium for continually renewing the supply of oxygen, necessary for the well being of the animals, is by streams of compressed air, which are constantly forced into the tanks through vulcanite tubes carried to the bottom of the water, each tank being fitted with a greater or less number of these tubes according to its size.

Ink in the Teapot.

The adulteration of tea by the addition of iron filings has just been brought rather forcibly to public attention, by a communication to *Food, Air, and Water*, from the pen of Dr. Hassall. The iron is added, the doctor believes, not so much for increasing the weight of the tea as for giving a dark color

to the infusion; and since tea naturally contains a large amount of tannin, there are thus brought together the two chief ingredients of ink. Not content with asserting the fact, the doctor demonstrates it by extracting, from such adulterated tea, a bottle of ink and using it in the writing of his communication.

This is a common way of giving an appearance of strength to teas that have been already once steeped. Those who like inky tea can get it more cheaply by using a rusty tin teapot.

Chinese Physiology.

In some respects the Chinese are an intelligent people but they are not strong in science. Their physiology is especially whimsical. According to their notion, the chief organ of the human economy is the spleen. Its functions are manifold. It rubs against the stomach and grinds the food, it keeps up the proper degree of heat in the five *toang*; it moves the muscles and the lips, and thus regulates the opening of the mouth; furthermore, it directs our secret ideas so that they become known to us. The liver regulates the tendons and ornaments the nails of the hands and feet. The heart regulates the blood vessels, beautifies the complexion, and by its means we are enabled to open the ears and move the tongue. Of the circulation of the blood, the Chinese are profoundly ignorant. The kidneys govern the bones, beautify the hair of the head, and open the orifices of the two *yin*. The diaphragm, being spread out like a membrane beneath the heart, and joined all round to the ribs and spine, covers over the thick vapors so that the foul air cannot rise. The gall bladder is the seat of courage; hence the popular belief that whoever eats the gall of a brave man or beast will inherit the valor of its original possessor: a belief which frequently leads to a lively competition for the galls of remarkable animals.

Of the function of the brain, the Chinese have but a vague idea, still they think it has something to do with the intellect. In proof of this suspicion, they offer the case of a man of great renown for his learning, whose misfortune it was to fall from a horse with such violence as to break his skull. The physician who was called to treat the case hit upon the happy thought of supplying from the skull of a cow the portion of brain the wise man had lost. The operation was only a partial success, since the subject's eminent powers of mind remained in utter prostration, and from that time forward he was a very different man from what he had been. Whether his residual intelligence exhibited any bovine characteristics, our informant unhappily neglects to say.

Hereafter we expect to see this case given as additional evidence that the Chinese are the original discoverers of everything. It is certain that it greatly antedates the operation recently reported from Leipzig for the edification of rural editors: a case in which the brain of a good natured wine seller, dead of heart disease, was transplanted into the cranium of a soldier condemned to death for murder, with a corresponding transference of mental and moral traits. The Leipzig surgeon is plainly no better than a skillful imitator.

The Persistence of a Name.

A curious illustration of the living force of a name is to be seen in the title given to the Virgin Mary by the people of the Basque Provinces. In the most ancient records of Chinese history (the annals of the Bamboo Books, lately translated by Dr. Legge), the name *Ishtar* appears as one of the titles of the Queen of the Stars. Among the ancient Assyrians, *Ishtar* was their chief female divinity, the celestial virgin mother. In Solomon's time, the Syrian equivalent of the name was *Astarte*; and in II. Kings, the wise man himself is charged with having set up an altar to this fascinating goddess. In the Hebrew record, the spelling is *Astarteth*. By Milton the name is given as

"Astarteth, whom the Phœniciana called
Astarte, Queen of Heaven."

Whether Phœnician voyagers left the name in Spain, or whether the Basques brought it with them in their original migration westward, it is impossible to say, nor does it matter. It is there in common use to this day, a living name with a history of at least five thousand years.



FRONT VIEW OF ONE TANK OF THE BRIGHTON AQUARIUM.

THE GERM THEORY AND ITS RELATIONS TO HYGIENE.

BY PRESIDENT F. A. P. BARNARD, LL.D., OF COLUMBIA COLLEGE.

(PART II.)

THE DOCTRINE OF BIOGENESIS.

This question was, however, not universally admitted to be settled. Dissenters made themselves heard from time to time, among them Gleichen, Othe, Müller, and Previanus, the latter of whom pointed out the significant fact that, while the species of infusorial animals found in infusions of the same kind were constantly the same, those which appeared in different infusions were not so. Early in the present century, the celebrated naturalist Lamarck ranged himself on the side of spontaneous generation. Oken took the same view, and subsequently Bory St. Vincent, J. Müller, Dujardin, Burdach, and Pineau, while on the opposite side appeared, among others, Schwann, Schultze, and Ehrenberg. The experiments of Schultze and Schwann were remarkable. They were undertaken for the purpose of testing the accuracy of those of Spallanzani. Since those experiments had been made, the importance of air, or of oxygen, one of its constituents, to the maintenance of animal life, had been discovered, and doubts had arisen whether, in those experiments, the air had not been rendered unfit for the support of life by the operations to which it had been subjected. In repeating the experiments, Schultze admitted to the flasks, after boiling the infusions, only such air as had been passed through concentrated sulphuric acid, and Schwann only such as had been conducted through red hot tubes. No animalcules made their appearance; and these results, reached as long ago as 1836 and 1837, were regarded by the great body of naturalists as finally settling the question.

CONTROVERSIES OF THE SAVANTS.

The controversy, however, after resting for 20 years, was revived, and prosecuted with even more animation than before, by M. Pouchet, in the first instance, on the side of spontaneous generation, and M. Pasteur, on that of biogenesis, but more recently by many naturalists of distinction, among whom may be named Dr. Jeffries Wyman, of our own country, whose experimental researches tend rather to the support of the archegenetic theory, and Professor Huxley, of London, whose opinion, given on a survey of the whole history of the controversy and expressed before the British Association in 1870, is very decidedly the other way. While the controversy was between M. Pasteur and M. Pouchet, there can be no doubt that, in the judgment of the world, the former had by far the best of the argument. His experiments, which were substantially repetitions of those of Needham and Spallanzani, but which were variously modified so as to render his demonstrations, in every possible way, cumulative, seemed to have disposed of the doctrine of spontaneous generation, effectually and forever. In multitudes of instances, infusions hermetically sealed while boiling remained for indefinite periods of time free from all traces of organic life, while portions of the same infusions, exposed side by side with these but open to the air, were speedily swarming with animalcules. He found that even an unsealed flask, of which the neck had been stopped during the boiling only with a plug of cotton, closely pressed together, continued to be equally free from these organisms so long as the stopper remained in its place. This last experiment presented a rather curious resemblance to that of Redi, with his gauze-covered jar; for the cotton forming the plug was found, on a microscopic examination, to contain the germs which its presence had prevented from entering the flask. M. Pasteur finally found—and this result was long supposed to have furnished an unanswerable reply to all the arguments of the advocates of archgenesis—that flasks containing infusions treated by boiling as before required neither sealing nor stopping with cotton to prevent invasion of the contained liquids by these low forms of life: provided only that the necks of such flasks had been originally bent over, so as to direct their mouths downward. This result he had predicted as probable, holding, as he did, that the germs by which such infusions are reseeded, when the living embryos they may contain have been destroyed by heat, must necessarily subside into them from the air above.

The experiments of Wyman, Bastian, Cantoni, and others, more recent than those of Pasteur, have led to results singularly, and at present, we must say, unaccountably, at variance with his. Professor Wyman found that bacteria will make their appearance in infusions which had not only been boiled before being sealed up, but which, after being sealed, had been kept at a boiling heat for many hours. He found, moreover, that these same organisms perish when exposed to a heat not over 134° Fahrenheit. Bastian, in a very extended series of experiments, has pushed the heat in the tubes containing his infusions as high as 360° Fahrenheit, maintaining this high temperature, in some instances, not less than four hours; and has yet found that living forms do not fail subsequently to make their appearance in them. Such forms appear also, according to him, in solutions containing nothing of organic origin whatever, but which are composed entirely of certain salts of soda and ammonia; and he even affirms that in such solutions he has occasionally seen very remarkable fungi to present themselves with their full fructification, drawings of which he has given in his work, recently published, entitled "The Beginnings of Life."

It seems to me that no one can rise from the perusal of the extraordinary book just mentioned without feeling that, if it does not embrace and contain the conclusion of the whole matter, it is, at least for the present, unanswerable. It leaves us, nevertheless, still perplexed, perhaps more deeply perplexed than before; for it is impossible to under-

stand how the results reached by so many naturalists, all in the first rank of scientific investigators, all conscientiously laboring to elicit the truth of this great question, should be, after all, so singularly discordant. And another weighty consideration adds to this perplexity. It is the existence of a practical refutation of the conclusions of the class of experimenters to which Dr. Bastian belongs, which is presented under our eyes every day on the grandest scale in the operations of one of the most important branches of modern industry. I cannot state this consideration better than in the words of Huxley: "There must," remarks this distinguished physiologist, "be some error about these experiments, because they are performed on an enormous scale every day with quite contrary results. Meats, fruits, vegetables, the very materials of the most fermentable and putrescent infusions, are preserved to the extent, I suppose I may say, of thousands of tons every year, by a method which is a mere application of Spallanzani's experiment. The matters to be preserved are well boiled in a tin case provided with a small hole, and this hole is soldered up when all the air in the case has been replaced by steam. By this method they may be kept for years without putrefying, fermenting, or getting moldy." He argues—and the argument has a weight that must be felt—that there is no mode of explaining this universal and inevitable result but the exclusion of germs from these cans. And, in view of the marvelous discrepancy between the results on the small and the grand scale, placed side by side, one can hardly repress the suspicion that, if there be any such thing as spontaneous generation, it is a thing which occurs only under rare and extraordinary conditions, which conditions Dr. Bastian has unintentionally succeeded in establishing; while, as a matter of practical importance or daily interest, it is as if it were not.

Zincing Iron.

The following is an excellent and cheap method for protecting iron articles exposed to the atmosphere, such as cramp irons for stone, etc., from rust: They are to be first cleansed by placing them in open wooden vessels, in water, containing three fourths to one per cent of common sulphuric acid, and allowed to remain in it until the surface appears clean or may be rendered so by scouring with a rag or wet sand. According to the amount of acid, this may require from 6 to 24 hours. Fresh acid must be added according to the extent of use and of the liquid; when this is saturated with sulphate of iron, it must be renewed. After removal from this bath, the articles are rinsed in fresh water, and scoured until they acquire a clean metallic surface, and then kept in water in which a little slaked lime has been stirred until the next operation. When thus freed from rust, they are to be coated with a thin film of zinc, while cold, by means of chloride of zinc, which may be made by filling a glazed earthen vessel, of about two thirds gallon capacity, three fourths full of muriatic acid, and adding zinc clippings until effervescence ceases. The liquid is then to be turned off from the undissolved zinc, and preserved in a glass vessel. For use, it is poured into a sheet zinc vessel, of suitable size and shape for the objects, and about 1-30 per cent of its weight of finely powdered sal ammoniac added. The articles are then immersed in it, a scum of fine bubbles forming on the surface in from one to two minutes, indicative of the completion of the operation. The articles are next drained, so that the excess may flow back into the vessel. The iron articles thus coated with a fine film of zinc are placed on clean sheet iron, heated from beneath, and perfectly dried; and then dipped piece by piece, by means of tongs, into very hot, though not glowing, molten zinc, for a short time, until they acquire the temperature of the zinc. They are then removed and beaten, to cause the excess of zinc to fall off.

Water as Fuel.

A correspondent, Dr. A. A. Hayes, writes to say that recently two similar boilers were employed with widely different results as to consumption of fuel. On investigation it was found that, with the deficient boiler, "the workmen had been restricted to about twenty inches in draft of ash pit; the other furnace had a vault, permitting ashes and cinders to be retained for several days, while here the paved, clean floor formed the bottom of the ash pit. The fuel was remarkable for purity, and so compact as to be kindled with difficulty. On opening sight holes, the fire could be seen burning intensely; the radiant heat appeared to be absorbed; very slight flame only could be seen, but the rush of highly heated air was constant. After some time, observation showed that the ash pit was the only point on which suggestion could be excited, the matter of quality of fuel being in favor of the bad furnace. A casual observation had shown that the ashes of the good furnace were damp. The pavement of the room and the ashes were accordingly wetted on the ash pit floor. Immediately flame appeared at the door joints, and from cracks (from unequal expansion); the damper was hurriedly raised to allow the great volume of combustible matter to reach the chimney. The pressure gage partook of the new life, and soon an over abundance of steam was formed. After the adjustments were made for using the steam, and a very little water was constantly admitted to the ashes, more than the necessary quantity of steam was afforded by the boiler, while the consumption of fuel was not increased. It will be inferred that, under conditions not unusual, a great economical gain resulted from the use of a portion of the heat of contact in decomposing vapor, or in heating steam so highly that it transported carbon to form flame; the result was the conversion of an imperfect to an efficient apparatus, without added expense, in opposition to a theoretical law.

In numerous cases, continued through many years of observation, I have seen similar results follow the use of moist air in the combustion of dry anthracite; but this case is considered exceptional from the accuracy of the proofs afforded.

In reviewing these facts, it will be seen that a useless apparatus was rendered thoroughly efficient by forming flame from the otherwise ignited fuel. More importance than here appears belonged to the trials, for on the success thus obtained grew up a most extended application of steam, where every point connected with its use is registered with the precision of philosophical apparatus.

A doubt in regard to the consumption of fuel has probably been present in some minds. How could the fuel be consumed, and vivid combustion maintained, without a corresponding production of steam? The answer is founded, not on observation alone, but on experiments. In a cold, dry atmosphere, the best anthracites produce so intense a radiant heat that near by surfaces of iron become heated above the temperature of economical rapid evaporation. That kind of fuel, too, affording no flame in cold dry air, requires more than double the theoretical amount of oxygen for its combustion; and this volume of heated air and products of combustion is far less hot than flame, and is repelled by the parts of the boiler behind the space over the mass of glowing fuel, as less highly heated gases are always repelled by colder surfaces. In fact the steam-generating surface was so far reduced in area as to render it impossible for steam to be formed in time, and the heat was wasted.

My wish is to see more attention given to flame fuel, as contrasted with radiant heat fuel, not only as a facile and economical application, but as a check to the use of old devices which waste the fuel. A long step in this direction has been taken in heating gas retorts. Apart from great economy, the destruction and wear of apparatus is reduced, as they may be in steam production."

California Wood Choppers.

It is in the logging camps that a stranger will be most interested on this coast; for there he will see and feel the big ness of the redwoods. A man in Humboldt county, says a writer in *Harper's Magazine*, got out of one tree lumber enough to make his house and barn, and to fence in two acres of ground. A schooner was filled with shingles made from a single tree. "One tree in Mendocino, whose remains were shown to me, made a mile of railroad ties. Trees fourteen feet in diameter have been frequently found and cut down; the saw logs are often split apart with wedges, because the entire mass is too large to float in the narrow and shallow streams, and I have even seen them blow a log apart with gunpowder. A tree four feet in diameter is called undersized in these woods; and so skillful are the wood choppers that they can make the largest giant of the forest fall just where they want it, or, as they say, they 'drive a stake with the tree.' The choppers do not stand on the ground, but on stages raised to such a height as to enable the ax to strike in where the tree attains its fair and regular thickness; for the redwood, like the sequoia, swells at the base, near the ground. These trees prefer steep hill-sides, and grow in an extremely rough and broken country; and their great height makes it necessary to fell them carefully, lest they should, falling with such an enormous weight, break to pieces. This constantly happens in spite of every precaution, and there is little doubt that, in these forests and at the mills two feet of wood are wasted for every foot of lumber sent to market. To mark the direction line on which the tree is to fall, the chopper usually drives a stake into the ground 100 or 150 feet from the base of the tree, and it is actually common to make the tree fall upon this stake, so straight do these redwoods stand, and so accurate is the skill of the cutters. To fell a tree eight feet in diameter is counted a day's work for a man."

An Inexhaustible Inkstand.

We have received from Messrs. Root, Anthony, & Co., of 62 Liberty street in this city, an inkstand, for the use of which the directions are: Put in a little cold water, let it stand for 3 or 4 hours, and the ink will be ready for use. We suspect that the coloring matter is supplied by some means analogous to Professor Bottger's invention for portable ink, already described in our columns. Our readers' grandchildren will be better able to speak to the permanency of the supply of ink; in the meantime, we can say that, after a trial, we find the inkstand to be filled with black ink of an excellent quality.

Sexadigitism.

A valued correspondent, W. T. R., writes as follows: "Recently, I fell in company with a gentleman with a peculiarity in one of his hands. I requested permission to make an examination, when, to my surprise, I found that he had an extra finger hinged on to the metacarpal bone, just back of the little finger and extending sideways from the palm of the hand; it shut up in the fist, but at right angles to the other fingers. Four of his children have similar developments on each hand, while a fifth child has six fingers on but one hand. The father and the children have each six toes on each foot, and a nephew who accompanied them was similarly endowed. Many of their ancestors and some of their relatives had or have sexadigital limbs. It appears, from evidence adduced, that these peculiarities were derived from a family in which they have existed from time immemorial.

If by any means a family inheriting such peculiarities should become isolated, the consequence would probably be a sexadigital race, which, according to the common rules of classification, would constitute a new species."

How Tin Plate is Made.

A paper recently read before the Franklin Institute of Philadelphia, by Mr. T. S. Speakman, representative of the Institute at the Vienna Exposition, gives the following interesting details of the manufacture of tin plate as carried on in Wales:

In the opinion of Mr. Henry I. Madge, tin plate manufacturer, of Swansea, in Wales, from whom I received the following information, the manufacturer prefers making his own iron to purchasing it, because he can thereby insure a more equable quality; he therefore buys suitable pig iron.

For common coke tin plates, the "iron bars" are made from puddled iron. The puddled ball is sometimes squeezed and sometimes hammered; much depends on the care of the puddler to so bring forward his ball that all its parts shall be equally decarbonized, when the fracture will be of a uniform, dull gray color, without crude admixtures of bright crystals. The unreduced crystals produce "wasters" of the iron plates; and if any such escape the notice of the mill manager, the wasters are thrown aside again after being covered with tin. If they escape the eye of the "assorter," the tin plate worker will find them fracture across the angles or bends of the sheets in working them up. The puddled ball, produced under the best conditions, is then taken to the "shingler," who submits it to the squeezer or hammer, sometimes both. This operation should be carefully executed. As the puddled ball is rugged and full of cinder, the cinder has to be squeezed out by this operation, and at the same time the roughness must be so managed as to be welded into a solid compact mass, which cannot be so well done in after operations. Some say it cannot be done afterwards, as the whole mass can never again be brought up to a thorough welding heat throughout, unless at the expense of much waste and loss. The bloom from the "shingler" is at once passed through the rolls, or roughed down to No. 1 bar. Some prefer letting the blooms lie exposed to the action of the elements for a time, and others think it of no importance. The bar, while hot, is cut into lengths and piled, five pieces being put and heated together in the "balling" or reheating furnace. When the faces are brought up to a welding heat, and the whole mass softened, it is again taken to the hammer, some rolling at once, others returning the bloom into the furnace to again bring up the heat. It is then rolled out into the finished bar, of suitable size and thickness for the kind of plates required.

Some manufacturers have made very good iron from the puddled ball direct, saving in wasters and improving the quality; but as the labor and number of hands were reduced by this mode, the men struck against it, and spoiled their work if not well looked after. This kind of iron was homogeneous and not fibrous, as the iron "piled" and brought through the reheating furnace is. The "shingler" must be very careful to form a second bloom under the hammer, and the bloom should be upset once or twice, so as to secure a welding of all the rough edges. If, after the shingling, the bloom has lost too much heat, it should be reheated. Care and expedition will remedy that necessity, and the reheating furnace dispensed with altogether. The saving is much in cost and waste; but the trouble with the workmen was great. Some also produced very excellent iron from the puddling furnace by adding to the charge about 60 lbs. of scrap or shearings, the trimmings of the plates when cut to size. The 60 lbs. of shearings were thrown into a bath of saturated solution of nitrate of soda, but added to the charge during the "boiling." The advantages gained were: the scrap iron improved the charge in proportion it bore to the whole mass; it was melted down quickly without waste, as the smelting took place under the surface. The weight of solid cold iron would take it to the bottom of the charge, carbon would be eliminated by fusion with the nitrate, and thereby improve the quality of the charge again. The ball was treated in the same way as ordinary puddled balls afterwards. The iron was tough as charcoal iron, with the characteristics of puddled iron, arising from crudities; for crystals unreduced were not exterminated, but greatly lessened. A careful puddler can at all times prevent these crude lumps to a very great extent. Another saving arising out of the process was that the scrap "shearing," formerly put into a furnace and reduced to a welding state, hammered out and rolled, gave only a return of 13 per cent to the tin, whereas the other returned the full weight of the shearings. However, difficulties with the union men prevented them from pursuing this mode of manufacture.

The bars are cut up into the required sizes, brought to a cherry red heat in a reverberatory furnace, rolled out to a certain length by gage, "doubled," and returned to the furnace, rerolled, again doubled, heated and reheated. The several foldings of the sheets adhere slightly.

After the sheets are cut down to size for tinning, they are separated from each other by what is called opening; during the process of opening, "stickers" and imperfect plates are thrown out, and the passed sheets then go into the "pickling room." There they are put into a hot pickle of dilute sulphuric acid, to be cleansed from oxydized and silicious matters, and undergo another rough examination in the "scouring process;" that is, any plate not cleansed is rubbed with sand in water. Defective sheets are again thrown out, and the sheets or plates are now passed into the annealing room.

The annealing furnace is a large reverberatory furnace, capable of holding several annealing pots. The pot is composed of a stand, of sufficient size to take the sheets, with a raised rim. Several hundred sheets are piled on the stand, and a square, box-shaped cast pot completes the pot. This is inverted over the sheets, and the space between the rim of the stand and the rim of the inverted pot is filled with

oxide of iron, to lute it down and exclude the air. The pots are then put into the furnace until it is full, and the whole brought up to a cherry red heat, or a little beyond. About eight hours are necessary for its perfect saturation by the heat. When removed from the furnace, they are slowly cooled in a place free from draft, and then the pots are opened. The plates never lie perfectly flat, and should be of a dark straw color at the edges. If the air should get in in small quantities, a deep blue color will cover the sheets more or less. The plates adhere slightly, are again separated, and ready for the second pickling room. The plates are then submitted to a hot but more dilute pickle of sulphuric acid, and again chemically cleansed; taken from the acid bath, they are well washed in running water, and kept in clean water until the tinner is ready for them.

The tinner takes the plates from the water bath (where they lie some hours) and plunges them wet into a bath of hot palm oil, called the "grease pot." When they have acquired the temperature of the grease pot, they are removed with tongs and quickly submerged in a bath of tin. The oil mixed with the water from the plates floats at the top, forming a flux which covers the melted tin and prevents oxidation. With the tongs, the sheets or plates are continually kept moving and separated, to insure the tin getting between all of the sheets. When the bath has recovered its heat, which it generally does in about half an hour, the tinner examines the charge, and if he finds that perfect amalgamation has taken place between the two metals, he removes them with a tongs to the next bath, which is kept at a low temperature.

The temperature, raised by the change from the "tin pot," is again allowed to cool down to a few degrees over the melting point of the tin, when the plates are taken in lots of a dozen or two at a time, and laid on an iron slab, which is at the side or head of the pot. The waste metal and grease run back into the pot, the slab being inclined. The workman then takes up sheet by sheet with the tongs, and dips each into another bath of fine metal, kept at a heat little over melting point, immediately withdraws it, and places it in a rack immersed in a large pot of melted palm oil kept at the proper temperature, where they are allowed to remain a certain time. The sheets are then slowly lifted out of the grease by a boy, who separates them into proper lots by counting carefully, regulating the intervals of time between them. The grease recoils from the top plate; and as little is left on the sheets, they are again placed in a rack in the open air to cool; when cool, a lad takes each sheet in a tongs, and dips the lower edge into a small bath of melted tin so regulated that the sheet can only enter to about the eighth of an inch. It is kept long enough to melt off the drops of metal which adhere to the lower edge; and when lifted, the sheet is struck to throw off the superfluous metal from the edge. The plates are again put into a rack, and taken while warm to a bin of bran, where each sheet is thrust into and under the bran, to get rid of the grease which adheres. It is then passed on to a second and third hand, when the grease is pretty well behind in the last bin, which is kept filled with new bran. The sheets are turned out covered with flour dust and bran, and dusted off with cotton shaggy cloth.

The next process is in the sorting room. Here the finished sheets are laid on tables, and each sheet undergoes an examination by the sorter, who throws out those shearings which are defective in the iron or trimmings. The latter are reheated to regain the tin; the imperfect sheets are sold as "wasters" at a less price; the sheets are counted, and the box of 100 lbs. weight is composed of 225 sheets of 14 inches by 10 inches, for home use or for exportation.

What an Englishman Thinks of American Railway Traveling.

Mr. Robert W. Edis, an intelligent English architect, is now communicating to the *Building News*, London, a series of interesting letters from this country, giving an account of his experience in traveling from New York to the West. In one of these recent letters he draws the following comparisons between the railway facilities of the old and new worlds:

"No one who has not been in America can thoroughly understand or appreciate the comfort and luxury of these palace cars, in which, whether by night or day, the traveler may journey for days together without the misery and cramped up feeling in our own railway cars; a comfortable seat by day, with plenty of room for legs and knees, and a luxurious bed by night, entirely shut off from your neighbor, with good attendance, lavatories, and other conveniences, all tend to make traveling in the States, where great distances have to be got over frequently and rapidly, comfortable, not to say as luxurious and safe as human ingenuity can make it. It may not be out of place to mention that no expense is spared in the construction or fitting up of these cars, the cost of which often varies from \$15,000 to \$25,000, and that, built as they are in the most strong and substantial manner, and attached invariably to the end of the train, the minimum amount of risk is thereby incurred in case of "telescoping" or "colliding" in the course of a long journey. Not only in this comfort of traveling, but in the universally adopted system of baggage checking, by which endless trouble and annoyance is saved to travelers, may we in England learn a useful lesson; but while railway directors here are content to allow their servants to labor ten or twelve hours at a stretch *per diem*, on work requiring not only constant hard bodily labor, but continual mental anxiety in "blocking," "signaling," and "switching," etc., we can hardly expect to be free from those pleasant but exciting incidents in railway traveling which too often terminate fatally, or, as frequently is the case, maim and wound, either

bodily or mentally, for life; for which some poor, wretched, overworked signalman or under servant is sought to be made responsible, while the real workers of the evil, the directors and heads of departments, seem to value the safety and comfort of the public as little as they recognize the mental and bodily labor of their servants, and for which they pay the minimum amount of wages. I can imagine the horror and dismay with which an English railway director would look upon the comfortable seats, the luxurious fitting up, the pleasant heating apparatus, the general good system of lighting, the lavatories, etc., and the lead water tanks attached to the palace cars of America and Canada, not to mention the comfortable beds and night accommodation which make traveling in the States almost a pleasure, instead of a nuisance and a trouble, as it invariably is in this country; or the dismay with which they would accept or adopt the aids to safety in case of accident, in the shape of Miller's platforms, Westinghouse brakes, and get-at-able cord communications. This is a digression, brought about by a comparison of recent traveling in the old and new countries, for which I pray the pardon of my readers."

The Horse Bit.

The question of the bit, and of the hand that rules the bit, underlies the consideration of the whole subject of man's dominion over the horse. The intelligence of mankind has hitherto invented but two principal forms of bit; the snaffle, the simple piece of iron which lies across the mouth, subject to endless modifications, such as being twisted, jointed, and so forth; and the curb bit, a more powerful implement, which has likewise undergone innumerable variations. The curb bit is an adaptation of the principle of the lever, and the lengthening of the check piece allows a very powerful pressure to be exercised upon the jaw of the horse. The snaffle is, so to say, a natural bit, and the curb an artificial one. The snaffle was used by our ancestors and by the ancient Greeks; the curb is an Asiatic invention, and was probably brought into Europe with the Moors. In the famous mosaic found at Pompeii, representing, as is supposed, a battle between the Greeks and Persians, and which, at any rate, is the picture of a battle between Europeans and Asiatics, the Eastern horsemen ride with curbs, and the Europeans with snaffles. The difference in the bit modifies the whole style of riding; and as there are two sorts of bits, so are there two quite different styles or schools of horsemanship, which may be called the Eastern and Western styles. The type of the Eastern is best seen in the modern Bedouin Arab, with his short stirrups, peaked saddle, and severe bit; and the Western type in its simplest form is beautifully exemplified in the Elgin marbles, where naked men bestride bare-backed horses. To ride after this fashion is an athletic exercise; the strength of the man is set against the strength of the horse, with little adventitious aid. The rider restrains the horse's impetuosity by the sheer force of his arm, and he maintains a seat on his back by exercising the muscles of his legs. It is the equitation of athletes and of heroes; but it is clear that the balanced seat of the Arab, and the more complete command over his horse which follows from the greater security of his seat, would make him infinitely more formidable in war than the European, in spite of the superior size and strength of the latter. History teaches us how the cavalry of the Saracens—small men on small horses—rode down the Christian horsemen till they learned to ride with the bits, and saddles, and lances of the Moslem cavalry. The invention of the curb bit necessitated the stirrup, for a man sitting upon a bare-backed horse is forced to bear, at times, more or less heavily upon the bridle; and if, so riding, he were using a curb bit, and he were to lean any part of his body upon it, his horse would stop, or would rear, or would flinch. The ancient Greeks and Romans are believed not to have known the use of stirrups. They are, indeed, said not to have been discovered till the fifth century of our era. This, if it is true, would only apply to Europe. In the East they were used many centuries before. The earliest representation of one I know is in the above mentioned mosaic, where the horse of a dismounted trooper in Oriental costume is drawn with clearly indicated stirrups; the Greek horsemen in the mosaic are without them.—*New Quarterly Magazine*.

A PRACTICAL SYSTEM FOR THE SALE OF PATENTS.

We have recently received from Messrs. S. S. Mann & Co., corner of Linden avenue and Hoffman street, Baltimore, Md., a neatly printed manual and a number of sample blanks, the collection being explanatory of a system which the above firm have devised for the use of inventors desirous of disposing of their patents or rights under the same. The book of instructions comprises practical and excellent advice relating to the proceedings incident to selling patents or of making arrangements for the manufacture of articles on royalty. With this work are supplied full sized blanks, handsomely printed, consisting of forms for grants of rights, powers of attorney, etc., with which are furnished detailed printed explanations.

From examination of the method we believe it will be an acquisition of much value to inventors. We are informed that the system has been adopted by many patentees, all of whom have expressed complete satisfaction.

CEMENT FOR WOOD VESSELS.—A mixture of lime clay and oxide of iron, separately calcined and reduced to fine powder, then intimately mixed, kept in a close vessel, and mixed with the requisite quantity of water when used. This will render a vessel watertight if the ingredients are good.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

THE BACHELDER SEWING MACHINE.—JOHN BACHELDER vs. WILLIAM J. MOULTON et al.

BLANCHFORD, J.

The released letters patent granted to the plaintiff December 12, 1865, for an improvement in sewing machines, and on which motion for a provisional injunction in this case is made, were the foundation of the suit of Porter vs. Blanchford (2 Blatchf., C. C. R., 95), decided by this court on equal hearing. Every question necessary or pertinent to the decision of the present motion was considered in that case, and disposed of adversely to the defense. Since that time such released patent has been by this act of Congress, approved July 16, 1870 (16 Stat., at Large, 656), extended for seven years from the 5th of May, 1870.

The sewing machine of the defendants in the former case was called the *Atina* machine, and employed, as a perpetual feeding device, a cylinder moving intermittently by revolving on a horizontal axis, and so arranged that the cloth laid horizontally upon it and was partially supported by it. Each cylinder was situated immediately in front of the needle, and was provided with a roughened surface, which acted from below, through an aperture in a horizontal table, upon the under surface of the cloth to be fed, and operated, in feeding, in combination with a yielding curved pressure foot, which was pressed from above, by a spring, upon the upper surface of the cloth, such foot also acting as a needle stripper. The *Atina* machine was provided also with the other devices necessary to make up the combinations covered by the first, second, third, fourth, fifth, sixth, and seventh claims of the Bachelder patent—namely, a reciprocating eye-pointed needle and a reciprocating needle carrier, moving substantially in vertical planes; a horizontal holding surface provided with a throat for the passage of the needle (such holding surface forming part of the supporting bed), and a table, a part of which was so arranged, with reference to the feed, as to receive and support the material in its passage from the feed. In the *Atina* machine the material could be fed perpetually while it was supported horizontally, and a seam of any length could be sewn without requiring the sewing to be stopped at any time to attach a fresh portion of the material to the feeding instrument. This material feature distinguished the Bachelder machine from those which preceded it. The *Atina* machine had, it is true, a capacity beyond that of the Bachelder machine—namely, that of sewing a seam of any desired structure, arising from the fact that, in the Bachelder machine, the material is moved on pins, while, in the *Atina* machine, the roughened surface of the feeding cylinder causes the material only to such extent as was necessary to move the material forward, but not to such extent as to prevent the free lateral turning of the material by the operator during the process of feeding, so as to produce a curved or angular seam. But this, though an improvement on Bachelder's invention, embodied that invention.

The machine of the defendants in the present case is known as the *Whitney* sewing machine, and uses, as a perpetual feed, what is known as the feed of Allen B. Wilson. That feeding arrangement was covered by two patents issued to Wilson, which have now expired. One of them, released No. 246, issued January 22, 1866, was extended, and expired November 12, 1872. It covered, in its claims, four features of invention: First, the described method of causing the material to be sewed to progress regularly by the joint action of the surfaces between which it is clamped, and which act in conjunction; second, holding the material at rest by the needle, or its equivalent, in combination with the action of causing it to progress regularly; third, arranging the described surfaces in such relation to the needle that the one or one of them, shall perform the office of stripping the material from the needle; fourth, so mounting and attaching one of the feeding surfaces to some other part of the machine that it may be removed or drawn away from the other surface at pleasure. The other patent, released No. 414, issued December 8, 1866, was extended, and expired November 12, 1872. It covered, in its claims, a combination of three elements—namely, a table or platform to support the material to be sewn, holding it for the action of the needle, and presenting it properly to the grasp of the feeding apparatus—a sewing mechanism proper consisting of a needle and shuttle, or their equivalents, and a mechanical feed, automatic, and causing the cloth to progress regularly, to which the cloth is not attached, and so grasping the cloth that it may be turned and twisted by the hand of an operator, such twisting not interfering with the regular progression of the cloth. The feed of Wilson consists of two surfaces or bars which clamp the material. The material is advanced and moved forward under the needle, to receive the stitches, by the joint operation of two such surfaces. One of such bars has a rough surface and a lateral motion. The other has a smooth surface and no lateral motion.

The machine of the defendants has Bachelder's horizontal holding surface, in having a small horizontal round plate, through slots in which teeth on the reciprocating feed bar project upward, on which plate the material immediately about the needle rests, so as to be borne up horizontally under the thrust of the needle, such plate being perforated with an opening or throat for the passage of the needle.

The machine of the defendants has Bachelder's receiving plate, in that portion of the said round plate which receives and supports the material as it passes from the feed.

The machine of the defendants has Bachelder's yielding pressure holder, in having a spring pressure foot near the needle, which rests on the upper surface of the material, and holds the material to the bed on which it is supported, the pressure foot adapting itself to variations in the thickness of the material.

The machine of the defendants has a reciprocating eye-pointed needle, and a reciprocating needle carrier, substantially like those of Bachelder. In all these particulars in which the *Atina* machine was like the Bachelder machine, the defendants' machine does not differ from the *Atina* machine. This embraces all particulars except the feed. In the defendants' machine the cloth is advanced regularly and horizontally, by an intermittent motion, through the joint action of the rough surface of the moving bar beneath and the surface of the pressure foot above. It is apparent that, in the defendants' machine, the operation of the feed, and its relations to other co-operating parts of the machine, there are the following material features in common with Bachelder's machine: The cloth lies horizontally on the feeding device, and a portion of the surface of the cloth which lies immediately in front of the needle and of the horizontal holding surface, is supported by a feeding device during the act of feeding. The material is advanced, as a result of any length can be sewn without removal or replacement of the parts of the machine. The material is delivered, with a seam sewn in it, upon the receiving plate.

In the Bachelder machine, different portions of the belt are feeding at different times, as, in the *Atina* machine, different portions of the cylinder were feeding at different times, while, in the defendants' machine, the same part of the feeding bar always acts in feeding. But this difference is immaterial. The action, in feeding, of the parts employed at one time in feeding, is the same in the two machines, so far as the essence of Bachelder's invention of a perpetual feed is concerned. So, too, it is an immaterial difference, that, in the Bachelder machine, the feeding device is always in contact with the material, and always aids in supporting it, while, in the defendants' machine, the feeding device is not always in contact with the material, and, therefore, only aids at intervals in supporting it. Equally immaterial is it that, the defendants' feeding bar being provided with a roughened surface instead of with impaling pins, seams of any desired regularity or curvature can be sewn in the defendants' machine, while such seams cannot be sewn in the Bachelder machine. But this is the same difference which existed between the *Atina* machine and the Bachelder machine. The increased capacity given to the machine by the facility of turning and twisting the material, due to the absence of impaling pins, is an improvement, but the vital features of Bachelder's arrangement are retained. The feeding device of the defendants has a horizontal surface, which, at the time of feeding, aids in supporting the material, and thus makes the feeding possible, and is a perpetual feed, and delivers the material to and upon the receiving plate.

The point most strenuously urged on behalf of the defendants is that heretofore suits have been brought in many of the courts for infringements of the released patents of Wilson before mentioned, Nos. 346 and 414; that the defendants in those suits have set up the prior existence of the Bachelder machine, and the prior granting of the Bachelder patent, as destroying the novelty of the above claims of the Wilson patents; and that it has been uniformly held that there was nothing in the Bachelder machine or the Bachelder patent to invalidate those claims. These decisions of the courts are urged as decisions that the feeding arrangement of Wilson and the feeding arrangement of Bachelder do not interfere with each other, and consequently that the use of the feeding arrangement of Wilson cannot infringe the Bachelder patent. But this is not a logical conclusion from what was decided in the cases referred to. All that was decided in those cases was that the claims of the Wilson patents covered inventions which were not to be found in the Bachelder patent—inventions beyond anything found in the Bachelder patent, being the inventions claimed in the Wilson patents; but there was no decision that a machine constructed according to the descriptions contained in the specifications of the Wilson patents did not embrace inventions claimed in the Bachelder patent. No such decision could have been made, because no such question was involved. The principle properly applicable to the decision of the question involved in the present motion is a familiar one in the patent law. Bachelder had no right to use Wilson's improvements without Wilson's consent. Wilson, on the other hand, had no right, in constructing a machine containing his own improvements, to embody therein the improvements patented by Bachelder, without Bachelder's consent.

Nothing is shown which anticipates Bachelder's inventions on the point of novelty. The plaintiff's title and the validity of his claims are free from doubt and have been established, and the infringement by the defendants' machine is clear.

An injunction must issue on all the claims.
Judson J. Gordon and George Gifford, for complainant.
Theodore Ogley and Andrew Boardman, for defendants.

Recent American and Foreign Patents.

Improved Car Coupling.

Richard Lloyd, Cleveland, Ohio.—The invention consists in the coupling bars, provided with V-shaped and inclined or dovetailed shoulders upon their upper and lower sides, and at different distances from their points, and joined to the ends of the drawbars. It was illustrated and fully described on page 236 of the current volume of the *SCIENTIFIC AMERICAN*.

Improved Spike Bar.

George Douglas, Bridgeport, Conn.—Bars for drawing spikes on railroad tracks and in other places are very liable to be broken, and they fall first in the claws. The object in this invention is to provide a remedy; and it consists in making the claws in separate pieces and attaching them to the bar, so that if either claw fails it may be renewed without trouble or delay.

Improved Land Roller.

William H. Grow and Crawford M. Sloan, Darien, Kan.—Each roller is formed of wooden staves or sections, secured together by means of rods, which pass through them. Both ends of each of the rods pass through the section or stave, and are provided with screw nuts, which fit in recesses formed in the edges of the stave. A central transverse groove is formed in each stave, which adapts the cylinders to be applied to the wheels and firmly secured thereto. When this is to be done, the nuts are removed from the ends of the rods, and the staves separated from each other, so as to make the cylinders large enough to admit the wheel. When the latter have been adjusted in the grooves, the staves are again brought close together and clamped around the wheels by means of the rods and nuts. The wheels are mounted on an axle provided with a tongue forming a running gear, such as is ordinarily used as the front running gear of farm wagons.

Improved Eaves Trough Hanger.

Thomas G. Williams, Akron, O., assignor to William Warner & Co., of same place.—The invention is an eaves trough hanger having a prolonged end, adjustable vertically in a clamp, and turned over to hold the trough at any elevation desired, thus avoiding the use of an adjusting screw.

Improved Machine for Cutting Cloth.

Nathaniel C. Fluck, Gloucester, Eng.—This invention consists of a movable cutting table or board on a stationary bed, a guide for the cutting knife, a pawl for moving the cutting table, and an adjustable stop and a gage for regulating the movement, all combined in a manner by which the cutting of cloth strips into sample pieces of any size required is simplified and facilitated. The extent of forward movement of the board and the cloth upon it is regulated for the required length of samples by a stop against which the shoe of a pawl strikes, and by which it is arrested. A guide is then swung back down on the cloth, ready for guiding the knife for cutting off the sample, and a gage shows where to fix the stop for samples of the length required.

Improved Ventilator and Pipe Hole Plate for Tents.

Robert Brien and William Brien, Jersey City, N. J.—This invention consists of a metal plate, provided with an aperture of sufficient size to afford proper ventilation or allow the exit of a stove pipe, and which is fastened to the tent cloth, or to a suitable patch in the latter. A valve is arranged for closing the orifice, provided with springs and a cord and pulley.

Improved Belt Hole Cover.

Toppan P. Rodgers, Taunton, Mass.—The stationary part of the cover is made in two parts, which fit closely upon each other, and are secured together by bolts passing through the sides of the case. The bottom plates of said case are secured to the floor. The upright plates project upward at any desired angle, according to the direction of the belt, and are made in the form of segments of circles. Curved flanges are formed upon the lower part of the inner sides of the uprights, near their edges. The inner edges of these flanges correspond with and fit upon each other, where they are secured in place by projecting points which interlock. The upper or movable part of the belt cover has a base plate which is curved upon the arc of a circle to fit and slide upon the arched flanges as a seat. In the middle part of the base plate is formed a hole of sufficient size for the belt to pass through freely, and which is surrounded by an inclined flange, making the opening hopper-shaped. By this construction the belt can carry the upper part of the cover with it in its lateral movements, and the said part will stand in any position into which it may be moved, preventing the belt from being rubbed and chafed.

Improved Toy Horn.

William A. Harwood, Brooklyn, N. Y.—The mouth piece is cast in two parts, in one of which is formed a little slot in which the reed is inserted at one end and wedged in so as to be held. The other piece is in the form of a conical tube, and fits on over the one in which the reed is fitted and is secured by wedging. In the second place, the part having the reed is formed with a conical tubular portion on the end, to be attached to the body of the horn, and secured by forcing it on the conical end, so as to be held by friction. It may also be soldered, if desired.

Improved Balance.

Edward C. Pickering, Boston, Mass.—The object of this invention is to produce, for the purposes of scientific investigation and the use of the public in general, an improved balance, which consists in arranging a spirit level and adjustable weights with one end of a scale beam carrying a weighing pan at its opposite end. All the weights, large and small, are put on the scale pan, which will then balance the weight of the beam, so that the bubble of the level will come to the center of the tube. If not, a loose nut is adjusted till the exact balance of the weights is obtained. The body to be weighed is then placed on the pan and the weights removed gradually until the bubble is again in the center. The weights removed are equal to the weight of the body. The weights may also be taken off and added in the usual way till the beam is again horizontal. Those remaining give the weight of the body.

Improve Slide for Extension Table.

Jesse King, Oswego, N. Y.—The object of this invention is to so improve the slides for extension tables that the splitting of the slide bars is prevented by transferring the strain to the center instead of the sides, and allowing the construction of the slide bars in half the thickness of the slide bars in common use. The invention consists in arranging the ends of the slide bars with arched slide plates having short extensions, which are inclined toward the longitudinal axis and slide in similarly inclined grooves of the adjacent slide bars.

Improved Car Starter.

Archibald H. Crozier, New York City.—A bevel wheel is attached to a sleeve, and revolves freely on the axle. On the back of this wheel is a clutch with which a sliding clutch coupling engages and acts upon the axle when the spring is uncoiling. This spiral spring bears against the coupling, and forces it to engage with the clutch of the wheel. In winding up the spring, the teeth of the coupling clutch slip past each other without affecting the axle; but when the coil spring reacts they engage, and the power is conveyed to the axle. A frame is given a sliding motion beneath the bottom of the car by means of the lever, and is confined to the bottom of the car. A shaft is attached to this frame by journal boxes, and a bevel wheel on this shaft meshes with the clutch wheel, and another bevel wheel on the end of this shaft meshes with the wheel fast on the car axle. The coil spring is wound up around the shaft in stopping or braking up the car. One end of the spring is attached to the shaft, and the other end to the frame. In braking or stopping the car, the two mitre wheels are thrown into gear, which winds or coils up the spring and stops the car. Should the momentum of the car be greater than required for winding up the spring, a brake may be applied to the wheel by the driver. When it is desired to start the car, the driver moves a lever to the other end of a stop plate, which throws the bevel wheels out of gear. The clutch wheel, being engaged with the coupling and axle, receives the reactive force of the coil spring and transmits it to the axle, thus starting the car.

Improved Nut Lock.

Casper Dittman, Leacock, Pa.—This invention relates to that class of nut locks which by some elastic substance take up the longitudinal expansion of the bolt, and provide at the same time for a corresponding contraction. It consists in placing rubber balls between a washer and the flanges of nut, and holding them together temporarily by upsetting an annular projecting lip of the one upon the opposite wall of the other.

Improved Machine for Forming Hat Frames.

Biagio Ertola and Angelo Caselli, New York City.—A vertical shaft, pivoted to a cross bar of the frame and its upper end revolving in bearings in the table, is rotated by a lever worked by the foot of the operator. To the upper end of the shaft is attached a circular table, to which is secured the lower form or mold. The upper form or mold, which is secured to a circular table, is rigidly attached to a short shaft which passes up through a hole in the cross bar by which it may be raised. The cross bar is connected with the foot lever so that the operator can bring the upper mold down upon the lower mold to form the hat by pressing down the lever. The material from which the hat frames are formed, and which is wound upon a rod, is dampened by a suitable arrangement of water vessel and sponges.

Improved Combined Extension Measuring Rod and Divider.

George H. Diecher, Mobile, Ala.—The object of this invention is to facilitate the taking of measurements between rigid surfaces and striking circles, arcs of circles, and ovals and ellipses. In each of two opposite sides of the center piece is a dovetail groove. Near the inner end of the extension pieces are metallic dovetails, which fit into and slide in the dovetail grooves of the center piece, and guide and hold those pieces to the center piece. Bands are attached to the center piece, which admit the extension pieces so that they may slide back and forth therein, and are held in any position by thumb screws. These extension pieces are graduated or marked off into inches and fractions, so that the length of the rod in feet and inches may be, at any time, readily ascertained. A removable point and pencil, each fastened in place by a thumb screw, are provided when the rod is used as a tram for striking circles, arcs of circles, ovals, or ellipses. In the latter case, the third point is attached to the end of the center piece. When not used as a tram, the points and pencil may be disposed of in the ends of the pieces.

Improved Blackboard.

James Heber, Nebraska, Ohio.—This invention consists, mainly, in arranging the blackboard with hinged leaves in a strong standard or stock, in which it may be raised or lowered by rack and ratchet arrangement, to be inclined by hinged arm and bow construction, and folded open by pivoted levers.

Improved Extension Trunk.

Gustav Engelman, New York City.—This invention has for its object to furnish an improved trunk, which shall be so constructed that it may be extended to form a trunk of large size, or contracted to the size of an ordinary trunk. The sides and the end parts of the extension are made with an offset upon their outer and inner sides, the outer shoulder being designed to rest upon the upper edge of the sides and ends of the lower part of the trunk, so that the outer surfaces of the said parts may be flush with each other. The inner shoulders are designed to receive the till. The edges of the ends of the extension are rabbeted upon their inner sides to fit upon rabbeted angle blocks, which have a metallic plate attached to their outer sides to overlap the outer surfaces of the ends. With this construction the hinges that connect the top part to the lower part of the trunk are so formed that they can be readily attached to and detached from the upper part, or rear extension piece, as may be required. The haup of the lock is made long, and should have two keepers attached to it to enable the trunk to be locked when extended and when contracted.

Improved Grinding Mill.

Price Evans, New York City.—There is a rectangular bed frame on which is an upright frame near one end, consisting of two "bents," on the bridge trees of which is a horizontal shaft carrying the running stone, which overhangs the bridge tree, and runs in a case. In the upper part of the latter is a spout for the escape of hot air, and in the lower part is a spout for the escape of the meal. In front of the runner is a stationary stone, standing face to face with it, and is pivoted at its horizontal axis by trunnions, supported in the arms of a crotched standard, and said trunnions can be shifted forward and back to locate the stone. The arrangement forms a universal joint, on which the bed stone accommodates itself to the runner. The feed shoe, under the hopper, delivers the grain into the eye of the stationary stone, in which there is a projection of the shaft, with a coarse spiral screw thread, which conveys the grain to the runner, where it is met by the radiating distributing plates on the runner, which work it along between the stones and distribute it equally. The shoe is actuated by a tappet on the shaft. It will be seen that these mills can be geared by a direct belt from the driving shaft on the pulley upon the shaft in the most simple manner, and the spindle of the runner has not to support the weight of the stone on its end or step, but only the necessary pressure for grinding.

Improved Apparatus for Preserving and Forcing Ferment.

This invention relates to an apparatus intended to preserve such fermented or other liquids, which may be deteriorated, decomposed, or in any way injured by coming in contact with the atmospheric air, or by coming under a less pressure than they were originally subjected to, or by attaining an improper temperature during the time said liquids are on draft. The invention consists in means for excluding the atmospheric air and replacing the same by a gas, indifferent and not injurious to the liquid to be preserved, and bringing said gas under a sufficient pressure to preserve, increase, or diminish the temperature, and thus keep them in their normal condition.

Improved Railway Switch.

William A. Slingerland, New York City.—This invention relates to means whereby the liability of a railway train running off the track in consequence of the misplacement of a switch is avoided. It consists in a peculiar mode of combining a three rail switch and two pairs of frog rails.

Improved Apparatus for Transferring Embroidery Patterns.

Charles Borda, New York City.—The object of this invention is to facilitate the operation of transferring embroidered designs, patterns, etc., from a perforated original pattern sheet to other sheets of paper or other material. The apparatus for holding and giving tension to the pattern sheet consists of a frame and an adjustable clamp attached to one side of the table by hinges, so that it can be turned up to a vertical position. The adjustable clamp consists of a bed piece with a rib thereon and a hinged clamp, which has a groove which fits on the rib of the bed. The end of the sheet is laid on the bed over the rib, and then the clamp is turned down and fastened by means of the buttons. The clamp is now drawn back, so as to give the sheet the proper tension to hold it smooth and keep it in position. It is adjusted by means of cords, the ends of which are attached to the spiral springs, and the other ends are passed through the eyes. The tension is given by drawing the cords back. When the proper tension is given, the cords are secured around pins, and the clamp is fastened to the side pieces of the frame by the finger screws. By the ordinary process, this stamping, as it is called, through a perforated pattern, is done with colored powder, and the pattern is held by the hand. A single pattern can only be used in this manner, on account of the difficulty in keeping it smooth. By the improvement a number of patterns may be contained on the sheet, and stamped at one operation. Instead of using a powder, a liquid is employed, with which the brush is saturated. When the pattern sheet is properly stretched, the brush, which has been dipped in the liquid, is drawn over it and the impression is made. The frame with the pattern sheet is then raised, and the impressed sheet is removed. The frame is again closed down, and the operation is repeated, and so on for any required period of time.

Improved Spring Bed.

Samuel Smith and John H. Gill, Williamsburgh, N. Y.—This invention has for its object to improve the construction of spring beds in such a way that the bed will not crush down at the side, and that the bed will be level when two persons of unequal weight may be lying upon it. Ordinary coiled springs are interposed between, and the ends of which are attached to, the bottom and top straps. In the outer row of springs, upon both sides of the bed, every other spring is composed of two cups, made in the form of truncated cones, placed with their smaller ends adjacent to each other, and with a partition in the neck or smallest parts. Two springs are coiled into conical form, so as to fit into the cups or case and have their smaller ends resting against the opposite sides of the partition of said case. The larger end of the lower spring is attached to the bottom straps, and the larger end of the upper spring is attached to the top straps. By this construction, any tendency to press the bed down or over at the side presses the sides of the springs against the sides of the case. This keeps the springs upright, so that the person upon each side of the bed will be supported by the springs of that side.

Improved Paper Hanger's Brush.

John M. McComb, Lancaster, O.—This invention relates to a novel construction of paper hangers' brushes whereby they may be made to place the paper in proper position upon the wall. It consists in applying a hinged spring-pressed clamp to the top of the brush, also in a novel mode of enabling the operator to open the clamp after the paper has been located upon the wall, by a lifter, connected by a cord or wire with his hand. It also consists in providing the lifter with an extension arm and subjecting this to the action of a crooked lever, which holds the clamp open until the brush is taken down from the wall.

N. S. says: I am constructing a glass speculum on the following plan: The curvatures of the concave and convex surfaces are unequal; so that the rays of light reflected from the concave surface (as no glass transmits all the rays of light) may come to a focus before those reflected from the convex surface come to focus. The object is thus constructing the speculum to destroy the secondary image formed by the rays of light reflected from the concave surface. For if the curvatures of the speculum be equal, the images reflected (one from the exterior and the other from the interior surface) will appear near each other, and thus prevent distinct vision. The diameter of the speculum is 10 inches. The focal length of the convex surface is five feet, while the focal length of the concave surface is four feet. 1. Is the above plan a correct one? 2. How high a magnifying power will the above speculum be for astronomical purposes? 3. What should be the diameter of an eye glass $\frac{1}{4}$ of an inch in focal length? 4. What should be the diameter and focal length of the object glass, to a microscope magnifying 400 diameters: also what should be the diameter and focal length of the eye glass? 5. Is there any work published on the construction of optical instruments? Answers: 1. We think your idea is original, but such construction is not necessary, as a glass speculum is ordinarily silvered on the concave surface. There is a good essay upon the relative merits of metallic and glass specula in the *Philosophical Transactions* for 1829. We could not answer your other enquiries satisfactorily in our limited space, and would advise you to read up some treatise on the construction of optical instruments. We can recommend the works on physics by Stillman, Ganot and Deschanel.

B. says: I have lots of boiled bones and animal matter, and I think of employing them in making fertilizers. How can I make superphosphates, bone dust and bone manure? What other material shall I mix with the bones, and what kind of a mill is used for crushing and grinding the stuff? Answer: Your best plan is to grind the bones and mix the bone dust with ashes or ordinary manure. This forms an excellent fertilizer. There are many mills in the market for grinding and crushing, and an advertisement for the mill you need would probably bring you the information.

W. P. B. says, in reply to a correspondent who complains of a gummy substance which exudes from his boots: It is not the wax from the thread, but comes from poor oil used in finishing the leather. Cod oil (the proper article) was so scarce a few years since that other oils, particularly menhaden or porgey, were used instead of and to adulterate it, so that it became almost impossible to get a true cod oil. I have seen hundreds of sides of leather stuck together in the roll so as to need two men to separate them. It has now become possible to get good oil, and there is little danger of gum on leather from any responsible tanner.

F. N. says, in reply to G. W. C., that the largest wheeled locomotive would reach the foot of the hill first, for she would have the advantage of the other both in gravity and friction.

L. S. F. says: Let S. M. S. kill his roaches by making a mixture of Paris green and flour in equal parts. Then pour enough water upon the flour, in the place which the roach frequents, to form a little puddle, and form a circle of the mixture around it. They will run over it to drink, and thus bedaub their legs with the poison. In making their toilets, they lick their legs, and so eat the poison, which soon despatches them.

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

M. W. H.—Your specimens are particles of galena disseminated in sand.

W. A. D.—Blende, sulphide of zinc.

E. A. W.—Grains of quartz.

G. O. H.—It is an alloy of copper, but a chemical analysis will be necessary to determine the constituents.

L. S.—No. 1 is bituminous shale. No. 2 resembles oxide of iron.

E. K.—Galena (sulphide of lead) in limestone.

R. C.—Your mineral is crystallized sulphate of lime, known to mineralogists as selenite.

P. S.—Nos. 1 and 2 are iron pyrites. No. 3 is galena. No. 4 resembles oxide of iron in quartz.

C. H. C.—Carbonate of lime. Dilute hydrochloric acid will rapidly dissolve it, and will not materially injure iron pipes, if not kept too long in contact with the metal.

W. K.—Barytes, sulphate of baryta.

J. H. S.—Sandstone.

R. F. S.—1. Blende. 2. Blende with barytes. 3 and 4. Blende (sulphide of zinc). 5. Arragonite, a form of carbonate of lime. 6. Quartz and oxide of iron. Read Dana's "Mineralogy."

W. C. B. asks: What is the best varnish to use on a water color drawing, that will not blot or crack off afterwards?—T. F. asks: If the sum of two squares be given, can science determine the two particular squares which compose the sum?—F. C. says: We put up fruit in airtight jars, and never put a jar away until we had taken off the iron clamp and found that the jars were tight enough to be lifted up by the cover. Notwithstanding this, three of the jars burst. As they were airtight, how could they ferment?—F. A. asks for a remedy for a fever sore, which breaks out on the slightest exertion. —J. C. H. asks for a cheap indelible coloring matter, or paint, which could be used with a brush in marking the horns of cattle. —H. B. asks: How can I put the fish on brass as it is in watch movements?—T. B. J. asks: What is the composition of the ink used on hand stamps and for saturating ribbon for ribbon stamps?—J. E. E. says: In a suit now in the San Francisco courts, against a sea captain for alleged cruelty to a seaman, it is shown by the witnesses that it is a common practice on shipboard to hang sailors up by the wrists as a punishment. Will some one scientifically explain the physical effect of this punishment upon the system?—J. A. McK. asks: What two metals, gases, or other substances are the most subject to expansion and contraction by heat and cold?—S. S. R. asks: Can you inform me what variation occurs in the time of sunrise and sunset on the same day of the same month, in the same place, but in different years?

COMMUNICATIONS RECEIVED.

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

On the Coal Tar Interest. By H. C. F.
On Treatment of Cancer. By G. W. B.
On a Cheap Fertilizer. By G. W. B.
On Mysterious Boiler Explosions, etc. By C. B.
On Fireless Engines. By I. P.
On the Science of Iron and Steel. By C. C. Jr.
On Railway Religion. By J. E. E.

Also enquiries from the following:
C. K. C.—W. L. A.—H. H. J.—J. T. S.—J. H. G.—P. L.—R. W. W.—S. B. H.—F. B. J.—F. E. C. M.—J. M. S. Jr.—E. N.

Correspondents in different parts of the country ask: Who makes a carpet stretcher with a magnet in it to hold the tacks? Who makes coal-cutting machinery? Who makes pen shellers? Who makes the best steam washing machinery? Who makes plaster fuses? Who makes transmitters? Who sells horse power potato diggers? Who sells machines for pearling barley? Who makes small lithographic presses for amateur use? Who makes small steam engines for running jig saws, etc.? Where can apparatus for burning petroleum be obtained? Who makes diamond drills? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

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

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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:

27,094.—CARTRIDGE MACHINE CASE.—E. Allen. Jan. 28.	
27,135.—SUGAR CUTTER.—C. Kinsler et al. Jan. 28.	
27,139.—HANGING RUDDER.—J. P. Manton et al. Jan. 28.	
27,179.—SKING GAGE.—C. D. Wheeler. Jan. 28.	

EXTENSIONS GRANTED.

26,001.—EN PLANTER.—E. C. Allen.	
26,025.—MANUFACTURE OF GAS.—L. D. Gale.	
26,034.—MANUFACTURE OF GAS.—L. D. Gale.	
26,050.—MAKING BOX JOINTS.—J. Simpson.	
26,090.—PAPER FOLDING MACHINE.—C. Chambers, Jr.	
26,097.—ELECTROMAGNETIC TELEGRAPH.—M. G. Farmer.	
26,125.—PORTABLE PUMP.—W. T. Vose.	
26,136.—MODE OF ADVERTISING.—E. Wiebe.	
26,139.—PUMP.—W. Wright.	
26,145.—WATER CLOSET COCK.—D. Wellington.	

DESIGNS PATENTED.

6,997.—DRINKING GLASSES, ETC.—T. O. Cook, Phila., Pa.	
6,998.—COLLARETTE.—A. S. Ellison, New York city.	
6,999 & 7,000.—PRINTING TYPE.—H. Hensburg, N. Y. city.	
6,991 to 6,994.—OIL CLOTHS.—H. Kary, Philadelphia, Pa.	
6,995.—PICTURE FRAMES.—J. Nonnenbacher, N. Y. city.	

TRADE MARKS REGISTERED.

1,522.—GOLD PENS.—C. M. Fisher, New York city.	
1,523.—CLOTHES WRINGER.—Haley & Co., Boston, Mass.	
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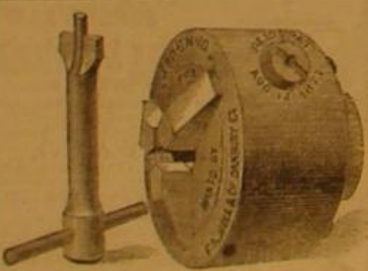
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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES

Vol. XXIX.—No. 25.
(NEW SERIES.)

NEW YORK, DECEMBER 20, 1873.

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IN ADVANCE.

THE JAMIN MAGNET.

It is a well known fact that a compound magnet, formed of a number of plates or layers, each of which is separately magnetized, is possessed of a greater portative force, that is to say, will carry a heavier load than a simple homogeneous magnet of equal weight. Generally, however, it has been heretofore considered that this portative force is, as compared with the weight of the magnet, quite small, and Hacker has established a formula showing that the load carried is equal to a constant (depending upon the method of magnetization) multiplied by the cube root of the square of the weight. Thus, to illustrate, while a magnet weighing one pound will exercise a portative force of ten pounds, a second one, similarly magnetized, weighing eight pounds, will, according to the formula, only lift forty pounds.

Up to the present time the manufacture of magnets has been principally pursued at the city of Haarlem, in Holland, and to the Dutch workshop it has been customary for scientific men of all countries to repair, when powerful apparatus of this description became needed. In spite of the brilliant researches of Coulomb, of Biot, and others, but little has been definitely determined regarding the laws governing the construction of magnets, and notably in reference to their dimensions in order to attain a given power.

The manufacture has been, in fact, more a matter of experience and individual skill than of established rule. For some time past, however, investigations have been in progress at the French Academy of Sciences, and M. Jamin has succeeded in not only providing magnets of most extraordinary powers, but also in deducing laws for their construction and for determination of their capabilities, thus adding data of the highest importance in elucidation of a department of physics regarding which, it may be safely stated, we know less than of any other branch.

Before entering upon a brief abstract of the principles governing M. Jamin's researches, there are two words which we shall employ, and which may need a previous explanation: first, by a "contact" we mean a piece of soft iron brought into juxtaposition with a magnet; and, second, by "dissimulation" is understood the temporary neutralization of the magnetism of one body by that of another when the same are together, so that, on their being drawn apart, the normal condition of each may be supposed to return.

I. When a steel plate is superposed upon a bundle of already magnetized iron (*faisceau*), the first effect is that two equivalent quantities of opposing magnetism separate in such a manner that the solenoids, which terminate at the surface of the bundle, appear to prolong themselves through

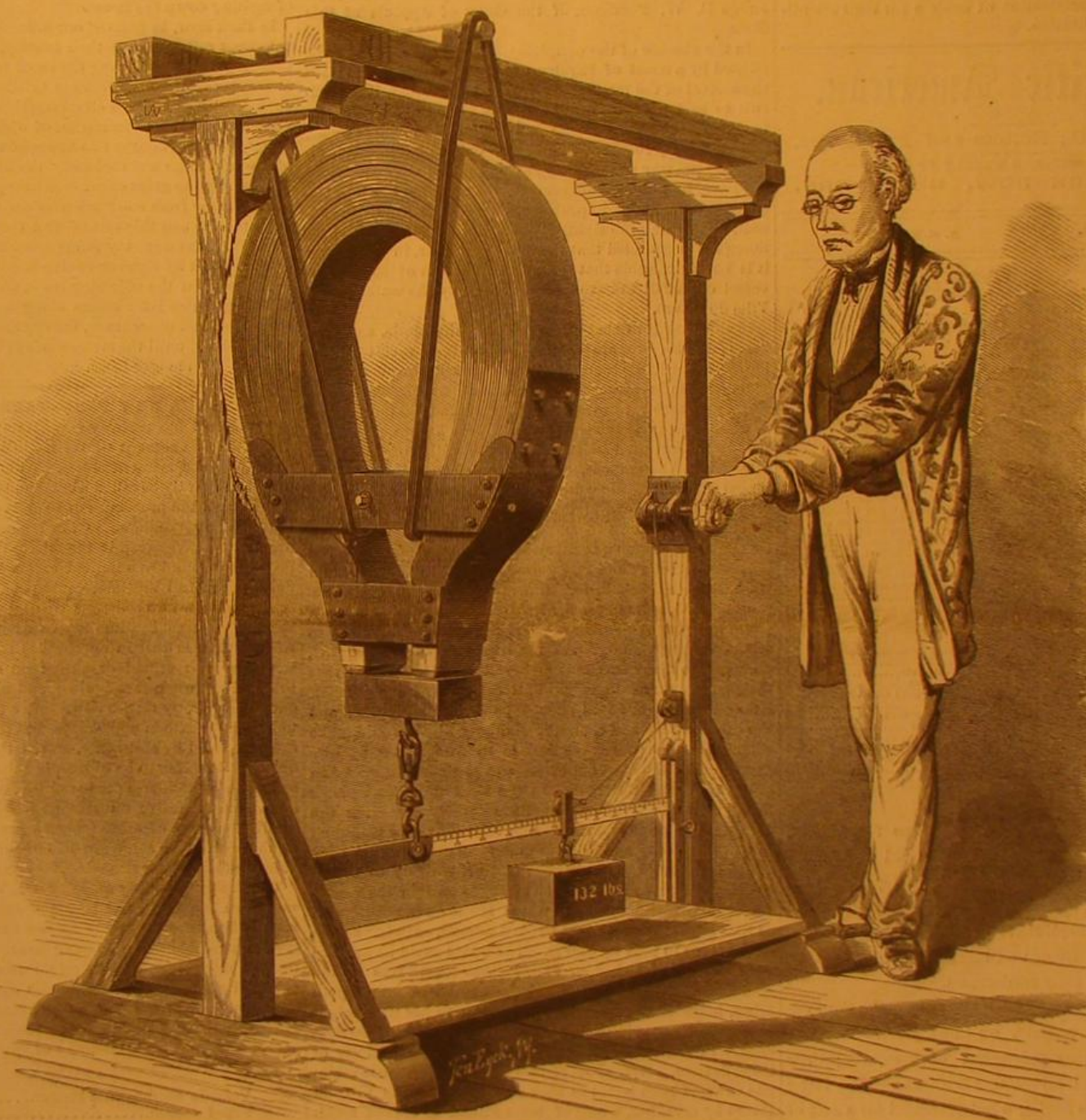
the new layer, so that the magnetic power is referred to the new surface, and nothing is added to the primitive state of the magnet. But the latter produces two other actions: it repulses at its exterior the magnetism of the plate, and also determines in the plate a contrary magnetization increasing with its energy. The difference of these two actions represents the gain which the annexed layer brings to the bundle, and this at first considerably decreases with the addition of new layers, until the normal magnet results.

gained. Replace the contact, remagnetize, and again the superior extreme is found. This we may term F, and it is clearly transitory and without utility, since it disappears on the first removal of the contact; and although the latter may be returned, unless re-magnetization of the plates be accomplished, the lower limit, *f*, remains constant.

III. Arranging two armatures in suitable position, M. Jamin connected his magnetized steel plates with them. If the former touched, he found that they dissipated all the

magnetism of a certain number of plates, but when separated, only a portion of this property became neutralized. In other words, the plates partially discharge each other, and lose a portion of the normal magnetism, but less than if the armatures did not exist, and still less than before they were separated. Now, by applying a contact to the armatures, a permanent positive force was obtained, *F*, greater than *f*, and less than the sum of the two. This was an ample arrangement for the limit of the second series of experiments; on repeating the experiment, *F*, then appeared, equal to 260 kilogrammes; on displacing the armatures, *f* was reached, equal to 170 kilogrammes; on returning the armatures, *F*, was again reached, equal to 260 kilogrammes; and the difference between 170 and 260, in this example, roughly indicates the gain in permanent portative force resulting from M. Jamin's discoveries.

Lack of space forbids our entering in greater detail into the elaborate



THE JAMIN MAGNET.

The magnetization becomes, at a certain point, maximum, and a limit is reached, which, it may be here stated, is the inferior extreme of the portative force of the apparatus, and which, for the sake of future clearness, we shall call *f*.

II. Suppose that a contact be suitably fixed and supported, and a number of steel plates, magnetized to saturation, be separately applied in connection therewith. M. Jamin, at this point, finds that an indisputable analogy exists between the influence exercised by a magnet upon iron, and that of an electrified body upon an electrical condenser, as, for example, a Leyden jar.

The magnetisms normal to each body dissimulate each other, and the magnet and its contact constitute a true magnetic condenser. Now, in the case of the steel plates and a contact above noted, the magnetism of the first plate is dissipated by the soft iron, so also of the second, third, and so on, until a point of equilibrium, so to speak, may be considered as reached, when, if more plates be added, a certain quantity of surplus magnetism becomes free. The plates react upon each other, lose polarity, and eventually a new limit is reached, which is the superior extreme of portative force. If, however, we remove the contact, the effect noted in the preceding paragraph takes place; the plates are subjected to their mutual influence, and the lower limit is re-

rate theories of the investigator. As regards the material composing his steel plates, he adduces the remarkable fact that the degree of temper, re-temper, and of annealing necessary is not uniform, and varies greatly with different kinds of steel, a circumstance which explains the hitherto great uncertainty in the construction of magnetic apparatus.

We present herewith an excellent engraving of the great magnet which M. Jamin recently exhibited before the French Academy of Sciences. The apparatus is arranged in a simple machine for testing the portative force, which consists essentially of a graduated lever, on which is suspended a weight of 133 lbs. The latter is gradually drawn toward the end of the lever by a cord, attached to a small ratchet wheel shown, in the hands of the operator, until contact is broken, when a very simple calculation determines the force. The magnet is constructed of two armatures placed opposite to each other, and each weighing 35 lbs. They are rigidly connected by heavy crosspieces of copper, and support a cubical contact of soft iron weighing 28 lbs. From their lower ends the armatures spread out and grow thinner, ending in sharp edges. Secured by screws to the exterior surfaces of both is a thin strip of steel, which takes a natural curve from one armature to the other. All the other plates previously magnetized are placed within and left to assume

As to whether it will eventually be possible to obtain magnetized bars of even higher powers than thus reached, it remains yet to discover. Their utility may perhaps be questioned, or at least their direct and immediate application to scientific purposes; but the answer to this, as to every other interrogatory of the *cui bono* nature, is simply that even the most abstract of theories may, in the light of new investigation, lead to other ideas of considerable practical importance. Suffice it that M. Jamin has taught us how to construct, theoretically and practically, a magnet capable of producing the highest effect of which it is susceptible, and that it rests for inventors to apply these newly found principles toward the improvement or the origination of devices for their scientific and industrial utilization.

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NEW YORK, SATURDAY, DECEMBER 20, 1873.

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Another casualty at sea, which, in its terrible details, fairly rivals the horrors of the wreck of the Atlantic, has recently occurred in the sinking of the French steamer Ville du Havre while on her voyage from New York to Havre and Brest, France. She left this port on the 15th of November last, and at 2 o'clock on the morning of the 22d while in mid ocean, was run into by the British ship Loch Earn. All accounts agree in the fact that the steamer was struck amidships on the port side, the effect of the blow being to crush in her iron frame for a depth of at least thirty feet, and to cause her to plunge bow first under the waves twelve minutes afterward. Out of three hundred and thirteen people on board, but eighty-seven were picked up by the colliding vessel, and of this latter number, fifty-four were a portion of the crew, including the captain and some of the

The *Ville du Havre*, formerly known as the *Napoleon III.*, belonged to the *Compagnie Générale Transatlantique* and was one of the largest ocean steamers afloat. Her length was 423 feet, beam 49 feet, depth of hold 40 feet, and tonnage 5,500. She was magnificently fitted up, and commanded by experienced officers, drawn from the regular French naval service.

The list of the lost includes a number of well known citizens of New York and Boston, several members of the Evangelical Alliance, who were returning to their homes, and Judge R. W. Peckham, of the Court of Appeals of this State.

In the absence of the complete details of the disaster, to be elicited by a court of inquiry now in progress, for which the arrival of the mails will have to be awaited, it is difficult to assign the immediate cause. That there is gross negligence and carelessness to be imputed to both vessels, there is hardly room for doubt. It was the steamer's business to give way to the sailing ship, but that the latter could not have, by proper management, lessened the shock of the collision seems very improbable. There are conflicting accounts regarding the sighting of the lights of the *Loch Earn*, though it is conceded that the night was clear, in which case it is hardly possible that the rapid approach of so large a vessel could fail to have been perceived by the watch of the *Ville du Havre*.

In this case as in that of the Atlantic, the Metis, and previous wrecks, we are again compelled to revert to that incomprehensible economy on the part of owners which sanctions the lavishing of large sums upon elegant upholstery, gorgeous furniture, and luxurious table at the expense of the provision of the simplest and best known appliances for the preservation of life. As a preventive of just such disasters as the present, there is the electric light, which placed at an elevated position on the bow of the ship, can be seen at a distance of 15 miles, and which illuminates the surrounding space like a room. The apparatus could be driven by the main engine or donkey at an expense of four horse power. In cloudy and foggy weather or at night, the steam whistle, the ship's bell, fog horns, and the firing of guns, precautions which are never omitted on board of men of war, afford a means of signifying the position of one vessel to others in the vicinity. As for life-preserving apparatus, there are so many excellent and well tried inventions that their mere enumeration would fill columns of our journal. Every mattress on board should be stuffed with cork, and the cabin settees and chairs, if similarly filled, would make admirable supports, sure to float in the roughest sea. Life preservers of the most approved pattern should be placed in every berth, and distributed in the most prominent places throughout the vessel, in numbers largely exceeding the aggregate of people carried. Life rafts should be placed on the upper deck, and conspicuously marked so that they might be resorted to, in sudden danger, without confusion or delay. Buoys also might be arranged outside the vessel, and provided with chemicals which ignite on becoming wet, so that brilliant light might be shed around, enabling people in the boats to pick up others. The buoys could be fixed so as to be easily detached, or to disengage themselves on the sinking of the vessel. Similarly, a number of long copper tubes, hermetically closed and provided with life lines might be conveniently stowed in the chains; these would also float clear. In fact there should be, if anything, a superfluity of these devices. Every boat should be practically unsinkable; and to avoid such losses as were occasioned on the Ville du Havre by crushing, a nest of boats should be stowed amidships, and a part of the space now given up to deck houses be devoted to that purpose. There are also numerous inventions of folding and canvas boats, which could be placed around the decks, occupying little space, and which would also do good service in time of need.

The great desideratum, however, is an unsinkable ship, and to this need we desire particularly again to call the attention of inventors. The compartment plan, though it has been the saving of many vessels, has failed to counteract the effect of severe injuries, which rack the entire frame of the ship. What we require is a hull built with a double skin and honeycombed with air spaces, so that, no matter how big a hole is made, the fabric will still float: either this or some similar device which will keep the deck above water, no matter if the entire hold or lower works fill.

There is a need of compulsory legislation on this subject, which will reach not only our own vessels but those belonging to foreign owners sailing to and from our ports. A clearance might be refused to any passenger ship unless she could show a satisfactory certificate from proper officials that her life-preserving apparatus was adequate and in perfect order; or there might be such exemplary penalties attached to the loss of a vessel, which, upon investigation, it could be proved was not in every particular sufficiently provided, as would force her owners to look to the lives of their passengers with at least as much care as they now give to the insurance of their ships.

A new machine for cleaning the tracks of street railways of snow, the invention of John Mullaly of this city, was lately tried here on the Lexington avenue railway. It consists of a car, on which is mounted a steam boiler and a superheater. Under the floor of the car, arranged between the wheels, is a steam chamber, three feet wide, seven feet long, from the bottom whereof project a large number of little pipes or openings. The steam issues from the superheater into the chamber, and is there discharged directly upon the snow beneath, which is instantly melted. The steam tank is surrounded by an apron or curtain, which encloses the escaping steam. On the trial mentioned, the machine worked with success, so far as the melting of the snow was concerned. In regard to the actual expense of its use, we have no data. But considering the large amount of heat theoretically required to melt ice, and the great waste of fuel in the practical heating of steam boilers, it would seem as if this must necessarily be an expensive method of clearing the streets. It would probably be cheaper to shovel up the snow and remove it in carts. But this sort of removal, prompt, economical and effective as it is, the railway companies take especial pains to avoid. Perhaps they will prefer the more expensive method of melting down the snow.

In Park Row, in front of our office, some half dozen different street railways have their *termini*, and the operations of their workmen in clearing the snow from the tracks, after a storm, are something ludicrous to behold. The street is occupied, for a distance of about one thousand feet, by the convergence of the various tracks, of which there are four. It might, perhaps, occupy two hours of time, if all the companies would unite and cart away the snow. But instead of this, they go to great expense in annoying each other by tossing the snow from one track over upon another, by means of snow plows; and this sort of fun they keep up sometimes for days. One company sends down a great snow plow and brush, drawn by eight or twelve horses, which throws aside the snow upon the adjoining track, and makes a clean sweep. Fifteen minutes later comes along a similar machine, running upon that other track, throws the said snow back again. So it goes on, until the air becomes milder, or the snow solidifies and is no longer loose.

A new fuel has recently made its appearance in our market, which, on account of its intrinsic value as well as its novelty, is deserving of notice. Although a natural production it can hardly be called a coal; and although possessing to some extent the properties of coke, it is not produced by any of the methods common to the manufacture of coke. The proprietors have given it the appropriate name of "carbonite." It is found to a limited extent in the bituminous coal fields of Central Virginia, constituting a distinct vein by itself, which is now fairly developed and yielding a steady supply. It is sold in lumps like cannel coal. The surface when broken is dull in appearance instead of glossy, as is the case with cannel or anthracite coal. It burns with a bright flame when first ignited, and almost without smoke, and subsequently settles down into a bed of bright coals not unlike anthracite in appearance, but lacking the intensity of heat produced by anthracite, and at the same time more enduring. It seems to be especially suitable for open grates, and more particularly for parlor use, on account of its freedom from smoke or bituminous smell, and also from the small proportion of ashes (only $2\frac{1}{2}$ per cent) resulting from combustion. The ashes are also of such density that, in the process of stirring or removing, they do not rise into the room.

The analysis recently made by Dr. Wallace, of Glasgow, and given below, shows a larger proportion of combustible matter than is found in any known fuel, being 96 per cent that is available for producing heat. It has but a slight trace of sulphur, and is therefore free from the pungent odor and gas incident to anthracite coal. It is superior to any other fuel in the power of producing steam, and may prove especially desirable for steamships making long voyages, on account of its economy of space.

Volatile combustible matter.....	14.26
Fixed carbon.....	81.01
Sulphur.....	.33
Ash.....	2.24
Water at 212° Fah.....	1.56

100.00

This unique product of the earth is accounted for as follows: Originally a vein of bituminous coal, but lying upon and covered with a fine clay, it appears to have been subjected to heat by an overflow of trap rock on the surface, thereby expelling the gaseous and volatile properties of the coal. A process of nature has thus accomplished on a grand scale a more perfect result than is attainable by artificial means, and has delivered for human use a deposit of natural coke, so condensed, by the process under which it was formed, as to acquire a specific gravity nearly the same as bituminous coal, and possessing a heating power fully equal to our best anthracite.

The traffic in coal tar is a comparatively new industry, and its growth has been very rapid. This is attributable to the many wonderful transmutations which have rewarded the chemical tests to which the substance has been subjected. From being considered but the worthless refuse resulting from the manufacture of gas, and of no commercial value whatever, it has within a few years attained an importance of no common order and the promise it affords of almost illimitable future development is evidenced by the

fact that it is at present undergoing a wider range of experiments than any other crude material now serving as the subject of the analytical operations or as an ingredient in the compounding processes of the laboratory. In one of its variations it has proved a positive blessing to humanity; and did carbolic acid alone represent the sum total of virtue derivable from coal tar, still would this isolated fruit of the crucible well repay the time and toil expended in its discovery, and hold its place as one of the greatest material gifts of modern days. But the bituminous distillation flowing from the gas house retorts assumes other marked forms in the chemist's hands; and although they may not so directly contribute to the physical welfare of mankind, yet for certain purposes of utility they are unapproachable. Creosote oil, for instance, is certainly unequalled in its peculiar preservative qualities, which are none the less valuable because the revelation of these special properties is of comparatively recent date. The United States government annually purchases thousands of barrels of this liquid, using it on all wood work exposed to the weather, especially on gun carriages; 120,000 gallons were employed in saturating the timber composing the bulkheads in the St. Clair Flats, Detroit river. It is extensively used by railroad companies for the preservation of railroad ties, bridge timbers, and piles, and also upon the blocks constituting the wooden pavements of Washington, Pittsburgh, and other cities. The artificial oil of bitter almonds (oil of myrbane), of superior fragrance and flavor, is also extracted from the same viscid base, and is exclusively an American invention and manufacture. But the most remarkable product obtained from coal tar is the new article called anthracene, from which is produced the coloring matter known as alizarine, the identical substance which for two hundred years has been found solely in madder. It is only in the United States that coal tar has been made to yield anthracene in large quantities, several hundred pounds of which are daily manufactured in this country and shipped to Europe on orders from the manufacturers of alizarine, which is not yet numbered among our domestic productions. This article constitutes the base of all the madder colors—Turkey red, black, pink, and purple. It was first discovered in coal tar by the distinguished chemists Grieb and Leibermann of Berlin in 1867. More than \$10,000,000 is invested in its manufacture. In several foreign countries, the pitch from coal tar is combined with coal dust and pressed into the form of bricks, and an excellent fuel is thus produced, a given amount of which, it is said, will generate a greater heat than can be obtained from the same quantity of any other combustible material employed for utility or comfort; while at the same time, it can be stored more compactly and in better shape than either wood or coal. It is understood that negotiations are in progress in New York, looking to the utilization, in the manner described, of the 40,000,000 tons of valueless coal dust now lying in the vicinity of the coal mines and depots of Pennsylvania.

RECENT ORDNANCE TRIALS.

Some remarkable results have been obtained during recent trials of naval ordnance, carried on under the supervision of Mr. Norman Wiard, at Nut Island, in Boston Harbor. Mr. Wiard's improvement consists in rifling an ordinary smooth bore gun with two grooves, having for a 15 inch cannon a twist of one turn in 50 feet, and cut in the sides of the bore so as not to cross the bottom. The object of this arrangement is primarily to allow the gun to be used as if it were a smooth bore and with ordinary spherical projectiles, which, were the upper and lower surfaces of the interior rifled, would in balloting destroy the grooves and strain and weaken the piece, while the firing would besides be greatly impaired in accuracy.

The trials above referred to have, however, proved an unusual gain of penetrating force, due to this system of rifling. Two ordinary smooth bore guns, of 15 inch bore, were selected, one of which was grooved according to Mr. Wiard's plan and provided with conical projectiles. The other was left in its normal condition, and ordinary round shot employed. The extremely large charge of 140 pounds of powder was used, and the projectiles weighed 460 pounds each. Two targets, of wrought iron plates 15 inches in thickness, were erected side by side, 160 feet distant. The rifle was fired first, when its bolt went clear through the target, tearing off a huge fragment and throwing the same for considerable distance and then burying itself in a sand bank. The smooth bore shot entered the target for six and a half inches and there stuck.

The experiments were of course designed merely to determine penetrative power, and hence were made at very short range, but we understand that further experiments are to be inaugurated for the purpose of estimating the comparative distance and rapidity with which projectiles can be thrown from guns rifled after the Wiard pattern and smooth bores. It will be seen, however, that the results thus far obtained are better than those reached in the celebrated Tegel tests of the Krupp guns in Germany. Two of the cannon employed in that case were respectively of 11 and 10 inches bore. The range was 164 yards. The 11 inch gun with 88 pounds of powder drove a shell through a 12 inch plate backed by 26 inches of wood, but the 10 inch projectile did not penetrate. The English 11 inch gun, at 200 yards, with 88 pounds of powder, has sent shot through 13 inches of iron, 12 inches of wood and 14 inches of skin, and *The Engineer* asserts that the shot of a 12 inch 25 ton piece, with 110 pounds of powder, at 330 feet, has entered, but not penetrated, 18½ inches of iron backed by 12 inches of teak. In the Glatton experiments, the 600 pound projectile of a 12 inch English gun, weighing 25 tons, with 85 pounds of powder, at 200 yards, pierced 14

inches of iron and 64 inches of oak. Our American 15 inch naval gun, it may be noted by way of comparison, is of about 23 tons in weight. Until we obtain data based on range in connection with penetrative power, it will be hardly possible to draw more than a general parallel between the performances of our improved ordnance and that of foreign nations. We may here state that the official reports of the naval officers, witnessing the Nut Island tests, have created considerable interest in government circles, and it is believed that there is every probability of future experiments developing even more remarkable results. There is one all important fact, however, which places our gun, from a certain point of view, far ahead of its foreign competitors, and that is that it is made of simple cast iron; while the English and German pieces are either, in the former case of wrought iron elaborately built up or else steel, or in the latter instance, as is well known, of the cast steel from the celebrated Krupp foundry. It is unnecessary to point out the vast difference in the cost of such ordnance or the high superiority of American iron thus indicated.

The ordinary spherical projectiles now in use are to be improved by the insertion of three brass pins in holes equidistant from each other on the surface, and hence in the form of a regular triangle. The pins are cut to support the shot exactly in the middle of the bore, so that the windage will be equal all around and the shot receive its impulse directly from the center of the exploding charge. The advantage gained is the prevention of the lodgments or indentation on the lower side of the bore, produced by the escape of the gas through the windage, before the ball has moved from its seat. The elasticity or crowding up of the metal causes the projectile to rebound, and, on its being carried forward by the charge to strike the upper surface of the bore, and there be reflected and re-reflected before it emerges. Of course these last three indentations, termed enlargements, become gradually deeper, and, besides rendering the firing inaccurate, eventually cause the gun to become unserviceable.

We understand that the Wiard improvement does not require the manufacture of new guns but simply a modification of those already in use. All the projectiles, equipments, etc., ordinarily employed are as available as ever, and in brief the idea is, merely by rifling the pieces, to give them the capabilities of both rifles and smooth bores, while besides materially adding to their range, penetrative power, and general efficiency.

SCIENTIFIC AND PRACTICAL INFORMATION.

TESTING STEAM BOILERS.

It is generally believed that steam boilers become weakened (for resistance to internal pressure) after continued use, from various known and unknown causes, so that the engineer cannot judge of the pressure to which his boiler can be worked with safety. But this he may determine by a very simple process and means which are always at his command. It is as follows: Let the boiler be filled entirely full of cold water even to the throttle and safety valves, and all closed tight to prevent any escape. Now, by lighting a fire under the boiler, the water will gradually expand and produce a pressure sufficient to even rupture the iron before the temperature of the water has reached the boiling point. While the pressure is increasing, let the steam gage or pressure indicator be watched; and when the test pressure (which may be twice or more as great as the working pressure) is reached, a portion of the water may be allowed to escape and the pressure reduced. The pressure results from the fact that water is expanded by heat more than iron. The process above given is attended with as much safety as the use of the hydrostatic press, unless the water be heated above 212°, which would not be required unless the boiler leaks. Below this temperature, no disastrous consequences would follow, even if the boiler should be torn asunder.

A GOOD FERTILIZER.

Farmers generally have to pay a high price for an article which, with a little skill, they could make themselves during the winter months or on rainy days, when they have little else to do. We give a recipe for a cheap, good fertilizer, which has been used successfully by farmers in Pennsylvania and Ohio. One recommends it especially for potatoes and wheat, and ends by saying that he has used it with success on corn and other products. It is as follows: Take 1,000 lbs. of good mold, sieve and screen it to get the gravel out and make it as fine as possible, then spread on a floor or some suitable place; add 100 lbs. sulphate of ammonia, 100 lbs. common salt, then mix with a rake. When thoroughly mixed, add 25 lbs. pearlash and 25 lbs. sulphate of soda, mix well, then add 400 lbs. ground bone, 25 lbs. best Peruvian guano, and 150 lbs. ground plaster. Mix the whole thoroughly, throw on a pile for forty-eight hours, and it is fit for use. If it is to be used for potatoes in districts where potato bugs are numerous, 5 gallons sulphuric acid may be sprinkled over the mass. Care must be taken not to use the acid in a confined place, as the fumes are bad for the health. If it is spilled on the floor, do not throw water on it, as it generates great heat when in contact with water. Sulphuric acid sprinkled on the ground will kill bugs of any kind, and its fumes are especially fatal to the potato bug.

REDUCTION OF GALENA AND OTHER LEAD ORES.

When in contact with metallic zinc, galena is readily decomposed by acids. Even oxalic, acetic, and dilute sulphuric acids are capable, when hot, of decomposing galena, metallic lead being deposited and sulphuretted hydrogen gas set free; while with chlorhydric acid, the decomposition is peculiarly rapid and complete. Galena is easily decomposed, also, even in the cold, by dilute nitric acid in presence of

zinc, but the reaction differs in this case from that just described, not metallic lead but free sulphur being deposited, while nitrate of lead goes into solution. The reaction with zinc and chlorhydric acid may be employed with advantage for assaying galena, particularly the common American variety, which contains no heavy metal besides lead. The details of the process are as follows: Weigh out 30 or 40 grains or more of the finely powdered galena. Place the powder in a tall beaker, together with a smooth lump of pure metallic zinc. Pour upon the mixture 6 or 8 cubic inches of dilute chlorhydric acid which has been previously warmed to 40° or 50° C.; cover the beaker with a watch glass or broad funnel, and put it in a moderately warm place. Chlorhydric acid, fit for the purpose, may be prepared by diluting 1 volume of the ordinary commercial acid with 4 volumes of water. For the quantity of galena above indicated, the lumps of zinc should be one inch in diameter by a quarter of an inch thick; they may be readily obtained by dropping melted zinc upon a smooth surface of wood or metal. The zinc and acid should be allowed to act upon the mineral for fifteen or twenty minutes in order to insure complete decomposition. Any particle of galena which may be thrown up against the cover or sides of the beaker should, of course, be washed back into the liquid. It is well, moreover, to stir the mixture from time to time with a glass rod.

When all the galena has been decomposed, as may be determined by the facts that the liquid has become clear and that no more sulphuretted hydrogen is evolved, decant the liquid from the beaker into a tolerably large filter of smooth paper, in which a small piece of metallic zinc has been placed. Wash the lead and zinc in the beaker as quickly as possible with hot water, by decantation, until the liquid from the filter ceases to give an acid reaction with litmus paper; then transfer the lead from the beaker to a weighed porcelain crucible. In order to remove any portion of lead which may adhere to the lump of zinc, the latter may be rubbed gently with a glass rod, and afterwards with the fingers, if need be. Wash out the filter into an evaporating dish, remove the zinc, and add the particles of lead thus collected to the crucible. Finally dry the lead, at a moderate heat, in a current of ordinary illuminating gas, and weigh.

A THERMOMETER MOTOR.

M. de Paz, at a recent session of the French Academy of Sciences, proposed an odd though original idea, which it is needless to remark is hardly susceptible of any useful application. He places around the circumference of a wheel, the axle of which is horizontal, a series of precisely similar thermometers. Then he exposes one half the wheel to the sun, and shades the other half. The result, he says, is that the mercury in the exposed instruments dilates and carries their centers of gravity further from the center of suspension, consequently the effect, he believes, is as if the thermometers on one side became heavier, and hence the wheel turns around.

THE INFLUENCE OF GASES AND OF CARBOLIC ACID ON THE CONSERVATION OF EGGS.

According to M. Calvert, if an egg be placed in dry oxygen, no alteration takes place; but if the gas be moist, at the end of three weeks or a month, the egg becomes covered with white filaments, some 3 inches each in length. Its interior, however, shows no signs of decomposition. If, however, at the end of the egg a small needle hole be made, putrescence takes place in dry oxygen, attended with the disengagement of nitrogen and carbonic acid, and also the formation of great quantities of vibrions and microzymas. In damp nitrogen, eggs, whether pierced or not, may be kept perfectly for three months; and although a light deposit of *penicillium* appears on the exterior, the contents do not decompose. In hydrogen, the same effect is noticed. In carbonic acid, the conservation is perfect as above, but without a trace of *penicillium*, whether the gas be moist or dry. Similar results to the latter are obtained with ordinary illuminating gases.

New laid eggs were also plunged in weak solutions (1-500) of chlorine, of hypochlorite of lime, of sulphite of lime, and of carbolic acid; but the author gives no results except as relating to the latter substance, in the liquor containing which, the eggs kept perfectly for three months.

WET PLATING FOR BRASS, IRON, ZINC, ETC.

C. Paul says: Brass, copper, and German silver are tinned by boiling with granulated tin and cream of tartar. Iron must first be cleaned by a mixture of 1 part of sulphuric or nitric acid with 10 parts of water, and then coppered by adding a solution of some copper salt, moistening with a solution of 1 part of protochloride of tin in 2 parts of water and 2 parts muriatic acid, and subsequent immersion in a solution of ammonium copper sulphate. Brass, copper, and German silver, and iron or zinc, which have been coated with copper, can be silvered by rubbing with the following mixture: 14 grains of silver are dissolved in 26 grains of nitric acid and 120 grains of potassium cyanide in 4 cubic inches of water; the solutions are mixed and 24 grains of whiting added.

PROFESSOR JOSEPH HENRY, Secretary of the Smithsonian Institution, has received from the French Government a superb porcelain vase, as a testimonial of his services as the United States representative of the commission on the international standard meter.

THE first patent issued in the United States, of which there is any record, was granted to Samuel Hopkins, on July 31, 1790, for making pot and pearl ashes. The second was to James Stacey Sampson, on August 6, 1790, for making candles; and the third and last for the year 1790 was to Oliver Evans, for making flour and meal. The latter bears date December 18, 1790.

ALBINISM AMONG BIRDS.

In the issue of the SCIENTIFIC AMERICAN bearing date October 25, 1873, a correspondent has given us the particulars of the finding of a nearly perfect albino starling, or blackbird.

Although this perverse mood of nature is by no means uncommon or unnoted, it is of sufficient importance and rarity to attract the attention of the most untutored observer, whenever an example of the kind presents itself. We hear mention, by eminent ornithologists, of albinism occurring among crows, some of the sparrows, starlings, and the shore lark, but the writer does not recollect finding note of this freak among the thrushes, and therefore presents, with the accompanying engraving, a description of the singular markings of plumage as exhibited by an adult female American robin (*turdus migratorius*).

For several successive days, in the opening spring of 1870, this specimen was observed frequenting the grounds of a citizen of Auburn, N. Y., on one of the principal streets. The remarkable markings of this robin, especially as seen in its flight, evoked expressions of surprise and comment from the most casual observers. At this time the bird under notice was busily engaged with its mate, a bird of perfect plumage, in building its nest in the branches of a tall and thrifty pear tree, and assiduously fulfilling its maternal instincts. Not willing that so rare a freak in feather should pass without an examination, a favorable opportunity was seized for bagging it, with the following results:

General color above, wherever occurring (see the shaded parts in the engraving), of a dull or faded umber, much lighter than the shade found in the perfect bird; the rest of the upper plumage, from frontlet to tail, pure white; breast, white, lightly and irregularly interspersed with a faint ferruginous color; bill, yellow; primaries, pale umber, edged with white; alula and scapulars, ashy brown; third tertials, pure white, with the outer webs loose and frayed in appearance; tail, two outer coverts wholly, and the remaining feathers irregularly, tipped and marked upon their outer vanes with white; iris, of the prevailing color of the species; legs and feet, lighter than in the perfect bird; dimensions, regular; specimen active, and note set clear to the predominant scale of the robins. Specimen shot at Auburn, N. Y., April 21, 1870.

A correspondent, E. H. F., sends us the following similar instance: The white blackbird mentioned in your journal of November 25, I have seen twice myself. One of them was in Maine some years ago, and was lost by being destroyed in a burned building. The other is, or was last May, in the possession of Mr. Charles Deringer, of Sauk City, Sauk county, Wis., who is a German naturalist of no mean acquirements, but of such retiring and modest disposition as to have allowed his light to be hidden from the world at large. He had a very fine collection of mounted birds, all done by his own hands, and among them many albinos: Two white quail (*ortyx virginianus*), a white robin (*turdus migratorius*), white tree sparrow (*spizella monticola*), a white swamp or red winged blackbird (*agelaius phoeniceus*), and a white duck, which I believe to be, as near as I could judge, a canvas back. The white blackbird was a young bird of a pure white color, with the exception of some few feathers which were tipped with a dull brown or drab. The wings distinctly showed the scarlet markings of the species. Mr. Deringer stated that his was the only one he had ever seen, in a twenty-five years' experience, in a country where blackbirds are so plentiful as to be an unmitigated nuisance, at least to the farmers.

Pinoline.

When heat is applied to the retorts a light oil, crude pinoline, passes over at first, and then ceases. The receivers are changed, and the fire augmented, when the heavy oils pass over, and colophonium is left in the retorts. The heavy oils are of a deep violet color. They are boiled for a day with water, and a part of the matter which passes off with the steam is collected. The next day the water is drawn off, and the residue saponified with caustic soda of 36° B. The almost solid product is then heated anew till no more oil distills over. The oil which has been distilled (single rectified) is submitted again to the same treatment, and that which finally passes into the receiver is called double rectified. It is used for adulterating fish oils. Crude pinoline contains acetic acid, from which acetate of lime may be prepared by neutralizing the crude product of distillation with chalk, and redistilling the oily liquid.

New Method for Chromic Acid.

The following method is based upon the decomposition of barium chromate by nitric acid, with the separation of the barium nitrate thus formed, by means of sulphuric acid.

Precipitated barium chromate is added to boiling nitric acid (diluted with an equal bulk of water) till completely saturated; the whole is then allowed to cool, when the greater quantity of the barium nitrate crystallizes out. To the mother liquor a sufficiency of sulphuric acid is added, to precipitate the remainder of the barium; the barium sulphate settles readily to the bottom of the vessel. The supernatant liquor, containing chromic and nitric acids, is drawn off and evaporated to dryness on a water bath, when all the nitric acid is expelled, leaving a residue of nearly pure chromic acid, which may be purified by crystallization. By this method, nearly

bottom, A. The pot is then placed on the fire, when the steam generated in A forces a continual flow of water up through pipes, B, into drum, C, thence through the perforations in the bottom of the latter to the coffee, which has previously been ground and placed in the muslin bag, D. This circulation is allowed to continue until the strength of the coffee is extracted, when the drum and bag are removed and the pot filled with hot water. No boiling over can take place, and the infusion is made very quickly, thus preventing the escape of the aroma and flavor of the coffee.

Patented through the Scientific American Patent Agency, September 23, 1873, by Margaret J. Stubbings, Lock Box 41, Youngstown, Mahoning county, Ohio, to whom letters for further information may be addressed.

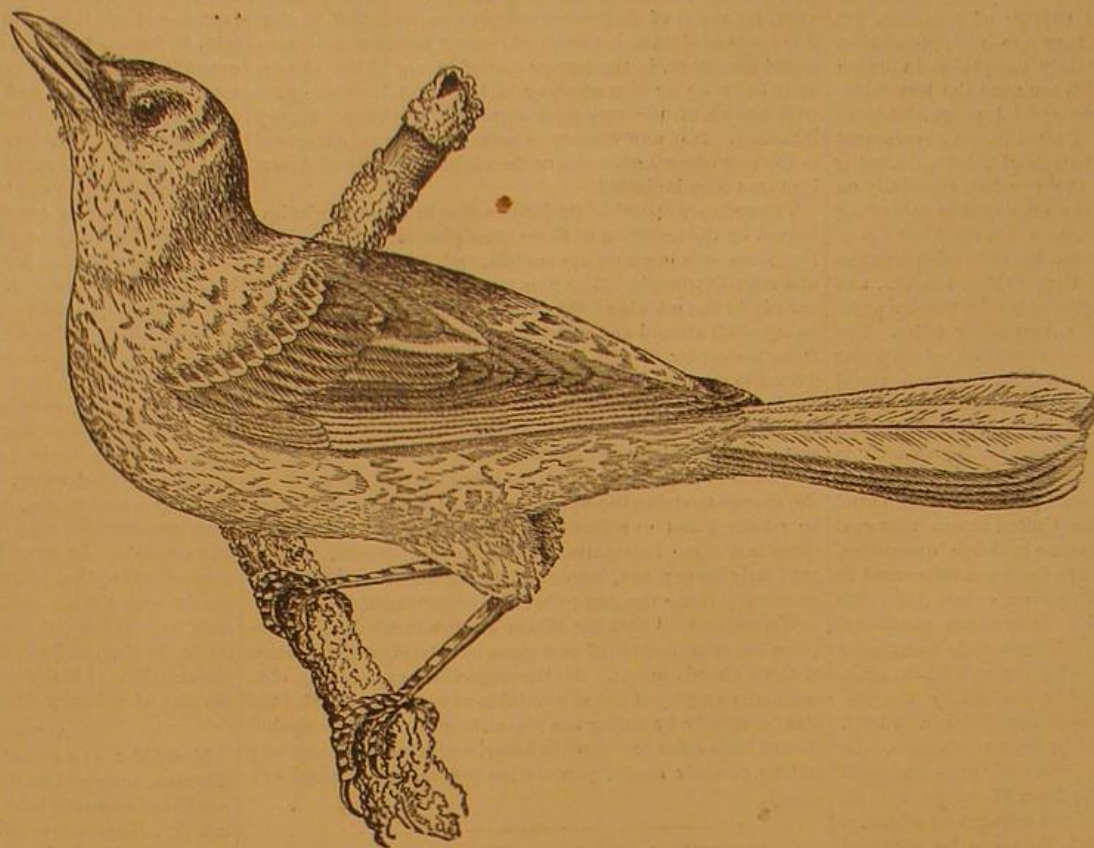
Life in the South.

A correspondent in Phillips' Southern Planter thinks that the agriculturists at the South should make their homes more attractive, and advises that the farmers quit raising so much cotton and put in something to eat. He further says: "The Northern people have ten times as much amusement for themselves and children as we do. The fact is that the cotton planter works harder, lives harder, endures more trouble, has fewer comforts, rides poorer horses, sees less of the comforts or pleasures of life than any other people on the globe. The only excitement he has is in the spring: it is in making calculations for so many bales at one hundred dollars per bale, amounting to so many thousand dollars, and in the fall in finding out that it has cost him all his year's work, and all his crop came to, to pay the expenses of making it."

[We think, at the high price cotton fetches this year, the

planter will find considerable profit above the cost of production, and we are in much doubt if any other crop he can produce will net him as good return. But it is desirable to make homes as attractive as possible everywhere. We agree with the writer in this advice.—EDS.]

ALBINO ROBIN.



IMPROVED COFFEE POT.

Very few persons know how to make good coffee. In the majority of cases, and especially in hotels and restaurants, the beverage is served in a reasonable state of clearness, but has an astringent and bitter flavor, while, if it be allowed to stand in the cup until cold, globules of oil may be noticed upon the surface. Coffee thus prepared has lost its caffeine, which is the nutritive and valuable principle of the bean, and the infusion swallowed is merely a decoction of indigestible tannin. Good coffee, in small quantity, is deleterious to but very few organizations, and is healthy to most persons except those of extremely nervous temperament; but when badly cooked, it is productive of headache, nausea, and other disagreeable ailments.



In order to aid those who have not learned the art of making clear and aromatic coffee, we illustrate herewith a newly invented apparatus which, according to the inventress, will produce an excellent beverage. The outer part of the pot is of the usual form, and is provided with a tightly fitting lid. A is a cylindrical cover which rests upon the bottom, and has notches, as shown, at the lower open circumference. Two or more vertical pipes, B, of slightly conical shape, connect with the top of the steam cover, and carry, by means of elbows which fit closely over their upper ends, the cylindrical drum, C. The bottom of the latter is perforated, and below it is suspended a muslin bag, D, which is held by a ring that fits between the elbows and rests on suitable lugs. Boiling water is first put in until it covers the steam

Mennonites of Southern Russia.

The Secretary of the Interior, in his recent annual report says:

"I desire to invite the attention of Congress to a request from a colony of Mennonites, now and for several generations residing in Southern Russia, near the shores of the Black Sea and the Sea of Azov, for a modification of the existing land laws in certain particulars, to enable them to settle upon our public domain in a compact colony.

By a decree of the Russian government, this people, numbering between forty thousand and fifty thousand persons, have been deprived of certain immunities which they have enjoyed ever since their first settlement in Russia, and the granting of which had originally induced them to leave their former homes in Prussia and settle in their present place of abode.

It is their desire to come to the United States and to occupy a portion of our public lands in a compact body, with no strangers to their religious faith within the exterior bounds of their possessions. Such exclusive occupancy they deem essential to enable them to carry out their peculiar system of farming, which to some extent involves a community of interest in and occupancy of the lands; and they also wish to avoid, as far as possible, the presence of any disturbing elements in their immediate neighborhood.

The deprivation of the immunities heretofore enjoyed by them does not take effect until the expiration of ten years from June, 1871, the date of the imperial decree. Within that it is their desire to dispose of their property in Russia, and remove to a country where they may enjoy civil and religious liberty; and they have selected the United States as a place where they can most fully realize such freedom.

In order, however, to enable them to obtain possession of lands in a compact body, some concessions must necessarily be made from the present requirements of the land laws. I would respectfully suggest that the Secretary of the Interior be authorized to withdraw from sale or entry such lands as they may desire to occupy, for a term of years long enough to enable them to emigrate to this country and settle thereon, and to dispose of such lands to those persons among the emigrants who shall make the proper entry or purchase thereof in accordance with existing laws. Should they desire to settle within railroad limits, the authority should enable the withdrawal, in like manner, of the alternate sections belonging to the Government. It is possible that the entire body of the emigrants may not desire to locate in one colony but would prefer the selection of two or more colonies or locations. It would be well, therefore, to confer such discretion on the Secretary of the Interior as would enable him to meet their views in that regard. The entire area they will probably require will be about 500,000 acres."

THE HULL DOCK COMPANY'S NEW OFFICES.

The wealthy corporation who own the extensive docks at Hull, in England, have recently erected a highly ornate building for their offices, of which we present an engraving. The structure stands on a triangular piece of ground, its plan consequently presenting much difficulty, especially as a maximum accommodation was required upon a comparative limited area. The architect, by designing the building to follow the outline of the complete site, has utilized the whole area, and obtained space for a central court for light and ventilation. There being much water in proximity to the site, the Italian style of architecture, of the Venetian type, has

square standards at intervals, capped by escutcheons and crowns.

Within the building is an open court; this affords means for thorough ventilation and lighting. The warming and ventilating arrangements are effected by means of a fan, worked by a small steam engine.

Labor and Machinery.

The rapid introduction of steam power and machine labor into all branches of trades and industries shows how capital, availing itself of invention, science, and steam and animal power, is daily gaining an advantage over labor. When

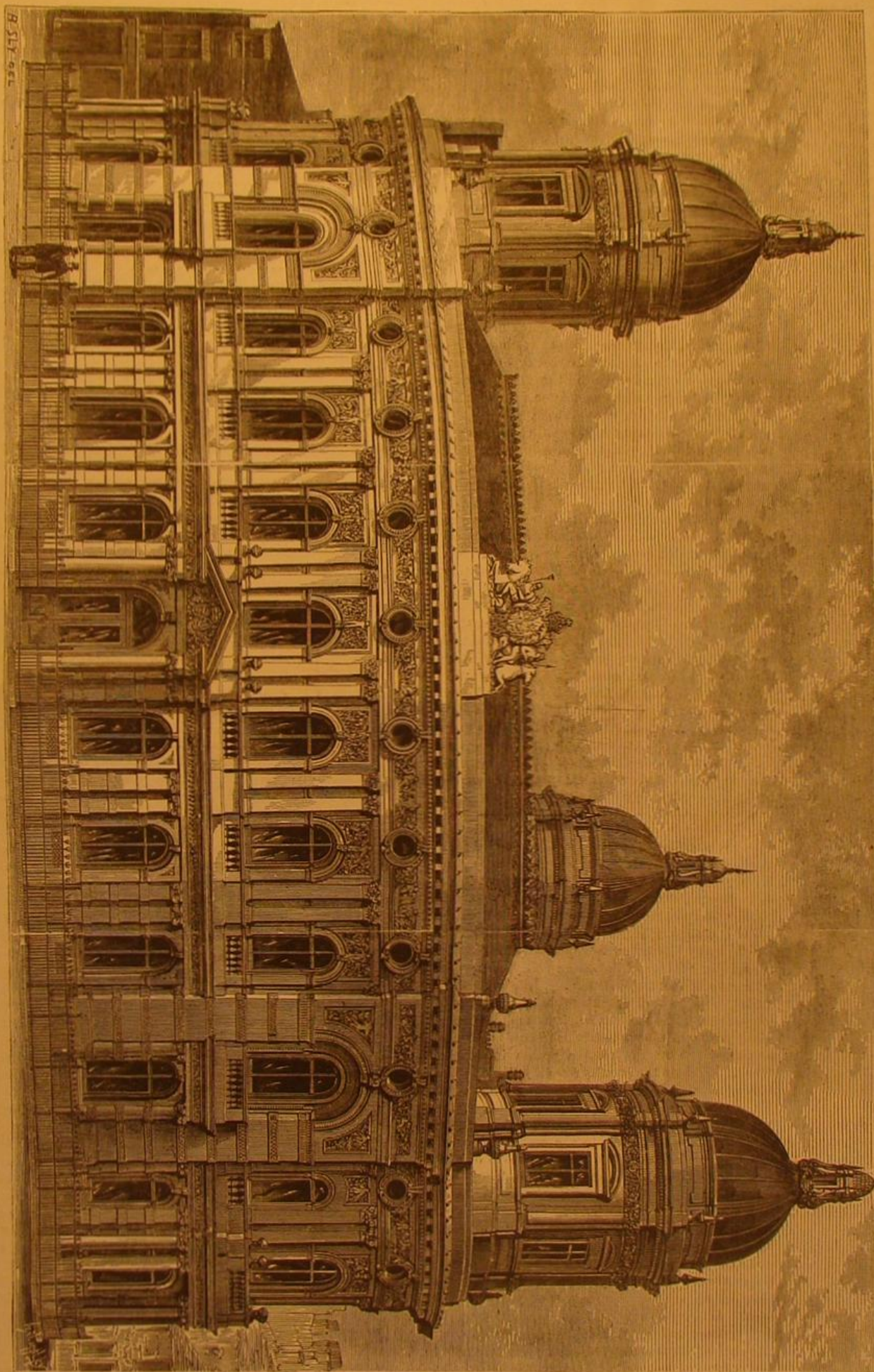
be to some extent relieved from muscular toll and from need of it at the same time. But before that time comes, the process of re-adjustment must be attended with serious disturbance. Every day is changing the field of labor, putting more upon the machine and less upon the man. If, as is claimed, the expansion of industry and production shall make room for labor in a higher position, requiring more skill and returning a better reward, the final result will be only beneficial. How this is to be done without some convulsions remains to be seen.—*American Builder*.

Secondary Currents and their Applications.

BY M. G. PLATE.

In pursuing the study of the phenomena presented by secondary couples with plates of lead, I have made the following observations: The chemical modification of the electrodes, which constitutes the source of the secondary current, is rendered more complete by alternate charge of the primary current in two directions, with repose between this double action. By the successive action of the primary current in two directions, the deposits of oxide are reduced, and the electrodes are modified in their molecular constitution not only at their surface but in their mass. By rest, the deposits formed on the surface of the plates, whether the deposits be of metallic oxides or of reduced metal, acquire a crystalline texture and strong adherence which contribute to protect the sub-adjacent deposits tending to form themselves under the continued action of the primary current. By following this course of operation, which I have termed the formation of secondary couples, deposits of great thickness may be obtained, admitting in the discharge of calorific effects more or less prolonged. A secondary couple, having less than five and a half square feet surface, charged under the foregoing conditions by two Bunsen elements, will redden a platinum wire of 0.02 inch diameter during twenty minutes, and a wire of 0.008 inch diameter for about an hour, without any communication with the primary source, even forty-eight hours after charging. A battery of 16.5 square feet surface, equally well charged, preserved sufficient of its charge to redden a platinum wire for some minutes a month after charging. Although the formation of the secondary couples necessitates the use of two Bunsen couples, of which we change the direction, with intervals of repose, in order to give the deposits time to take a crystalline aggregation, once this operation is effected, it is no longer necessary to change the direction of the current, and the secondary couples can then be charged by the aid of a very feeble primary current acting constantly in the same direction, such as that furnished by a sulphate of copper element, even mounted with water around the zinc. The chemical work produced by this feeble pile accumulates slowly, but nearly without loss, in the secondary couples, and there will be received, in the discharge, effects of an intensity infinitely superior to that of the primary source. These observations facilitated the several applications of the secondary currents that I have already mentioned, and have led me to construct the apparatus that I have the honor to submit to the Academy. It consists of a small couple perfectly prepared, or formed, contained in a box, of which the base and sides carry a system of connections arranged so as to redden a platinum wire, and to ignite, by simple pressure of a finger on a metallic touch, a wax candle, spirit lamp, or gas jet. The battery intended to put the apparatus in action consists of three elements of zinc and water, copper and sulphate of copper, and copper, and is placed at a distance or near the apparatus. It is not necessary to maintain the secondary couple constantly *en charge* under the action of the battery; for, once charged, we can produce a hundred consecutive ignitions. The ignition of a wax candle can be produced instantly, and such method of

NEW OFFICES FOR THE HULL DOCK COMPANY ENGLAND



been adopted for the building, which is arranged with three façades, corresponding with the frontages. The main façades are connected with each angle by short circular façades, but having projecting porticoes, with detached Ionic columns, on the ground floor, which serve as buttresses to towers and cupolas surmounting these angles.

The entire building is faced with selected Ancaster stone, excepting the principal sculptures, which are of Portland, and the basement, which is of Bramley Fall. The roofs are covered with Westmoreland slates. The whole structure is surrounded by an iron railing, the uprights formed of ornamental tridents and harpoons placed alternately, with solid

this aspect of the case was first presented, and the laborer by instinct, as it were, denounced the machine that excelled him both in quality and amount of labor, he was met by a sharp denial that machinery prejudiced his chances for a livelihood. It was asserted that the only effect would be to change his mode of employment, to relieve him from slavish drudgery, to quicken his intelligence by illustrating the triumphs of mind, and to elevate him from a mere beast of burden to the presiding spirit over the powers of nature. Within certain limits, all this is true. In that new and golden age, when all the relations of society are properly adjusted to the true standard, it may be that every man will

ignition is very economical and safe. The apparatus may be employed with electric bells in such a manner as to use only three cells of a sulphate of copper battery, being placed in a derived circuit from the primary and in direct communication with the two poles of the battery. It appears that, during the charge of a secondary couple under the action of a battery in whose circuit occur one of several bells, the couple absorbs all the current, and prevents the use of the bells; but, as the secondary couple acquires, under the influence of the battery, a high temporary intensity, it results that it does not act as an inert derived circuit, but itself contributes to the action of the bells. Further, if the battery

is rendered too feeble to work the bells, the secondary couple is capable, by the electricity which it accumulates, of putting them in action. By a combination of the apparatus, not only may sound be produced, but light may be obtained at the same time.—*Comptes Rendus*.

Correspondence.

The Treatment of Cancer by Pressure and Iron.

To the Editor of the Scientific American:

Pressure is supposed to act beneficially in cases of cancer by diminishing the supply of blood, and consequently of nourishment to the tumor, by preventing the growth of the cells by depriving them of the necessary space, by injuring them from direct violence, and by promoting absorption. The credit of this discovery is due to the writer of this. Although there were many who doubtless had some vague glimmerings of the truth, yet none ever put their ideas into practice. The number of cases subjected to the pressure system alone was nineteen. Of these, seventeen were cancer of the breast, and two, ulcers of the cheek and upper lip. Twelve cases terminated by cure, and five were considerably benefited, the two cutaneous ulcers being somewhat improved. The majority of the tumors were hard, irregular, tuberculated, and the seat of great pain. Six of them were ulcerated and discharged ichorous pus. Even in the worst cases, the tumor diminished in size, but the patients fell victims to the constitutional disorder.

So favorable results attracted but little attention, and almost all my resources were exhausted, and I was afraid that I would have to give up any further experiments, when I attracted the attention of M. Récamier, of the Hotel Dieu, Paris, who consented to go on with my experiments. One hundred cancerous patients were selected, on whom the pressure system was employed; sixteen appeared incurable and underwent a palliative treatment. Thirty were completely cured by compression alone, and twenty received considerable benefit from it; fifteen were radically cured by extirpation and pressure combined, and six by compression and cauterization. The compress used was made by using strips of soap plaster and adhesive plaster. Since then, I have used soft rubber balls, three quarters full of air or water, binding them on the ulcer with a common form of bandage. The artery feeding the cancer must be compressed by a spring truss, and great care must be taken that no ulceration of the artery ensues. A caustic plaster may be used to advantage under the ball, where the cancer is small.

Give the patient carbonate of iron, of which the dose is from 6 to 12 grains. Keep the bowels open; and if suffering great pain, use hydrate of chloral. The diet must be carefully attended to, and stimulants may be freely employed. In every place where this treatment has been pursued, every case has been cured with but one exception. Iron has been cried down, and been as little used as possible of late years; but it exerts a great influence on cancer, and kills the cancer cells that may exist in the blood and allows no other cells to gather. I have just received a letter, from a gentleman of high standing in medical circles, in which he assures me that he has used iron in the form of the carbonate, and that in every case it has effected a cure. GEO. W. BAILEY, M. D.

Two Wrinkles.

To the Editor of the Scientific American:

Mechanics who want small gig saw blades will find that the steel springs of which hoop skirts are formed will make capital ones of any lengths; and they vary in width so as to be suitable for a variety of uses. They can be jointed straight by brazing, and then they make capital band saws.

I would suggest the investigation of the practicability of weaving covers for umbrellas, of a circular form, with a selva around. The invention of a loom to produce such work would furnish ample study for an ingenious man, and would probably lead to fortune. WM. P. HOPKINS, Lawrence, Mass.

The Interplanetary Telegraph.

To the Editor of the Scientific American:

Officers of the United States Coast Survey have long been accustomed to converse together at stations over 100 miles apart, by long and short flashes of sunlight reflected from the surface of a mirror. Similar signal lights are occasionally used at sea.

1. Any cryptogram, hieroglyphic, or signal flag alphabet is readily solved by modern ingenuity, often without a key. We may safely assume that any race of beings, who have developed a superior civilization to our own, would be able to interpret Morse signals, if their attention was once attracted thereto. That such beings exist, we infer from the fact that our sun is only a second rate yellow star, of comparative insignificance.

2. Light is the only means of communication available or possible for traversing space.

3. It is therefore probable that light messages are even now passing around us in every direction, between the inhabitants of different stellar systems.

Let us assume, for example, that the huge planets which travel around Sirius or Procyon are peopled by intelligences slightly more advanced in science than ourselves, and that they communicate with Uranus or Neptune in the manner supposed. It is evident that we need only a large telescope wherewith to verify the existence of such a conversation, in order to join in it with manifest profit to ourselves. In such a case we should select the simplest telluric language, perhaps the "modified English" of Minister Arimori Mori. Our stellar correspondents would perceive a flash of light

from each metallic element in turn, followed by its English name in Morse signals. Wherever in the universe these light rays might impinge upon the object glass of a telescope, there the observer would become aware of the existence of an inquisitive humanity.

One objection to my project of an interstellar telegraph is the insufficient swiftness of light, only 186,000 miles per second. Thus no less than four hours are required to send a message to Neptune, and three years are necessary to send a signal from our earth to the planets of a neighboring star. The same length of time must elapse before receipt of an immediate reply. SAMUEL H. MEAD, JR., New York city.

Scientific Prophets.

Under this heading the New Orleans *Picayune* very tersely gives the results of the labor of the learned scientific Americans who lately met in Portland, from which it would appear that the prospect of the denizens of this sublunary world is not of the most cheering character.

"Professor Young tells us that the sun is nothing but a gigantic spherical mass of gaseous matter, which is constantly being contracted by the gradual cooling of its outside circumference. The central kernel of this huge star will always, according to the learned Professor, finally be crushed over with a thick, impervious coating, through which neither light nor heat can possibly reach us. The result, as far as we are concerned, will be total darkness, intense cold, the end of animal life, and a return to primeval chaos.

"General Barnard—another scientific seer—compares the earth to a hollow india rubber ball filled with molten lead. The spherical shape of our globe being the result of its rapid rotary motion, any accident such as the bursting up of some great volcano, the shock of a comet or of a meteoric body, would open a vent through the thin rind upon which we live whereupon the incandescent matter would at once project expiring humanity into vacant space.

"Professor Walling denounces the sun as a spendthrift who wastes with stupendous folly his inheritance of heat and light, and who, thanks to his prodigal habits, is fast progressing towards that bourne whence no traveller returns—the bankruptcy court.

"Professor Franklin Hough draws it more mildly, as he only threatens us with the total disappearance of water, owing to the wanton destruction of trees and forests.

"Professor Le Comte has paid special attention to insects, and warns us that their frightful increase will ultimately lead to the total destruction of the vegetable world, after which man himself will become their prey. The earth will then be a gigantic parish of Plaquemines, in which the mosquito tribe will rule supreme, until some other equally noxious vermin shall arise and devour them."

This cheerful *résumé* of the labors of our American savans indicates, adds the *American Builder*, that the human race is decidedly in a tight place. If the sun is to go out like a snuffed candle and the earth to explode like an old steam boiler, we may as well overlook the lesser contingencies of rainless years and the universal prevalence of vermin. *De minimis non curat scientia*

Impure Water.

Public attention cannot be too often called to the danger of using impure water in households. The origin of typhoid fever, which so frequently runs through families in city and country, is oftener in wells and springs than is supposed. In cities it is easy to understand, when aqueduct water is not supplied, how wells may become contaminated, but for many it is not so easy to see how wells in the country, among the hills or in the green valleys, can become so impure as to be sources of disease.

Since the general introduction of aqueduct water into large cities, typhoid fever has become more common in the country than in the city, and this disease is certainly zymotic, or one which results from a poison introduced into the blood. Wells in the country are very liable to become contaminated with house sewage, as they are generally placed, for convenience, very near the dwelling, and the waste liquids thrown out upon the ground find easy access by percolation through the soil to the water. The instances of such contamination which have come to our notice, and which gave rise to fevers, are numerous. The gelatinous matter, which is often found covering the stones in wells affected by sewage, is a true fungoid growth, and highly poisonous when introduced into the system. It is undoubtedly concerned in the production of typhoid fever. How it acts it is difficult to determine, but it is at least conceivable that the spores of the fungus may get into the blood and bring about changes after the manner of yeast in beer. These spores, as is well known, develop rapidly by a kind of budding process, and but a little time passes before the whole circulation becomes filled with them, giving rise to abnormal heat and general derangement, called fever. These fungoid or confervoid growths are always present in waters rendered impure by house drainage, and great caution should be used in maintaining well waters free from all sources of pollution.—*Boston Journal of Chemistry*.

MOTH PREVENTIVE.—The following recipe for keeping moths out of clothing is a favorite in some families: Mix half a pint of alcohol, the same quantity of spirits of turpentine, and two ounces of camphor. Keep in a stone bottle, and shake before using. The clothes or furs are to be wrapped in linen, and crumpled up pieces of blotting paper dipped in the liquid are to be placed in the box with them, so that it smells strong. This requires renewing about once a year.

Electrical Metallurgy.

Specifications of the English patents of R. Werderman, C. E., have lately been published, which are interesting as presenting a new application of electricity to the arts. This new purpose, to which electricity lends its aid, is to the reduction of metals from their ores, and the refining and purifying of the reduced metals, without the ordinary chemical action of carbonaceous matter, the purifying and refining taking place at the same time and by the same process, during the reduction from the ore. The ores, that is to say, oxides, sulphides, carbonates, or other combinations in which the metals exist in Nature, are first crushed, and then heated in a suitable furnace or retort. After the whole charge is raised to a red heat, two pieces of carbon or platinum, or some other suitable material which conducts electricity, are plunged in the crushed ore. These two pieces are connected by platinum or other suitable wires or ribbons with the two poles of a galvanic battery or magneto-electric machine. The electrical action and chemical decomposition which then take place may be seen from the following equations, which are given for the purpose of illustration, and are arranged in the order for their elimination:

	Negative pole.	Positive pole.
Oxide of zinc.....	ZnO	Zn O
Red oxide of copper.....	Cu ₂ O	2Cu O
Plumbic oxide.....	PbO	Pb O
Sesquioxide of manganese.....	Mn ₂ O ₃	2Mn O+O+O
Loadstone.....	FeOFe ₂ O ₃	5Fe {SO ₂ , As ₂ O ₃ , Ph ₂ O ₃ , SiO ₂ , SiO ₃ , CO ₂ }
Hematite.....	Fe ₂ O ₃	2Fe {SO ₂ , As ₂ O ₃ , Ph ₂ O ₃ , SiO ₂ , SiO ₃ , CO ₂ }
Brown hematite.....	2Fe ₂ O ₃ ·3H ₂ O	3Fe {SO ₂ , As ₂ O ₃ , Ph ₂ O ₃ , SiO ₂ , SiO ₃ , CO ₂ }
Spathic iron.....	FeCO ₃	Fe {SO ₂ , As ₂ O ₃ , Ph ₂ O ₃ , SiO ₂ , SiO ₃ , CO ₂ }
Sulphide of zinc (blende).....	ZnS	Zn S
Subsulphide of copper.....	CuS	{Cu} CuS
Sulphide of nickel.....	Ni ₂ S	2Ni {SO ₂ , As ₂ O ₃ , Ph ₂ O ₃ , SiO ₂ , SiO ₃ , CO ₂ }
Bisulphide of iron (pyrites).....	FeS ₂	Fe 2SO ₂
Manganous carbonate.....	MnCO ₃	Mn CO ₂ +O
Carbonate of zinc (calamine).....	ZnCO ₃	Zn CO ₂ +O

The reduction of iron ores may be effected either in the usual manner in the melting furnace with carbonaceous matter, or in a reverberatory furnace with some suitable flux only. The best ore for this purpose is the hematite, because it is a good conductor of electricity. As soon as the oxide begins to flow, the reduction takes place, and all noxious elements are eliminated in the following order, viz: sulphur, arsenic, phosphorus, titanium, silicon, carbon.

By regulating in a suitable manner the electromotive force and the intensity of the electric current, and stopping it at the proper moment, cast iron, wrought iron, or steel can be produced directly from the furnace without any intermediate operations. This puddling by means of an electric current will occupy from 10 to 15 minutes only, instead of several hours as in the ordinary puddling by hand labor or machinery, and consequently a great saving of time will be effected.

The entire liberation of the electro-negative elements is in some cases not effected immediately, but an intermediate transformation of the ore takes place. For instance, in treating the subsulphide of copper, this ore does not conduct electricity at the ordinary temperature, but at 230° Fahrenheit it becomes a very good conductor; copper is then produced at the negative electrode or pole, and at the positive pole sulphide of copper is formed, which, being a good conductor at a lower temperature, is now entirely decomposed and converted into metallic copper. A great difficulty in the reduction of plumbic oxide in the usual process consists in the formation of silicate of lead, due to the presence of silicates mixed with the ore. This difficulty is entirely overcome by the application of the electrical current for the formation of the silicate of lead, which is readily fusible and is no obstacle; and all ores rich in silicates, which could not be treated till the present time, can now be employed for the extraction of lead.

Instead of treating the sulphides and carbonates and other more complicated combinations directly by the electrical current, such ores may first be converted into oxides by roasting them in the usual manner for some time in contact with atmospheric air or oxygen.

While the metal is being reduced, all impurities and noxious elements mixed or combined with it are eliminated, so that finally the metal is collected perfectly purified and refined.

In purifying metals, the removal of the metals or metalloids which are to be eliminated is effected either in a melting furnace or in a crucible or converter or puddling furnace. Two pipes of fire clay are dipped in the molten metal. Two hollow cylinders of carbon or platinum or other suitable matter are fixed inside the clay pipes at the end immersed in the molten mass. To the carbon or platinum cylinders are attached two platinum wires or ribbons, which run up inside the clay pipes and are connected directly or by means of copper wires to the two poles of a galvanic battery or magneto-electric machine. To prevent the development of heat in the battery or magneto-electric machine, the connecting wires pass through a cooling apparatus. Instead of hollow cylinders of carbon or platinum, solid cylinders or sheets, or any other suitably shaped pieces, of carbon or platinum or other suitable matter can be used; in the latter cases, space must be left between the said pieces and the fire clay envelope, to permit the eliminated metals or metalloids to be volatilized and to escape through the clay pipes, and to be collected in a suitable vessel, in which they are converted either into the liquid or solid state or into salts, in bringing them in this *statu nascendi* in contact with any suitable matter to which they have great affinity.

About Dyspepsia.

Sufferers from this horrible malady will find some of their own feelings described in the following article from the December number of the *Oerland Monthly*:

Did you ever have the dyspepsia? Did you ever have—or ever imagine you had—a complication of all known, and several unknown diseases? If yes, then you have had the dyspepsia, or its full equivalent. Chronic dyspepsia may be defined as an epitome of every complaint wherewith transgressing mortality is scourged. It is as nice a thing to have about you as a trunkful of tarantulas, with the trunk lid always up. An eminent English physician has said: "A man with a bad dyspepsia is a villain." He is, and worse. He is by turns a fiend, a moral monster, and a physical coward—and he cannot help it. He is his own bottomless pit, and his own demon at the bottom of it, which torments him continually with pangs indescribable.

When a worm of the business dust of this world has writhed with the dyspepsia until it has assumed a virulent chronic form, who shall find colors and abilities varied enough to paint his condition? His blood becomes first poverty-stricken, then impure, and, as "blood will tell," every part of his system is contaminated by the foul stream. The brain complains bitterly on its own account, and vehement complaints are being continually sent up to it from the famishing liver, bowels, spleen, heart, and lungs. Like "sweet bells jangled out of tune," the entire organization breathes discords. Even the remote toes telegraph up to the brain: "We are starving down here; send down some provender." The brain makes requisitions on the stomach, which are futile. The stomach is powerless to provide, and the brain cannot transmit. At times all the starving organs conspire together, suspend work and undertake to compass by riot what they fail to get by appeal. Then life trembles in the balance. Then the consolation—O, the consolation!—that is visited on the dyspeptic. Friends—when he is lifeless from lack of vitality—friends will exasperate him with taunts of being "lazy," "shiftless," "indolent," and "without ambition!" Nor can his friends be made to appreciate that it is as preposterous to expect one who is undergoing constant torture and consequent exhaustion to have "ambition" as it would be to expect a corpse to have an appetite. Remedy: everybody's advice—that is, ride everybody's hobby. Cure: death. Drugs are but aggravations, and "bitters" are bitter indeed we have heard of a chronic dyspeptic who took his cue from his chickens, and by swallowing daily a moderate handful of gravel stones of the size of a pea downward, finally succeeded in transforming "cue" into "cure." He claimed complete restoration. In the face of this evidence to the contrary, we re-assert that, for chronic dyspepsia in its worst form, there is but one certain cure—absolute rest. Preventive: take as good care of the coats of your stomachs as you do of the coats of your backs. Do you wish for faith in God, in human love, in earthly happiness, in the beneficence of Nature, and in immortality? Keep your digestion vigorous; on that bangall of these. Would you prefer an abiding faith in tortures unspeakable, in horrors inexpressible? Destroy your digestion. Would you live in the body for ever? Keep your digestion in full vigor; and although the end of the world may come, your end will not come—you will have to go after it. Old age is but the failure of nutrition. Nutrition is life; non-nutrition is death.

Spontaneous Combustion of Hydrocarbon Vapors.

During the years 1870, 1871 and a portion of 1872, at the Wood Preserving Works in San Francisco, Cal., several instances of spontaneous combustion occurred, accompanied by explosions of hydrocarbon vapors. Mr. I. C. Woods, manager of the works, at the last meeting of the California Academy of Sciences, gave the particulars of some of these accidents and a statement as to the remedy successfully applied. The hydrocarbon vapors used for the preservation of wood are obtained by the distillation of coal tar. A brick pit is attached to each two stills, to hold the hot pitch product as it runs from them. This pit has an opening in the side for access and a ventilating chimney through which the vapors from the pitch pass off into the atmosphere. The opening for access to the pit is closed by an iron door. The tar used is made at the gas works in that city. The stills used have a capacity of from 1,200 to 1,800 gallons.

In the progress of the work, the still containing the coal tar is run until the thermometer on the top, near the man hole, indicates a heat of 420° Fah., when they cease firing. The still and contents are then allowed to stand and cool until the thermometer indicates a heat of from 200° to 212° Fah. At this heat the liquid pitch is allowed to run from the still into the pitch pit; as it cools, it becomes solid. From the time the thermometer in the still indicates a heat of 420° Fah. until after the time of letting out the pitch, the corks remain open in the vapor pipe connecting the still with the wood-preserving tank.

Until April, 1873, this letting out of the hot pitch was attended with danger of fire, because of the tendency of its vapors to spontaneous combustion. If running the still daily, such accidents would occur three or four times a year. The vapors from the pitch in the pit, as they passed out of the ventilating chimney, were yellow, being the vapors of the naphthalin oils contained in the coal tar. The combustion would take place after the pitch had been running freely from the stills for some minutes. It was always accompanied by an explosion, loud enough to be heard across the street, and strong enough to force away the wooden braces placed against the iron door. Pieces of timbering in the pitch would take fire and burn until extinguished.

From the time the fire is extinguished under the stills to

the time of letting out the pitch, there is always an interval of fourteen hours. The furnace of the still is always closed with an iron door and clayed up. There is a strong draft up the chimney of the still. The top of the ventilating chimney of the pitch pit is as high as that of the fire chimney of the still; and there is always a strong draft up this chimney through the crack between the iron door and the brick work of the pitch pit. A person standing at the iron door would not smell any of the vapor of the pitch. The distance from the outlet of the pitch pipe of the still to the furnace door of the still is not less than twenty-two feet. At the time of the last explosion, the furnace of the still had been carefully examined before the pitch was let out; no remains of fire were found there, nor was there any other fire in the building. The hour was 10 A. M., on Sunday, the works not being in operation.

This property of heated hydrocarbon vapors to spontaneously ignite after absorbing a certain quantity of atmospheric air is not generally known. The remedy devised by Mr. Woods is simple and complete. It consists in the introduction of a small quantity of water into the pitch pit while the pitch is running from the still. The hot pitch vaporizes the water, the yellow vapor from the chimney is changed to white vapor, and the desired safety is obtained. Too much water must not be put into the pit at one time, or the pitch will boil over: not a dangerous but a troublesome result.

Mr. Woods had noticed that the hydrocarbon vapors would eat away in holes the seat and valves of composition globe valves; and whenever this took place, steam was liable to leak into the wood-preserving tank during the process of vaporizing the wood. He noticed that, whenever the steam did so leak, the influence of the hydrocarbon on the wood was destroyed. This led him to try with success the experiment of the effect of steam on the vapors of the pitch. Since April 28, 1872, when the remedy described was first applied, not a single explosion has occurred at the works. The water is applied through a half inch iron pipe, connected with the city mains and regulated by a cock. Mr. Woods has reason to believe that the vapors from a combination of coal tar and petroleum are more liable to spontaneous combustion than the vapors from coal tar alone.—*Mining and Scientific Press*.

Magic Squares.

BY L. G. BARBOUR.

I will give three positions of a square of four figures to a side:

First position.	Second position.	Third position.
1 5 9 13	1 8 12 13	1 8 12 13
2 6 10 14	2 7 11 14	14 11 7 2
3 7 11 15	3 6 10 15	15 10 6 3
4 8 12 16	4 5 9 16	4 5 9 16

The second position is obtained from the first by inverting the two middle vertical columns, and the third from the second by inverting the two middle horizontal columns. It will be observed that, in the third position, each vertical column, each horizontal column, and each diagonal column sums up 34.

In a square of eight figures to a side, invert the four middle vertical columns, and then the four middle horizontal columns.

In general, invert the middle half of the vertical and horizontal columns.

After discovering this rule, I applied it to a square of twelve figures to a side, and so simple is the process that I wrote down not the first position or the second, but the third, at the very first dash, and without mistake. I subjoin one with eight figures to a side, so that the application of this principle may be seen:

Third position.
1 9 24 32 40 48 49 57
2 10 23 31 39 47 50 58
59 51 46 38 30 22 11 3
60 52 45 37 29 21 12 4
61 53 44 36 28 20 13 5
62 54 43 35 27 19 14 6
7 15 18 26 34 42 55 63
8 16 17 25 33 41 56 64

The sum of each row is 260.

The reader may try his ingenuity in constructing as many tables as he pleases. Ascertain beforehand what each column should sum up, by the usual method of arithmetical progression. Thus: the sum of the series 1, 2, 3, 4, 5, etc., to 64, is $\frac{65 \times 64}{2} = 2080$. Dividing by 8, the number of vertical or horizontal columns, we get 260 for the sum of each.

For the series 1, 2, 3, on to 144, briefly, each vertical column $\frac{145 \times 144}{2 \times 12} = 145 \times 6 = 870$.

I found a square of six numbers to a side rather harder, and one of five to a side quite troublesome. The reason was that the above method is not applicable. By approximating it, however, as nearly as practicable, and then using tentative means toward the close, I succeeded in both cases.

These tables are not useful in the ordinary sense of that term; they do not teach us how to measure corn cribs or survey farms; but they may interest pupils in arithmetic, and may cultivate the necessary but irksome art of adding up columns of figures. Let the teacher take an ordinary checker board some winter evening, cut out of card or leather sixty-four men, namely, round pieces of the size of a nickel; number them from 1 to 64, and set the boys and girls to work to construct a magic square. My word for it they will go at it with an interest such as the rule of three has failed to awaken.—*Home and School*.

Atmospheric Refraction.

At a recent meeting of the Manchester Literary and Philosophical Society, a paper on this subject was read by David Winstanley.

Mr. Baxendell has noticed the fact that at the moment of the departure of the sun below the horizon, the last glimpse is colored bluish green. Dr. Joule also observes that on two or three occasions he had himself noticed the phenomenon in question, and that, "just at the upper edge where bands of the sun's disk are separated one after the other by refraction, each band becomes colored blue just before it vanishes."

During the past eighteen months the writer, from his residence in Blackpool, has had frequent opportunities of observing the setting sun, and has noticed the phenomenon of the final colored ray certainly more than fifty times. To the naked eye its appearance has generally been that of a green spark of large size and great intensity, very similar to one of the effects seen when the sun shines upon a well cut diamond. The color, however, is by no means constant, being often, as in the case of Mr. Baxendell's observation, bluish green, and at times, as mentioned by Dr. Joule, quite blue. The period of its duration, too, is likewise variable. Sometimes it lasts but half a second, ordinarily perhaps a second and a quarter, and occasionally as much as two seconds and a half.

When examined with the assistance of a telescope, it becomes evident that the green ray results at a certain stage of the solar obscuration, for it begins at the points or cusps of the visible segment of the sun; and when the "setting" is nearly complete, extends from both cusps to the central space between, where it produces the momentary and intense spark of colored light visible to the unaided eye.

"Respecting the increased range of colors seen when the phenomenon is observed with telescopic aid, I may mention that, on the 28th of June, the sea was calm and the sky quite cloudless at the setting of the sun. Of the final colored rays, fifteen diameters showed the first to be a full and splendid yellow, which was speedily followed by the usual green, and then, for a second and a half, by a full and perfect blue. Respecting the increased duration of the color, I have found that, when the atmosphere is sufficiently favorable to allow a power of sixty diameters being employed, with a 3 inch object glass, the green effect is seen at that part of the sun's limb in contact with the horizon, even when one half the sun is still unset, and of course from then till final disappearance.

The different colors seen, together with the order of their appearance, are suggestive of the prismatic action of the atmosphere as the cause of their production, and the interception of the horizon or the cloud as the cause of their separation.

Assuming the correctness of this view, it becomes evident that an artificial horizon would prove equally efficacious in separating the colored bands, and also that, if employed during an inspection of the sun's lower limb, the least refrangible end of the spectrum would be disclosed. Accordingly, I introduced into an eyepiece of my telescope a blackened disk of metallic copper, having a slit cut in it of about the one hundred and fiftieth of an inch in width, and proceeded to make an observation, in July, when the sun was about one half of its meridian height. The blinding glare, however, of that portion of the sun seen through the slit, rendered the observation futile. By projecting a large image of the sun into a darkened room, I was enabled to get the whole of the spectrum produced by the prismatic action of the atmosphere in a very satisfactory manner. In this case, a semicircular diaphragm was used, so placed that its straight edge divided the field of view into equal parts, from one of which it obscured the light. The diaphragm was placed as before in the focus of the eyepiece, and by rotating it every portion of the sun's limb could be in turn examined, and that too in the center of the field, so as to be equally subjected to the minimum of the peculiarities of the instrument. When the sun's lower limb was allowed to descend into the field of view, the first rays were intensely red. After a momentary duration, they gave place in succession to orange, yellow, and green, which were then lost in the ordinary refulgence of the sun. The upper limb gave green, blue, and finally purple, which latter color I have thus far never seen on the natural horizon. It should be remarked that the colors seen were vivid and unmistakable, and each one of them detained at will, or the whole phenomenon recalled, by the adjusting screws of the instrument. I apprehend that the results here given sufficiently prove that atmospheric refraction is the cause of the colored rays seen at the moment of the sun's departure below the horizon. I have, however, thought it worth while to examine the light proceeding from the moon's limb by the aid of the artificial horizon, and of course by direct observation. The results were decisive and satisfactory, the spectral colors being easily observed. The green effect I have also frequently seen on the departure of the moon beneath the edge of a dark and well defined bank of clouds. Telescopic aid has, however, in every instance been required.

The rapid changes in color observable in the case of almost any large fixed star at an elevation of twenty or thirty degrees above the horizon, and which changes vary between red, green, and blue, may I think be fairly attributed to the same cause as the color in the sun's final ray. Particles of dust floating in the air act, I apprehend, for the moment, in the capacity of diaphragm or horizon, and thus enable the eye to perceive, even in the light of the stars, the prismatic action of our atmosphere."

A TREE near a chimney will often cause a down draft of air.

THE UNIVERSAL BORING MACHINE.

Among the tools used in woodworking establishments, few have been more neglected than the wood boring machine. As a general rule, shops otherwise well supplied with labor-saving devices lack this important and useful tool, or, when its want becomes felt, seek to supply its place with an apparatus which, perhaps, partly answers for the special object sought, but which lacks the ingenious contrivance to make it advantageously used or even applicable to a great variety of work.

Our engraving represents the Universal Boring Machine, which, the manufacturers inform us, they have made a special study so as to effect the necessary improvements in order to enable it to meet the wants detailed in many inquiries which they have received relative to its adaptability for different uses. The machine is strongly built of iron and steel, and combines, in the small space it occupies, nearly all the facilities needed for boring large and small holes in any desired angle. It is cast with a heavy solid frame and body, and has two cone pulleys with three faces, for giving the mandrel the proper speeds for different sized bits. The mandrel, which is of steel, is made to traverse by a foot lever. The operator can adjust the leverage in a moment, so as to stop at any desired depth up to 11 inches. The adjustable table has a surface of 21 inches in width with 15 inches slide, and it can be raised or lowered 16 inches, enabling one to bore in the center of 33 inches. Adjustable rests upon the table render the work readily placed at any desired angle in the horizontal plane, while the table top itself can be set on an incline towards the bit to any angle not exceeding 45°, and the same can be raised or lowered, and slid forward or back, preserving the inclination given.

Augers and machine and pod bits of the various sizes can be employed, as an adjustable chuck is fitted to the mandrel for holding the same. The levers are in the inside of the machine, where they are protected, and where no dust and shavings can obstruct their movements. There is no spring connected with these parts to impart return motion, which requires a greater amount of pressure at this point of the operation than is needed to secure a smoothly finished hole.

It will be seen from the foregoing that the machine is ready for doing either light or heavy boring at any angle desired, with ease and, it is claimed, with great rapidity.

It is claimed that, on machines or devices where the stuff has to be moved up to the auger, there is a liability of twisting, of making a crooked hole, and of breaking the bit, especially if knotty or crossgrained material be used; and that the expense of bits would, in a short time, amount to the cost of the present invention.

The countershaft attached to the machine rests in adjustable boxes, and has a tight and loose pulley of eight inches diameter and three and a half inches face, and should make 900 revolutions per minute.

Messrs. Bentel, Marg-dant & Co., of Hamilton, Ohio, the makers of a great variety of woodworking tools, descriptions and illustrations of which have already appeared in our columns, are also the manufacturers of this machine. Letters for farther particulars may be directed to their address.

COMBINED COOKING, HEATING, AND DRYING APPARATUS.

The inventor of the device illustrated in the annexed engravings claims to have succeeded in producing a combination of useful apparatus relating to the operations of cooking, drying, house-warming, and ventilation. To families generally, and more especially to those residing in circumscribed quarters, notably French flats, this invention, it is believed, will prove of much utility, as it is practically a complete kitchen compressed into dimensions no larger than those of an ordinary good sized refrigerator. It serves as a range and, at the same time, as a heating furnace, while it exceeds the capabilities of both in its application to drying fruits, vegetables, or clothes. Paints and chemicals, we are told, may be similarly heated with success, and japanning, it may be added, is accomplished with great facility.

Fig. 1 represents the device with its attachments, and Fig. 2 the interior arrangements, portions of which are depicted as broken away. In the latter engraving, A is the fire box surmounted by an iron plate, B. The smoke and gases from the former pass through a tube, C, in which perforations are made, so that air is thus drawn in, which mingles with and insures the more complete combustion of the products within the hollow iron prism, D. With the latter communicates the chimney flue, E.

Surrounding the portions first described is a shield of sheet iron, F, and outside of this is another envelope, or, as it is termed, deflector,

G. The upper part of the latter is arched and provided with suitable blinged covers. There is also a number of perforations, H, near its upper edge. At I are two sets of orifices in the bottom plate, the inner of which lies between the shield and deflector, and the exterior row without the latter. A double current of cold air is thus constantly drawn in from below (as indicated by the arrows) and between deflector and shield, which, while preventing the atmosphere from direct contact with the heated iron within, maintains a constant and even circulation. The warm current emerges

ted tube, K, is designed to draw in the heavy and foul gases which sink to the floor of the room, thus, it is claimed, providing efficient and healthy ventilation.

Within the case, which may be of wood, marble, or any other suitable material, and on the left is the oven, the bottom of which is so constructed as to deflect the warm air to its sides and top. It is provided with a glass door in order that the process of baking may be watched, and with suitable shelves for the reception of the articles. It is readily removable, and, when in place, rests above the arched portion of the deflector as shown. To the right is a boiler similarly located; on this being taken out and the cover below lifted, the upper surface of the prism is exposed. The latter, together with the plate, B, Fig. 1, serves to receive sadirons for heating, or may be used for any of the culinary operations usually carried on on top of an ordinary range.

For drying fruit, the oven and boiler are removed and iron rods are placed on the ledges, L, Fig. 1. These support suitable shelves on which the material is placed, and which, in the aggregate, give a large amount of heating surface. It is claimed that the ordinary family sized heater will solidify from three to four bushels of fruit in from eight to ten hours, and that the substance gains from 32 to 35 per cent in weight as well as greatly in appearance over common dried fruit. An economy is, besides, effected in the cost of cans, sugar, labor, etc., as it is stated that the flavor and nutriment of the article heated is perfectly preserved.

For clothes drying, rods are provided over which the garments are hung, inside the case. The operation, we are informed, is completed in one and a half hours, during which period the irons may be thoroughly heated, so that the laundress can proceed at once with the pressing as the garments are removed. In baking, the oven is stated to be economical and rapid.

During culinary operations producing smoke, the latter is confined in the casing and passes freely off through the flue. There are no range lids to lift, and breathing the heated fumes arising from an open coal fire is avoided. The device may be adapted to burn either coal, wood, or coke.

Invented by Mr. J. K. Boswell, of Ohio. Applications for territory or for further particulars should be addressed to S. R. Wells, publisher of the *Phrenological Journal*, 389 Broadway, New York city, or to Dr. R. T. Trall, 1,516 Chestnut street, Philadelphia, Pa.

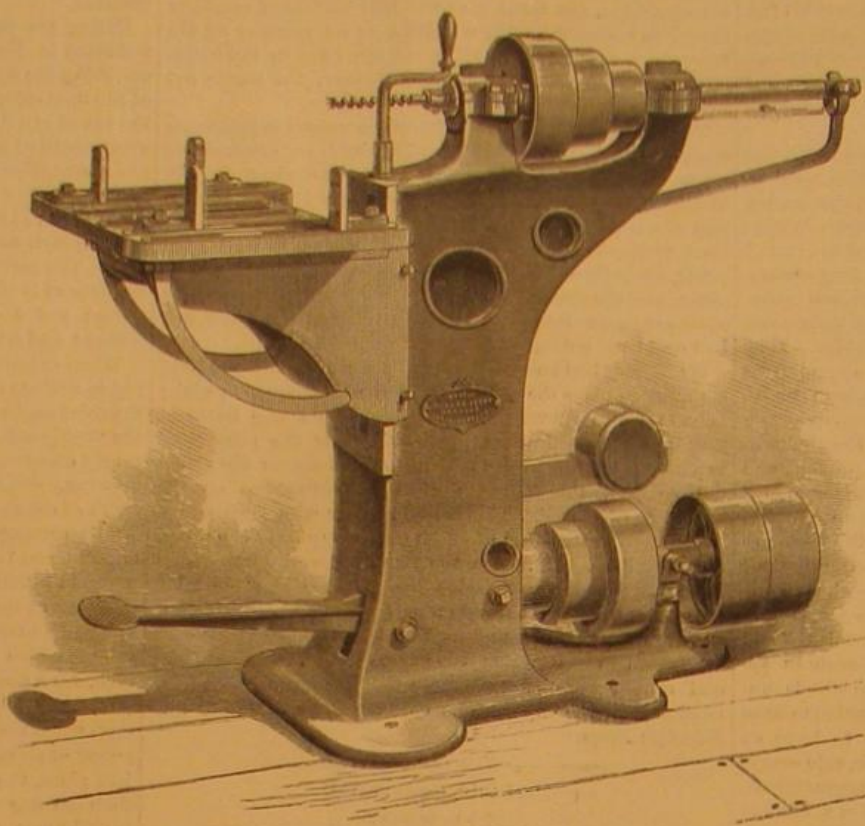
The Inter-Oceanic Canal.

The Secretary of the Navy in his annual report states that the expeditions authorized by Congress to survey the Isthmus of Darien, with a view toward the completion of a canal between the Atlantic and Pacific Oceans, have finished their labors. The preliminary operations to actual construction are therefore completed, and it now remains for Congress to determine whether the route, indicated by the officers engaged for so long in this arduous duty, present sufficient advantages to warrant the undertaking by the Government of this very important enterprise.

Two surveys have been made. The Darien expedition, under Commander T. O. Selfridge, has selected a route including 100 miles of river navigation of the Atrato, which stream has been found to offer a sufficient depth of water for the heaviest class of vessels. Between this river and the Pacific a canal is necessary, 28 miles in length; 22 miles of this distance is over a plain having a gradual rise of 90 feet. Finally, there will be three miles further of open cut, and three miles of tunneling to reach the Pacific. It is estimated that the work will cost from \$50,000,000 to \$60,000,000, and could be completed within ten years.

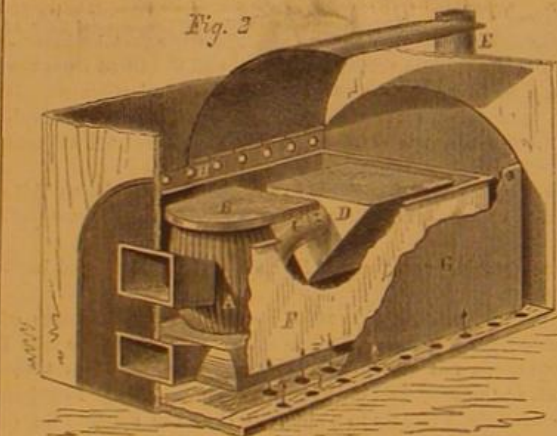
Commander Lull, in charge of the Nicaragua expedition, has determined a practicable route for an interoceanic ship canal, having Lake Nicaragua as its summit level. It is proposed to connect this lake with the Pacific by a canal 10.33 miles in length, beginning at the mouth of the Rio del Medio, and terminating at Brito. The first 7.5 miles will require an excavation averaging 54 feet in depth, and will constitute the most expensive part of the work. Ten locks and one tide lock will be required, and there will be 56 miles of lake navigation.

The San Juan river will be navigated to the mouth of the San Carlos, and will be improved by four dams, in order to get around three of which short canals must be built. From the fourth dam to Greytown, an independent canal 41.9 miles in length is needed. The total length of the canal is 61.74 miles, of which 47.34 miles are an embankment and excavation. No tunneling is required, and it is believed that Lake Nicaragua will supply 38 times the maximum demand of water. The route surveyed by Commander Selfridge seems to be much more direct and easier to construct.

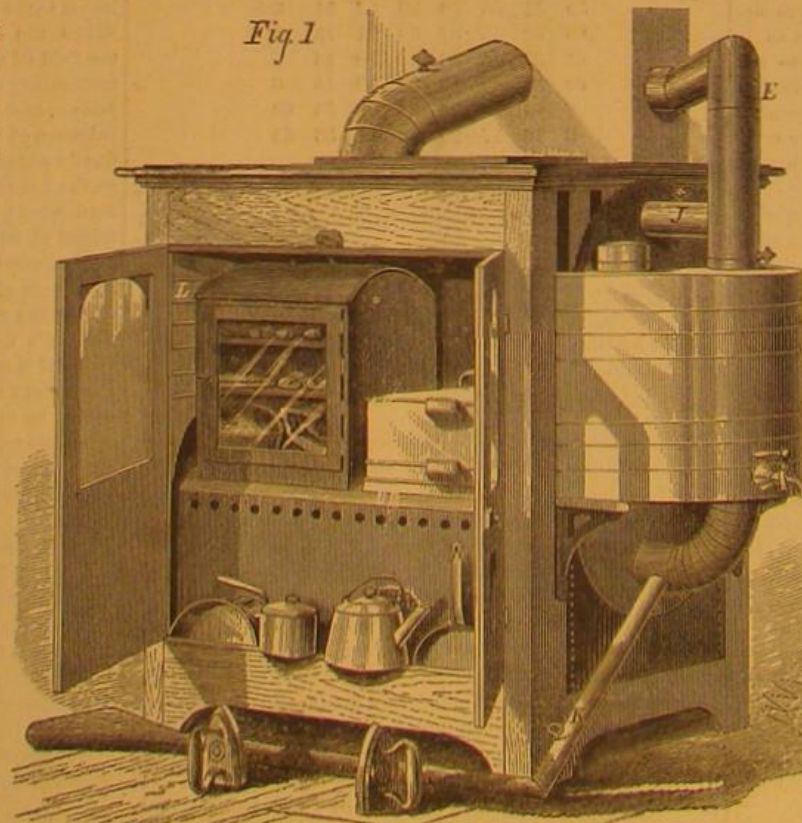


THE UNIVERSAL BORING MACHINE.

at a suitable register in the top of the casing, and, if desired, may be conducted into another apartment by the flue shown. In weather during which it is not necessary to warm the room, the register and flue may be closed, when the current



will escape into the chimney flue by the pipe, J, Fig. 1. The vessel shown surrounding the chimney flue in the last mentioned engraving is a hot water receptacle, and the perfora-



COMBINED COOKING, HEATING, AND DRYING APPARATUS.

DESIGN FOR A CONSERVATORY.

We present herewith an engraving of a conservatory, called by its designer "a cool conservatory in the natural style." It is intended for the cultivation of such specimens (and they are very numerous and beautiful) as do not require stove heat to bring them to maturity, the protection by glass being generally sufficient. Very little artificial heat is enough to keep the temperature in winter at a minimum of three degrees above the freezing point, which is quite sufficient for the period of repose which is required for many of the plants from Australia, China, Japan, New Zealand, and mountainous tropical regions, etc. One can hardly believe what numbers of plants there are, often supposed to belong to tropical climates, with which a cool conservatory can be furnished. Numbers of our beautiful palms would yield to cool treatment; and hundreds of ferns require no better situation than the shelter of glass. The dracaenas, agaves, acacias, dasyliroids, ficus, aralias, barksias, tender conifers like the Norfolk Island pine, yuccas, grevilleas, rhopalas, and the cactuses, would certainly submit to the same treatment, without mentioning the smaller kinds, which only thrive under a low winter temperature.

The experience acquired of the natural style of arrangement in conservatories during fifteen years in Europe, says the *Garden*, enables us to recommend it with confidence.

More than thirty species of palm now flourish in cool houses. A great number grow in the cold regions of tropical mountains, such as the *cerroglon andicola*, which is found at 10,000 feet and upwards. The *oreodoxa frigida*, and several kinds of *chamadorea*, rise up to the pine region; the *areca humilis* reaches to 8,000 feet in Java; the *chamocrops martiana* to 7,800 feet in Nepal; the *phoenix humilis* to 6,000 feet; without reckoning the *chamocrops excelsa* of China, the *rhapis flabelliformis* of Japan, *corypha Australis*, etc. For a winter garden, palms ought to be kept in pots up to the period when their leaves divide and show their character, and their stems become at their base as thick as the arm. They must not be put in the ground before this, nor until they shall have been kept as much as possible in a warm greenhouse where the pots have been plunged in tan. They should be repotted twice a year, in spring and summer, when their growth is rapid, without cutting the roots, and in pots deep and narrow. A quiet and warm atmosphere, somewhat shady, but without stagnant moisture, is best suited to palms when young. Growing ferns have nothing to fear from the open air or the sun; it is only the stemless kinds which flourish in the shade and under other plants, their roots requiring nourishment. The *alsophila Australis* may be placed outside in the full sun without injury; if it be watered from time to time with liquid manure, it will acquire considerable dimensions in a short time, and be of unsurpassable beauty.

A great number of the plants named will remain uninjured if protected from the frost; but it is better, as has been already said, to keep up the winter temperature a little over the freezing point; and even when the sun strikes upon the glass, raising the temperature, it will not be necessary to open the house at all during the winter. After February, however, when vegetation is getting active, it will be necessary to give air gradually, and to water in the evening. In March you must begin to shade with some light material up to the time that you can uncover the greater part of the conservatory, and at last place some of the plants in pots or boxes in the open air. As to the great palms and tree ferns, dracaenas, aralias, etc., they will be better slightly shaded throughout the year, taking care to give plenty of air. Where it could be easily done, it would be desirable to remove the roof and allow the contents to be refreshed by the summer rains. Thus managed, with plenty of water and a proper amount of shade, it is very possible to develop splendid vegetation in such a structure.

Dr. MONCHAUX recommends the use of cold infusion of green coffee in the treatment of gout.

Arsenic in Hydrophobia.

In a late number of the *Correspondenz-Blatt*, Dr. Gulsan gives a number of cases showing the value of arsenic as a prophylactic in hydrophobia, and even as a remedy also after the symptoms are marked. He relates that a rabid dog, between the 7th and 9th of June, bit thirteen persons in various towns of the canton of Freiburg. All were recommended to be treated with one twentieth of a grain of arsenic morning and evening, as a prophylactic measure. Eight submitted to this and none were affected. Four declined, or were not allowed to take, the arsenic. Of those four, two remained unaffected, and two died. One began the arsenic treatment, but speedily left it off; she was attacked, but at a much later period, and died. Dr. Gulsan recommends not only the internal employment of the arsenic, but that the wound should be dressed with it.

Screw Propulsion.

The subject of ship propulsion, which some years ago was one of the most frequented fields for the inventor, has now, for a long time, been comparatively quiet. After almost every conceivable form and arrangement of paddle wheels,

proposed to fit propellers of different forms in tunnels extending through the ship from the bow to the stern, but these had all been abandoned on account of the enormous loss of power, due to friction, which such a system must necessarily entail. Mr. Griffiths' tunnels were not proposed to extend fore and aft; in fact they amounted to two short tunnels, one at each end of the vessel, the fore one, after leaving the propeller, sloping downwards, and coming out with an easy curve at the ship's bottom some distance abaft the bow, and the after tunnel opening from the bottom of the vessel an equal distance on the fore side of the stern, and sloping upwards towards the after propeller until it emerges towards the stern in a direct fore and aft line.

In this proposal, of course, the objection on the score of increased friction could not be maintained to the same extent as if the tunnels were of great length; but what little experience had been gained of tunnels was not much in their favor, and it was incumbent on Mr. Griffiths to show that with his new system a certain power would propel the vessel faster than the same power applied on the usual system, of a screw on the fore side of the rudder post, would propel her. To do this a number of experiments have been carried out with models on the canal at the northwest corner of the Horticultural Gardens, at South Kensington, and a close scrutiny and study of these experiments have convinced us that very remarkable results are likely to arise from the adoption of the system, and that while opening up some curious and difficult questions on the theory of resistances and propulsion, the subject is full of practical importance, as affording every encouragement that economical results will be obtained of a character sufficiently striking to command support in these days of high priced coal.

That there is a pressing need for improvement in our steam mercantile marine is apparent to all engaged in shipping, and is shown by the increased number of orders which are being received by builders for new sailing ships, compared with the orders for steamers. This apparent tendency to return to sailing ships, which characterizes the present time, is no doubt due to two causes, namely, the expense of working steamers, and the great losses which have occurred among them. Both of these objections are proposed to be removed, to some extent, by Mr. Griffiths' plan, which combines the most desirable feature of separate engines at the bow and stern, with, as it is contended, an equal speed and less expenditure of power. On this latter point we have witnessed a large number of experiments, the details of which we hope shortly to publish, and shall therefore content ourselves, on the present occasion, with giving a brief outline of their results. They were made with a couple of models, so arranged that they could be propelled in the ordinary way or on the tunnel system, and every care and attention was paid to insure the power applied being accurately recorded, as well as the number of revolutions of the screws.

Experiments were made with the whole power concentrated

on one screw at the stern, and afterwards with the power divided, placing half in a tunnel in the bow, and the other at the stern; and the increased speed, with the new system, was very striking indeed, amounting to about 30 per cent in some of the runs; but this, doubtless, was assisted by other causes, to which we shall hereafter refer.

The most curious results of the trials appear when the model is tested with the engine at one end only at work, and compared with the result obtained with the screw working at both ends, and with the power doubled. It is well known that in ordinary vessels when the power is doubled, the speed is increased by one fourth; but in these experiments, trial after trial appear to show that when the power is doubled by adding a screw in the bow working in a tunnel, the speed is increased by one half.

We regret that space prevents us dealing, on the present occasion, more fully with these valuable and interesting experiments, to which, however, we shall return, and discuss fully the bearing they are likely to have on the steam shipping of the future.—*Engineering*.

OIL OF CLOVES is effectual in protecting animals against flies and mosquitoes.



A COOL CONSERVATORY IN THE NATURAL STYLE.

screw blades, and jet propellers had been proposed, and many of them tried practically, the screw has obtained the mastery, and we now scarcely ever hear of a paddle wheel steamer being built, while the jet propeller has failed even to obtain a footing except in a few experimental vessels for the Government or for pleasure boats. It is scarcely too much to say that, among those who labored to improve the screw propeller, no one is better known, or has been more successful, than Mr. Griffiths, whose system has been almost universally adopted in the Government service, and to a large extent in the mercantile navy.

When, therefore, we hear of Mr. Griffiths again coming before the public with a new mode of applying the screw propeller to drive ships, the recollection of his former successes awakens an interest which would not attach to the experiments of one less experienced in the particular subject he has undertaken to improve, when further improvement in it seems to have been almost given up as hopeless.

Some time ago Mr. Griffiths read a paper before the United Service Institution, in which he proposed to supersede the present system of employing a screw outside the ship at the stern by a pair of screws, one in the bow and the other in the stern, both working in tunnels. It had often been

THE GERM THEORY AND ITS RELATIONS TO HYGIENE.

BY PRESIDENT F. A. F. BARNARD, LL.D., OF COLUMBIA COLLEGE.

(PART III.—Conclusion.)

PARASITIC GROWTHS.

In order that we may be able to judge of the probability that an infectious disease, of which the cause is unknown, is a result of the invasion of the blood of the viscera of the patient by a parasitic vegetation, it is important to consider first what has been already ascertained of the effects of such parasitic growth infesting the animal organism. A simple form of fungus, called the *sarcina ventriculi*, is often found in matters thrown up by persons laboring under disorder of the stomach. It has also been met with in other parts of the body when diseased. But it is likewise found, and not unfrequently, in the stomachs of persons in perfect health; and, as Dr. Carpenter says, may accumulate there in considerable quantities without causing inconvenience. This parasite, therefore, cannot be regarded as an inciting cause of disease. The stomachs of many worms and insects are found, moreover, to be frequently infested with fungi, which grow there in great luxuriance. Many of these have been examined and described by Dr. Leidy, of Philadelphia. In the West Indies, according to Dr. Carpenter, it is not at all uncommon to see individuals of a species of *polistes* (corresponding to our wasp) flying about with plants of their own length projecting from some part of their surface, the germs of which have been introduced through the breathing pores at their sides. This fungus growth, however, soon kills the insect, and a similar effect follows a similar cause in the case of certain caterpillars in New Zealand, Australia, and China, of which the bodies become so thoroughly interpenetrated and, as it may be said, replaced by the fungoid vegetation that when dried they have almost the density of wood. Our common house fly is a not unfrequent victim of a similar parasitic visitation. A fungus called the *empusa musca*, originating from the germination of a single spore brought in contact almost anywhere with the body of the insect, pervades after a time its whole interior, and, while leaving the surface uninjured, emphatically eats out its substance. When the animal's life is nearly exhausted he comes to rest, and fungoid shoots put forth from his body on all sides, clothing him apparently with a kind of fur, consisting of filaments each bearing a fructification of innumerable spores. The harvest of spores becomes very conspicuous when the unfortunate animal makes his last stand upon the window pane, forming a thin film over the glass to a considerable distance around him; and if by any chance a healthy individual of the same species comes within the limit of this infected area, the disease which has destroyed his fellow will be sure to attack him also.

The epidemic among cattle, called in England "the blood," is shown by the researches of Davaine to be occasioned by the presence in the blood of the diseased animals of innumerable living organisms resembling vibrios. This disease is communicable to many, producing what is called malignant pustule, and this is attended with the development of the same organisms in the pustules thus produced. Professor Lister, an eminent surgeon of Edinburgh, long ago observed that, when a chronic abscess is discharged by means of a *canula* and *trocár*, the subsequent accumulations of fluid are frequently attended with putrefaction, though none had existed before. The putrid mass is also found to be swarming with vibrios, though none had been present in the discharges. No explanation of this singular phenomenon, according to him, can be given except that the germs of these organisms were introduced in the original operations with the *canula* and *trocár*.

In plants, the smut in wheat, the rust in cotton, the *oidium* in grapes, and the *botrytis* in potatoes, are examples of fungi, constantly concomitant with disease, and presumably, almost certainly, in the last two instances, its cause. Neither in plants nor animals, however, is it to be supposed that the noxious effects observed are occasioned by the presence of these parasites mechanically interfering with and obstructing the vital functions, or by acting directly as poisons in the ordinary sense; but rather by their own vital activity decomposing the substance of the organisms they infest, and making them their food. The consequences of their extensive prevalence to the material interests of communities and peoples, and to their means of subsistence, have been occasionally of the gravest character. The *oidium* may be said to have exterminated the vine from the island of Madeira; the *panhistophyton* cut down the product of silk in France from 130,000,000 of francs per annum to 30,000,000; and the *botrytis* threatened to depopulate Ireland, by destroying the vegetable which constituted, for the common people, the staple article of their food.

EVIDENCE IN FAVOR OF THE GERM THEORY.

Putting together these well known facts regarding this subject, before proceeding to more doubtful cases, we may say that the germ theory has an amount of *prima facie* evidence in its favor which entitles it to careful consideration. In certain instances, and in a certain sense, the evidence is complete that the germ theory is true. But when we come to apply it to infectious diseases in general, we find the analogies which they present, with the limited class of examples above enumerated, to be unexpectedly feeble, while the points of dissimilarity are numerous and marked. It is not even enough to discover that in such diseases there are actually present, in the blood, or in the tissues, or in the secretions, or in the dejections, of the suffering individuals, living forms of microscopic cryptogams, since the evidence is rarely conclusive either that these minute bodies are injuri-

ous to the patient or that they were present antecedently to the attack. And if, as to the first of these points, the evidence in some cases is satisfactory, as to the second it can hardly be pronounced to be so in any.

As to the frequent presence of vegetable organisms in the blood of men or animals suffering under infectious diseases, it is impossible to entertain a doubt. The testimony of all the observers who have occupied themselves with this subject is concurrent to this effect. Coze and Feltz, Klebs, Burdon-Sanderson, Klein, and many others, have found bacteria invariably in the blood of patients suffering under typhoid fever, small pox, scarlet fever, puerperal fever, pyæmia, and septicæmia. Dr. J. H. Salisbury, of Cleveland, Ohio, affirms, as the result of his own observations, that in healthy as well as in diseased blood there are always present two species of cryptogams, the one algaoid and the other fungoid. In the pustules of small pox, Dr. Salisbury has observed a cryptogam described by him as having both a fungoid and an algaoid development, and the spores of this he has also found in the blood. In cow pox, or in the disease produced in the cow by inoculation from a small pox subject, only the algaoid form appears. This the discoverer has named *ios vacciæola*, while the entire plant in its double form is called *ios variolosa vacciæola*. In typhoid fever, the same writer has detected a peculiar algaoid vegetation developing itself upon the external surface of the entire body and upon the mucous membrane of the interior cavities. This he regards as the efficient cause of the disease, the means by which it is propagated.

The disease which appeared in 1868 among the beef cattle brought to this city from the West, and which is known as the Texas cattle disease, was investigated at the time by Dr. Harris and Stiles of the New York Health Department, who found the spores of a peculiar species of fungus both in the blood and the bile of the diseased animals. Specimens of these cryptogams were sent by these gentlemen to Professor Hallier, by whom they were successfully cultivated, and who succeeded in deriving from them three distinct forms of the fungus. The epizootic which attacked all the horses of the country twelve months ago was also marked by the presence of the fungi in the blood and the urine of the animals affected, which were described by Dr. Eademann, and by Dr. Charles Am Ende of Hoboken.

About forty years ago, the yeast plant was discovered by Cagniard de la Tour, and almost simultaneously by Schwann. Till that discovery, the chemical theory of disease had a strong support in the imagined analogy of fermentation. To the suggestion, after the discovery, that fermentation is probably a consequence of the rapid growth of the plant, there was at first a very general and natural dissent; but when, in 1843, Helmholtz made a direct experimental test of the question by placing a fermenting liquid side by side with one of the same kind not fermenting, both being contained in the same vessel but separated by a membrane which permitted the mingling of the liquids, but prevented the passage of the plant, that analogy lost its force; for the fermenting liquid continued to ferment, while the quiescent liquid remained quiescent. The case of fermentation assumes now a significance quite the contrary of that which it had before seemed to possess, and it began to be claimed quite as conclusive in favor of the germ theory, as it had been before in favor of the chemical. This theory, however, though among its advocates have been, and continue to be, counted many of the most distinguished physicians and physiologists of the past and the present generation, has never met with universal acceptance.

DISEASED CONDITIONS THE PABULUM FOR FUNGI.

What account shall we give, therefore, of the multiplication of fungi and algae in diseased blood, if these organisms are not the cause of the disease? Simply, that the diseased condition furnishes to the organisms their pabulum, which is not present in the healthy state. For the cause of the disease we must, on this supposition, look elsewhere, and we shall be compelled, perhaps, to fall back upon the chemical doctrine of sympathetic decomposition. Many causes, in fact, produce profound changes in the blood with which parasites have nothing to do. This is true of the venom of the serpents, and of prussic acid, both of which produce fatal effects with singular rapidity. Of "the black death," which raged in the fifteenth century, Bastian quotes Hecker as saying that "many were struck as if by lightning, and died on the spot," and he cites the testimony of Dr. Aitken to the fact that, when the cholera reached Muscat, instances occurred in which only ten minutes elapsed from the first apparent seizure till life was extinct. These are cases for which the germ theory affords no solution.

On the other hand, we have the numerous observations and experiments of Coze and Feltz, of Burdon-Sanderson and Klein, of Klebs, of Davaine, of Zahn and Tiegel, and others, in which rabbits and guinea pigs were inoculated with bacterious blood drawn from patients laboring under a great variety of infectious diseases, including pyæmia, septicæmia, small pox, measles, scarlet fever, typhoid fever, etc., observations and experiments which seem to leave little room for doubt that these organisms are, in fact, in these cases, the vehicles of the infection and the causes of these several diseases.

In view of the conflicting character of the evidence surrounding the vexed problem under consideration, the conclusion to which the present speaker has been led, if it may be permitted to one so moderately versed in physiological science to have a conclusion at all, is that neither the germ theory of contagious disease, nor the chemical theory, is exclusively true, but that each of these morbid influences has

a range of action of its own, and that in some cases it is eminently probable that the disease in its inception is attributable to one of these causes, and that is the chemical; but owes its subsequent virulence mainly to the other, that is, to the presence of rapidly multiplying vegetable organisms.

Such has been the success of modern measures for closing up all the insidious approaches, by which disease has hitherto effected its entrance into the family, the community, or the individual organism, as to encourage a hope, even so seemingly wild and visionary, as that a time is coming in which disease itself shall be utterly extirpated, and men shall begin to live out the days which Heaven intended for them. When that time arrives, if it ever shall, your honorable and learned profession may find, like Othello, its occupation gone; but it will be itself which will have destroyed it, and which will have established, in doing so, a nobler title to the gratitude of mankind than all its untiring labors for the relief of suffering humanity through centuries of self-sacrificing devotion hitherto have already won.

The Emotions.

Professor Tyndall, while in this country last year, visited the Falls of Niagara, when, reaching the Cave of the Winds by descending Biddle's stairs, he conceived the idea of attempting to pass under the blue waters of Horse Shoe Falls from that point. He found a guide who was willing to make the attempt with him, and together, the next day, they passed through the mist and foam of the roaring cataract, reached the desired point, and returned in safety. In describing his emotions at one point in his perilous journey, he remarks as follows:

"Here my guide sheltered me again, and desired me to look up; I did so, and could see, as before, the green gleam of the mighty curve sweeping over the upper ledge, and the fitful plunge of the water as the spray between us and it alternately gathered and disappeared. An eminent friend of mine often speaks to me of the mistake of those physicians who regard man's ailments as purely chemical, to be met by chemical remedies only. He contends for the psychological element or cure. By agreeable emotions, he says, nervous currents are liberated which stimulate blood, brain, and viscera. The influence rained from ladies' eyes enables my friend to thrive on dishes which would kill him if eaten alone. A sanative effect of the same order I experienced amid the spray and thunder of Niagara. Quickened by the emotions there aroused, the blood sped healthily through the arteries, abolishing introspection, clearing the heart of all bitterness, and enabling one to think with tolerance, if not with tenderness, of the most relentless and unreasonable foe. Apart from its scientific value, and purely as a moral agent, the play, I submit, is worth the candle. My companion knew no more of me than that I enjoyed the wildness; but as I bent in the shelter of his large frame, he said, 'I should like to see you attempting to describe all this.' He rightly thought it indescribable. The name of this gallant fellow was Thomas Conroy."

There is, in this graphic statement of the eminent *seaman*, a hint at some truths which, physiologically considered, may be of supreme importance. "By agreeable emotions, nervous currents are liberated which stimulate blood, brain, and viscera." The "emotions" of every living person are unquestionably of more importance to his health, happiness, and well being than most physicians suppose. Agreeable emotions are curative in their influence, when coming to the relief of suffering invalids. Disagreeable emotions produce disease in individuals who, uninfluenced by them, would be in sound health. A dyspeptic who, at his own table, under the influence of depressing emotions, is unable to partake of an ounce of food without subsequent distress and pain, is able, at the table of a friend, under different circumstances, to eat a hearty meal without discomfort. It is a mistake to regard most diseases as resulting from chemical derangements of the system, and it is a mistake to meet a majority of diseases with chemical remedies. We have known physicians who exerted a moral influence over their patients, which gave them a success more gratifying and positive than ever resulted from the administration of any drug. The mind in its connection with the body exerts a controlling influence; and one of the great secrets in regard to securing health and longevity is to train the emotions so as to keep them outside of the cloud which hangs ever ready to darken our mental and moral horizon.—*Boston Journal of Chemistry*.

MOSQUITO NETTING AS A SURGICAL DRESSING.—The *Medical Record* remarks that in all those cases where it is desirable to keep up support and pressure, and at the same time permit the free escape of all discharges from the wound, or ulcer, or whatever it may be, the ordinary mosquito netting, used for a bandage, meets all the indications. Bundling dressings are avoided in this way, the parts are kept cool, the discharge goes on unrestrained, and at the same time support is maintained. If the discharge is considerable, a pad of oakum may be placed beneath the parts to secure the discharge, thus insuring perfect cleanliness. This netting serves an admirable purpose in dressing large abscesses; for instance, when compression and free discharges are to be associated.

LIQUID NOURISHMENT FOR SICK STOMACHS.—The *Dublin Medical Journal* commends the following: An egg, well beaten up, to which add one pint of good milk, and one pint of cold water, and salt to make it palatable; let it then be boiled, and when cold any quantity of it may be taken. If it turns into curds and whey, it is useless.

An Obscure Phenomenon in Psychology.

A few months ago a writer in this journal gave us a collection of facts illustrating the existence of what he called a "mental atmosphere." Such facts are of much more psychological importance than they are usually deemed. Indeed, most scientific writers fear to speak of them, lest censure for too great credulity be their reward.

This was long the case with mesmerism, until it was investigated by Dr. Carpenter, and then it proved a valuable means of furthering the study of mental phenomena, and led to the discovery, or at least the correct understanding, of the automatic cerebral action. This interesting function of the mind is closely connected with more recondite powers by which the brain, or rather the action of the brain, its rhythmical workings, become in some yet unknown manner in accord with workings of other brains, so as to lead to the rise of the same idea in two minds. If, with Fechner (still the best authority on all psycho-physical questions), we regard thought action as the manifestation of a series of vibrations subject to mathematical laws akin to those which govern the senses of sight and hearing, then the explanation which suggests itself to these instances of persons *en rapport*, or *clairvoyant*, is that the thought vibrations are detected by the consciousness as isochronous with those in another mind, somewhat as a musical ear will detect concord between the pitch of two sounds, when ordinary persons cannot.

But we care less just now to substantiate this theory than to illustrate the facts for which we are seeking explanations. Two remarkable and well attested instances have been laid before the profession in the last few months, in the pages of the *Chicago Medical Journal*, in the numbers for June and September.

The first is related by Dr. George W. Kittell, of Shabbona, Ill. A young lady cut her head severely with a pane of glass, imbedding a number of small fragments in the wound. It was not attended to properly at first, and in a few months "the pieces of glass actually removed, from the crown of her head to the soles of her feet, were numbered by thousands." This looks very much like one of those aggravated cases of hysterical dementia which, in their love of self-inflicted suffering, have always been the puzzle of the wise and the wonder of the vulgar. In this wretched condition she survived from 1865 to December 1872, when death from exhaustion supervened.

The part of Dr. Kittell's description we wish to call attention to is the following:

"One curious phase in her history should be noticed. I refer to clairvoyance.

"In this case it was not produced by mesmerism, but by chloroform, and she became more and more susceptible to its influence. In the latter stages of the case, this state came on occasionally from over excitement.

"Before the accident which introduced the case, she was given chloroform for the purpose of having a tooth extracted. The doctor who administered it had not always kept that moral rectitude, in some particulars, which becometh a physician. Shortly after the inhalation commenced, she began to upbraid him for his conduct. The doctor was frightened, and accused a man, the only one beside himself who knew the circumstance, of telling. The man protested he was innocent, for he really was. When Miss Low returned to consciousness she knew nothing of what she had said, or of the occurrence she had related.

"My first knowledge of this effect of chloroform on her came in this way: After removing some glass one day, and while she was still under the influence of the anæsthetic, I was called out for a private interview. The weather being pleasant, we stepped into the orchard and sat down under a tree. When I returned she remarked 'you thought yourself very 'cute when you went into the orchard to talk; but I heard it all.' I then asked her to tell what she heard, and she related our conversation correctly. She had not left the bed in my absence, and could not see the orchard, as it was on the other side of the house. In fact, she was apparently unconscious the whole time; and when she had fully recovered from the influence of the chloroform, she knew nothing of what had been done or said. I had known her to say strange things while anesthetized, but till now had not understood it.

"Sometimes, after having taken chloroform, she would rise in her sleep and go miles, in her night clothes, to find articles that had been lost. She never had any knowledge of these nocturnal expeditions in her waking state, except the proof afforded by the presence of missing articles, and the condition of the bed in the morning.

"Her clairvoyant state was another existence to her. When in this state she would tell anything that had transpired at other times, while in the same condition. I have given her chloroform in enable her to find lost articles, which she could always do. Some little thefts, and sometimes bigger ones, were made known in the same way.

"When very sick she was often delirious, sometimes for hours, which led many people to suppose she was insane, and some said she was possessed of the devil. It was from this fact that the horse thieves escaped punishment; many would take oath in court against her sanity. She was the principal witness; and popular prejudice, backed by some physicians for no laudable purpose, carried the day.

"To relate all that she said and did, while clairvoyant, would make a long and interesting chapter. The most interesting occurrences of this kind must be omitted because of their length. If any doubt is entertained as to the truth of these statements, any further proof desired will be gladly furnished by the author."

An example, not dissimilar in kind, but furnished by a

young man in perfect health, is given in the number for September, by Dr. Henry M. Lyman, Professor of Chemistry in Rush Medical College, Chicago. The person was Mr. Brown, known as the "mind reader," twenty-one years of age, sound in body and mind. He exhibited his peculiar power by finding, blindfolded, any object which Dr. Lyman secreted in an adjoining room. To do this, he was obliged to be in physical contact with the person who had secreted it. He did not pass into a condition of trance, but claimed to be guided by a sort of subjective appearance of light. His power varied with the temperature and with his own feelings. It depended also on a distinct knowledge of the whereabouts of the article, on the part of the person who conducted him.

Though neither of these examples present novel features, they are valuable because carefully established by competent observers. The deductions from them clearly include the position that the function of cerebration can be stimulated and directed by other means than those ordinarily considered exhaustive. The thought vibrations are not bounded by the superficies of the body, nor by the peripheral extremities of the nerves, but are continued beyond in space, doubtless under some law of decreasing intensity, until, perhaps, they are metamorphosed into some other form of motion, or else become extinguished.

Certain brains, usually but not always in abnormal conditions, are impressed by these vibrations with sufficient force to cause the cerebral action to rise to the level of conscious thought, and hence this singular power of "reading the thoughts of others." The physiological laws which are here involved are those especially which explain the phenomenon of consciousness; and as these are of very extended bearing on other branches of psychology, we shall defer entering upon them until some future occasion.—*Medical and Surgical Journal*.

The New Daily Newspaper.

Inter Ocean, of Chicago, congratulates itself on its already large daily circulation, having increased 25,000 copies during the past ten months, and adds that its regular edition fills eighty large mail sacks. Our contemporary modestly disclaims the honor of its success and virtually ascribes it to the favor of the people; but it seems to us, at least so far as our own experience extends, that the people are not in the habit of converting journalistic enterprises into success unless there be overwhelming reasons, which in fact prevent their doing anything else. Hence, even at the risk of offending its modesty, we are obliged to take issue with *Inter Ocean*, and to assert that, unless it had been edited and managed in the very admirable manner which has characterized it in the past and at present, its popularity might still be an affair of the future. At all events, we congratulate our contemporary upon its prosperity, and cordially wish it the brilliant career to which, from its excellence as a journal, it is fairly entitled.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

RUBBER WRINGER PATENT.—JAMES B. FORSYTH vs. CHARLES M. CLAPP et al. SKEPLEY, J.

Without at this time stating the conclusions to which the court arrived in relation to several questions presented in this case, it will be sufficient for the disposition of the cause to state the decision of the court upon the question of proper consideration of this question. It is necessary to consider the state of the art at the time of the alleged invention of Forsyth.

Rubber rolls for wringers were first made in the form of tubes or hollow cylinders, and expanded on to a plain shaft. Then attempts were made to secure the rolls more firmly to the shaft by winding the shaft with wire, and afterward with twine. An effort was made to secure a more lasting union to the shaft by forcing the tube upon a heated shaft. Next followed a mode of making the shaft itself of two or more parallel rods. The rubber rolls first made with a number of holes corresponding to the number of rods were forced on to these rods which were then connected at their extremities. Canvas was also interposed between the shaft and the roll and cemented to both. Various other devices appear to have been resorted to for the purpose of fastening more firmly the tube to the shaft. The purpose of all these inventions was to make a more perfect connection of the elastic roll with the metallic shaft.

The difficulty which Forsyth thought he saw, and which he claimed had not been obviated by any of the other devices, was not so much the separation of the roll from the shaft, at the lines or points of connection, as the tendency of the strain on the rolls when in use to a destruction of the body of the roll itself. His theory was that, while the connection, of the shaft with the homogeneous body of the roll, constricted on to the shaft, was sufficient for all practical purposes in the use of a wringing machine, the real difficulty to be overcome was that the particles of rubber in contact with the shaft separate and tear away from the rest of the rubber composing the body of the roll. He acted upon the hypothesis that, while the various connections of the roll with the shaft were sufficient to withstand the strain, portions of the body of the roll would break away from the portion retaining its connection with the shaft by a process of disruption or rending asunder of the body of the roll itself. He commenced, thereupon, a series of experiments, the object of which was to substitute for the homogeneous rolls in use a roll with a tougher, stronger, and less elastic substance in the interior than in the exterior portion of the roll. After trying various methods to accomplish this result, by the addition of fibrous or other non-elastic material to the stock of which the interior of the roll was composed, he finally constructed a roll with fibrous material arranged in the interior portion of the tubular roll in a manner which, in an expression proximately descriptive, he calls radially. A sheet of cloth, with a thin layer of vulcanizable compound on each side of it, first cut into long straight strips or diagonally across the threads or fibers of the cloth. Several of these long strips are placed upon each other and pressed together until the surfaces of rubber or vulcanizable compound are cemented and permanently united. The sheets thus formed are cut into strips or bands of suitable width to admit of their being easily wound on a mandrel, or the shaft of a roll, in such a manner that the fibers of the cloth will radiate from the mandrel or shaft. As shown by the drawing accompanying his specification, it is obvious that each thread would thus extend from the interior to the exterior of the fibrous portion of the roll in accurate radial line, the threads crossing each other, and such threads being nearer together at the core or axis, and separated further from each other as the distance from the core or axis increases. The roll is then made up to the desired size by winding rubber sheets around it coated with cement, when it is placed in molds and subjected to the vulcanizing process, the rubber in its soft and plastic state filling up all crevices around and between the layers and incorporating the parts together. In this way it is claimed that "the tenacity of the roll and the degree of adhesion of the layers are increased, and the position of the fiber is better adapted to resist any tendency of the roll to become loose and turn on its shaft when subjected to a strain."

Charles McBurney had invented and manufactured at the works of the Boston Belting Company a tube substantially, if not precisely, like the tube of Forsyth. No appreciable material distinction can be discovered between the modes of making the McBurney and the Forsyth tube, or in the tubes themselves when made on a mandrel. McBurney's tubes and their mode of manufacture are represented by exhibits ten to fourteen, inclusive. These tubes were made of all sizes, from three quarters of an inch to an inch and a half thickness of tubing, and sold in tubes to consumers. The purchasers cut them in sections or rings for the shafts. Such a tube constricted on to a shaft would be Forsyth's roll. Forsyth does not describe any particular mode of connecting the tube with the shaft. He leaves that to be effected by any of the old and well known processes in use. All that can be said by way of reason he claimed for his roll is the combination of an old tube with an old shaft in a mode which was old to accomplish a new and useful result.

Treating it as a valid patent for this new combination of an old shaft with an old tube by old means of connection, for the purpose of considering the question of infringement in the light of the state of the art as existing when he made his roll, we now proceed to examine the construction of the Moulton roll as actually made and relied upon as an infringing device. The Moulton roll, as manufactured by the respondents, was made by applying transversely to a sheet, or between two sheets of vulcanized rubber, a layer or range of strands of fibrous material and cutting this sheet into

ribbons of the desired width at right angles to the length of the strands. These ribbons are folded in the center, and a metallic wire is inserted in the fold and wound spirally about the shaft, under great tension, from end to end between the journals, the wire being fastened to the shaft at each extremity. A cylinder or sleeve of rubber is applied over the surface, and the whole is subjected to a vulcanizing process until the whole mass of the roll is thoroughly compacted together. The wire is so tightly wound under pressure that it, in fact, becomes a part of the shaft. The fibrous threads are, in fact, loops which pass into one orifice and out at another in the metallic shaft, their ends extending strictly radially into the body of the roll.

There is a radical and obvious difference in the function of the fibers in the two rolls. Their similarity consists in the fact that the fibers in one are arranged in curved radial diverging lines, extending in a direction toward the periphery of the roll, and in the other in radial lines extending in the same direction. In both of them the effect of the fibers is more or less to diminish the elasticity of the interior portion of the resilient roll; but in the Moulton roll, as made by the respondents, not to any material or appreciable extent. Their difference consists in the function they perform. The inner ends of the fibers in the Forsyth tube touch or nearly touch the shaft. They do not fasten the rubber compound to the shaft, or aid in fastening it. The ends of the fibers themselves are not fastened to the shaft except so far as they are cemented by the vulcanizable material. The vulcanizable material holds the ends of the fibers up to the shaft instead of the fibers performing that function for the vulcanizable compound. The inner ends of the fibers in the Forsyth roll were attached to the rigid portion of the roll resting upon the shaft, and the outer ends extended from this rigid portion toward the circumference of the roll, thus tending to secure the "adhesion of the parts" of the roll to each other, at which he aimed, as well as to limit the mobility of the rubber into which they extend. If McBurney's tube, or Forsyth's, be constricted upon a shaft which is too small, or insufficiently cemented or connected to the shaft by any of the then existing modes of connection in an imperfect manner, so that the shaft turns in the tube, that result would not be owing to the fact that the fibers of Forsyth failed to perform perfectly their function of constricting the rigid portion of the roll to the more elastic portion of it, and of limiting the mobility of the rubber in which they are buried. So, when the roll is subjected to strain by the passage of the silver of cloth between the rolls of a wringer, causing the outer surface to be compressed in one place and expanded in others, the fibers in the interior portion of the Forsyth roll do undoubtedly tend to prevent the body of the roll from being separated from the shaft; but they do not effect this result by reason of their attachment to the shaft preserving the connection between the shaft and the rubber, but by reason of their acting at the same time to preserve the form of the inner and more rigid portion of the tube, and keep up the adhesion of such parts with the outer portions where the mobility and resiliency is greater. But perfectly as the fibers may perform this function, a tube imperfectly cemented to the shaft may still, for that reason alone, turn on the shaft in the Forsyth roll. Now, the loops or bows in the Moulton fibers enter the shaft, and the ends of the fibers extend like "staples" (which they resemble in form) into the body of the roll, for the purpose of securing the interior of the resilient body to the shaft. The fibrous loop is to be taken as a whole. The parts of the fibers which extend from the interior toward the exterior of the rubber roll would not operate to confine the rubber to the shaft without the loops. By none of the methods in use at the date of Forsyth's patent, of making the connection between the shaft and the rubber, was the connection made any more tenacious by presenting the ends of the fiber to the surface of the shaft. In some of the claims of the ends of the fibers lessen the adhesion by as much as it displaced the rubber. The principal function of the fibers in the Forsyth tube, as before stated, is to make the inner portion of the tube more rigid, and to tie the more rigid to the more elastic portion of the tube. Now, in the Moulton roll, as manufactured by the respondents, the principal function of the fibrous loops is to tie the rubber to the shaft, and they do not create any material rigidity in the interior portion of the tube. The method of fastening in the Moulton roll is an inseparable part of the roll itself, being necessarily constructed and built up with the roll and constituting the inner portion of the roll. It is not adaptable to Forsyth's tube, nor is Forsyth's tube capable of having Moulton's fastening applied to it. Because Forsyth borrowed from McBurney his method of constructing the interior of a tube with fibers of cloth arranged in radial curves, it would be the height of injustice to allow him to monopolize any use of fibers for any purpose whatever in a wringer roll. If the ends of the fibers extended in a radial direction into the body of the roll, his release patent, examined in the light of the invention described in the original patent, if valid, must be limited to such a mode of introducing the fibers of a woven texture radially into the tube for the purpose indicated, without regard to the mode of fastening to the shaft.

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

Comparing the two rolls, as we have done in some more essential particulars, and without recapitulating other points of difference, enough has already been stated to show that, so radically different is the structure of the roll, and the function of the fibrous material, and its mode of operation, that the Moulton roll, as manufactured by the respondents, is clearly no infringement upon anything secured to Forsyth by his released patent, even giving to the invention claimed in that patent the fullest scope claimed for it in the evidence of Forsyth himself and the expert testimony introduced by him.

Bill dismissed.
(William Whiting and James E. Maynard, for complainant.
Benjamin R. Curtis and George L. Roberts, for defendants.)

Recent American and Foreign Patents.

Improved Cigarette Machine.

Joseph De S. Ruiseo, Paris, France.—In using this machine, the tobacco is placed in a receiver above a distributing apparatus, which causes a paped quantity of tobacco required for a cigarette to drop down to a compressor beneath, by the compressing action of which the tobacco, being rolled up, is inserted afterward into a paper tube ready to receive it, by means of a peculiar device. The paper sheets are laid into a rectangular box of the like section to the surface of the cigarette paper. A piston is constantly acting on the heap of sheets, and compels them to lean against a plate, which is called "a hand," forming one end of the box, and intended to catch them one by one, and carry them to the rolling rod, whereby the same are formed into tubes. The paper sheet is rolled up within a cylindrical tube or mold, split through one of its generating lines, which split edge of said sheet enters, and is caught by the rolling rod, that is set rotating within the said mold. The lower end of the rolled up sheet is, together with the mold, carried up to the compressor containing a roll of tobacco, which is then, by another rod, driven into the paper tube. The mold moves anew and presents the rolled sheet containing its tobacco, and having its lower end folded up, to the action of the upper end folders, when the cigarette is completed, and the mold returned to its starting point, or under the rolling rod. On its entering the mold, the rod drives out the made cigarette, and gets hold of a new sheet, which undergoes the very same operations as the foregoing one. From what has been said, the making of a cigarette consists of three different operations, effected simultaneously with three different molds, so as to obtain a three-fold speedy manufacturing action. The first operation consists in taking a sheet, rolling it, and folding the lower end thereof. The second operation consists in introducing the tobacco into the paper tube thus formed, and the third and last operation consists in folding the upper end.

Improved Spring for Chairs.

William T. Doremus, New York city.—This invention has for its object to furnish an improved spring for use upon articles of furniture, which shall be readily adjusted to give it any desired tension. The invention consists in an improved spring, formed by the combination with each other of the two rubber blocks, between which is placed the middle part of a U-shaped bar. Another U-shaped bar is passed between the arms of the bar above mentioned, and thus passes around both the rubber blocks. A yoke passes along the upper side of the upper block, and the various parts of the spring are connected and held in place by two bolts which pass through the yoke through notches in the ends of the rubber blocks and through the middle part of the U bar. By this construction, by tightening and loosening the nuts of the bolts, the tension of the spring may be regulated as required. Suitable construction adapts the spring for use in connecting a chair seat to its pedestal.

Improved Harrow.

Miles K. Young, Glen Haven, Wis.—This invention consists of a couple of pulverizing bars in front, four, more or less, bars with knives or teeth behind them, and a wide pulverizing bar behind the toothed bars, all connected together a few inches apart by chains, to be drawn side-wise over the surface. The toothed bars are arranged obliquely to each other to give a side draft to the teeth or cutters, to some extent. The knives incline from the front backward so as to rise upon the clods, etc., and cut them by pressing downward; but they can be made to point forward and downward to be used like a colter by reversing the bars.

Improved Means for Propelling Vessels.

John O'Sell, New York city.—This invention relates to improvements in the class of propellers formed of oscillating paddles; and it consists, chiefly, in the arrangement of the upper pivot for the slotted stems of the paddles to shift forward or backward of the vertical plane of the crank, so as to hold the paddles in such manner that they dip vertically into the water and thus save the loss of power due to beating it obliquely.

Improved Governor for Steam Engines.

Carl Robert Haugvick, Stockholm, Sweden.—This invention consists, more particularly, in the use of an oscillating ring or plate, or of a combination of several parts, which are more or less symmetrically placed around a common center of support and gravity. This plate or ring is kept in continuous oscillation, so that any point on a line drawn from the center of gravity, at right angles with the plane of this plate or ring, will describe a circle in space. Various applications are made of this principle, the following of which appears to be the simplest: The disk is mounted by a universal joint upon a hollow support, through which a shaft carrying the three arms and buttons is fitted, a spring crowding said pins against the plate, and serving as equivalent for a weight. A pinion hung loose upon the shaft, meshes into a toothed segment, that is mounted upon a weighted crank lever from which the connecting rod extends to the valve. When the speed of the engine is increased, the increased friction on the buttons causes the loose pinions to act upon a lever in such manner as to move it to more or less shut the valve.

Improved Trimmings.

Wellwood Murray, New York, city.—This inventor has patented three inventions of similar nature. The first consists of a trimming for dresses and other articles of wearing apparel for ladies, composed of a strip of muslin, lace, silk, or any other suitable textile fabric, with cross plait arranged in groups of, say, four or five (more or less) plait in a group, and plain portions between the plait of about the same width as the groups thereof. The second invention consists of a reverse box-plaited and puffed trimming for dresses, etc., in which, by reason of the plait of one side being made midway between those of the other side, they have the form of an ordinary box plait at one margin of the trimming, separated into two members at the other margin, and merged into the two adjacent box plaited thereat. The machine which is used for making this trimming consists of a pair of plaiting rollers with puffing teeth or formers in one, and sockets or dies in the other, and four plaiting blades for plaiting the cloth and pressing the plait between the rollers. The third invention consists of a reverse side plaited trimming in which the plait is folded in opposite directions at the margins, and, when desired, a puff is formed between the plait at the edge. To make this trimming a pair of intermittently rotating rollers is used, with puffing combs or teeth, when the trimming is to be puffed, combined with a pair of folding blades or knives and a feeding guide.

Improved Car Coupling.

Warren B. Snedaker, Syracuse, N. Y.—A coupling hook is pivoted in the drawhead, so that it turns freely on a pivot rod. The long limb of this hook forms the coupling pin, and when the car is uncoupled is in nearly a horizontal position. When the cars come together, the end of the link strikes the center of the hook, which throws the long limb to an upright position. Before reaching this position, its end strikes the underside of a hinged cover and raises it so as to pass a shoulder. The cover drops by its own gravity, and confines the hook, so that the shoulder forms the abutment against which the link pulls. To uncouple the cars, the cover is raised by means of a chain. A forked weight bar is pivoted at its rear end, and its weight is brought to bear upon the short limb of the hook, by means of pins, to keep the hook and bar steady, and in position before coupling, or when the hook is turned down. The forks of this bar also drop upon the end of the link, and hold the link in a horizontal position, so that it is unnecessary to go between the cars to guide the link when coupling the cars together.

Improved Milk Cooler.

James Pearl, Lawrenceville, N. Y.—A water chamber is arranged on a frame by covering it with a layer of sheet metal, painted on both sides to resist the action of the water thereon. The water course is produced by longitudinal partitions, which connect by apertures at alternate ends, so that the water is compelled to take a circuitous course through said chamber. The cold water passes around the partitions, and is conducted off through an exit pipe. Another sheet of metal, painted on both sides, is placed on top of the water chamber, and attached to the main frame. The milk pan is placed on the cover, being cooled as readily as by being directly in contact with the water, and especially keeping the water cooler, and preventing the corrosion of the bottom of the milk pan. The milk pans are thereby kept dry, and last a great deal longer than when placed directly on the water. The top cover forms, also, a table, which allows the use of smaller pans, according to the quantity of milk obtained, keeping also butter and other articles cool, as they may be set thereon in any vessel.

Improved Automatic Hatchway Guard.

George E. Berry and Frank C. Pingree, Detroit, Mich.—This invention consists of a gate arranged to slide up and down in the posts or doorway of the elevator, and connected by cords running over guide pulleys with a tilting lever. The latter is moved by a pin on the upper end of the elevator carriage, and caused to raise the gate out of the way when the carriage comes up to the place for unloading and loading. When, by the passage of the carriage to a higher floor, the gate is allowed to fall, the descent is regulated by a pin on the lower end of the carriage, which passes above the lower end of the lever just before the upper pin escapes from the upper perch. If the carriage descends without the upper pin passing above the lever, said pin regulates the descent. The gates closed below the carriage are opened by the lower pin on the carriage, and their closing is regulated by the upper pin.

Improved Curling Iron.

Joseph S. Morgan, Brooklyn, N. Y.—The object of this invention is to produce an improved curling iron, which is adapted to be conveniently used on every gas or other flame, keeping its polish and surface uninjured, and perfectly clean for use, and being easily handled with one hand, while the other curls the hair on the iron and manipulates it in the proper manner. This invention consists of a hollow metal tube, with a double elbow handle applied to its larger conical base, which is provided with air channels for carrying up the flame to the full length of the iron, and also with diametrical side recesses having vertical openings, by which the extinguishment of the flame on the burner is prevented.

Improved Box Clamp for Tobacco Presses.

Thomas L. Robertson, Madison, N. C.—This invention consists of a clamp formed of two blocks, made of hard wood, notched across the grain upon their inner sides, and held together by two or more bolts. The ends of the blocks at their inner edges are rabbeted to form grooves to receive the screw posts. To the outer forward corner of the upper side of the rear part are secured plates, and suitable arrangements are provided so that the rear part will not be pushed back out of place while the clamp is being manipulated. The straps are arranged to prevent the parts from being worn by the heads of the bolts.

Improved Foot Warmer and Improved Artificial Stem for Cut Flowers.

John B. Craig, Ferrysville, Pa.—This invention is an improvement in the class of portable heaters consisting of a metal case containing a block of soap or other material, which is removed when required to be heated. The invention consists in an arrangement of ribs and pins for supporting the block and holding it in place on the cover of the case. The pins prevent the block moving about in the box when the latter is being handled, and the ribs keep it from coming in contact with the cover, and thus unduly heating the same, thereby causing injury to the floor. The same inventor has also devised an artificial stem for cut flowers. It is the present practice of florists to stem flowers by attaching them to wooden splints by means of wire or thread. The improved device is formed of a wire, shaped spirally into the form of a hollow inverted cone, which is provided with a sink. To attach the device to a flower, the stem is drawn down through the coil until the latter embraces the base of the calyx, when the cone is compressed by slight pressure between the thumb and finger.

Improved Wheel Plow.

Fred Hasbrook, Stokes' Mount, Mo.—This invention has for its object to improve the construction of the wheel plow for which letters patent No. 121,223 were granted April 23, 1873. The invention relates to an arrangement of a rocking bar and pivoted rod in connection with the tongue and beam of the machine, for the purpose of adjusting them at certain angles to each other. By this construction the chain braces, in drawing the sulky, tend to press the forward end of the plow beam downward, and thus cause the plow to run deeper in the ground.

Improved Cutting Attachment for Sewing Machines.

William H. Sample, Albany, N. Y.—The object of this invention is to furnish an improved cutter attachment for sewing machines, by which fabrics of all kinds may be cut simultaneously with the stitching, and at suitable distances from the line of stitches, by the action of the machine. The instrument may, with slight variation, be attached to nearly every sewing machine, and consists of two upright arms, one of which is attached to the guide casing of the needle bar, and the other is connected loosely with the main arm of the sewing machine. The stationary arm carries at its lower end a cutter blade, which, together with a pivoted cutter blade operated by the reciprocating arm, cuts the fabric as the same is fed by the machine to it and the needle.

Improved Propulsion of Vessels.

George N. Jones, Philadelphia, Pa.—This improvement consists in propelling vessels by the alternate action of steam pressure and a vacuum, respectively operating and formed in a cylinder having a single orifice which is in communication with the water wherein the vessel floats, whereby the quantity of water in the cylinder is expelled and the same or an equivalent quantity readmitted in continuous succession through the aforesaid orifice. Thus no supplementary tube or passage is required to supply the steam and vacuum cylinder with the water to be expelled, but the inflow and outflow occur at the same point. The invention further consists in a valve and float mechanism connected with the cylinder, whereby the admission of steam is automatically regulated, as the water is expelled and admitted, thereby securing a proper and efficient action and allowing the steam pressure to be constantly applied.

Improved Automatic Lubricator for Car Axle Journal.

James Edward Bering, Newburgh, N. Y.—This invention consists in a method of automatically supplying the hot journals of a car axle with lubricating material by interposing, between the journal and a superposed lubricant holding-chamber, plugs fusible below that degree of temperature which will generate combustion.

Improved Implement for Capping Cartridges.

Henry M. Bronson, Sandusky, Ohio.—The object of this invention is to provide a convenient little instrument for capping the brass and paper shells used in the Parker and other breechloading shot guns, by which the operation can be performed in a quick, neat, and perfect manner. It consists of a tubular spring clamp, which takes hold of the caps and transfers them to the countersunk base of the shell by striking sharply the knob of a bolt with spiral spring sliding in the clamp.

Improved Accordion, etc.

Frederick Goetze and Donat Müller, New York, city.—This invention consists essentially of the application of two "unison" tuned reeds to every key of both key boards of a wind instrument in which the key boards form the sides of the bellows, as in an accordion, whereby one reed will sound by expanding and the other by contracting the bellows, and thus give the same note continuously as long as may be required. The invention also consists of sliding holders, in combination with the key board of such instruments, by which the bellows can be worked by the wrists of the player, thus leaving all the fingers free to work the keys, and allowing the hands to slide along the key boards, the instrument being supported at one end on the knees. The instrument thus improved is called an "aeolodikon."

Improved Slide Valve Mechanism.

Ebenezer E. Gilbert, Montreal, Canada.—The main slide valve has end tubes that slide upon closely fitting guide rods. These guide rods have rear flanges that hold them movably between guide brackets. When the friction between the valve and its seat creates wear, the valve is thus enabled to lower itself and automatically take up the wear. A clapping and disagreeable noise is prevented by the use of an auxiliary valve, peculiarly constructed, and arranged in the steam chest and over the main valve. This valve has two adjacent cavities which alternately connect with the exhaust by a vertical passage, and are separated by a partition. The steam passes through ports into and out of the tubes, to alternately force the main valve in opposite directions, and recesses, over which pass the ends of the valve, to admit steam into chambers and thence to the tubes. The object of this arrangement is to cut off the egress of steam from these cylinders in time to form a cushion to prevent their percussive impact upon the rods. In order to render the valve self-adjusting, to take up its own wear, and also to drop according to the wear that takes place on the main valve below it, an auxiliary valve is provided, which becomes automatically adjustable by its own gravity, both as respects its own wear and that of the main valve.

Improved Link Guide for Car Couplings.

William Warriner and William L. D. Johnson, Creelsborough, Ky.—The bumper heads of the cars are constructed in the ordinary manner, except that their cavities are deepened, and have blocks inserted in them. The blocks have stems formed upon their inner ends which enter holes in the inner parts of the bumpers, and around which are coiled the springs by which the blocks are held forward. Upon the forward end of the blocks are formed flanges to support the pin when withdrawn. A curved frame, upon the inner sides of the side bars of which are formed grooves, receives the side bars of an inner frame. The rear end of the curved frame is hinged to the rear part of the bumper head, and its forward part is supported by a yoke, the side bars of which pass through guides attached to the bumper head. The frame can be raised and lowered, according to the height of the adjacent car, by simply turning a screw. To the outer end of the inner sliding frame is attached a plate which, as the said frame is drawn outward, comes into such a position as to support the link in a horizontal position. A weight and cord of sufficient size are arranged to draw the frame forward as soon as released. The weight is supported by a small coiled spring, arranged to relieve the jar when the cars are run together, and the weight is drawn upward. The sliding frame is held when pushed toward by a lever pawl pivoted to the frame and held to its place by a spring. The forward end of the lever pawl projects at the side of the bumper, so that it can be readily operated to release the frame and allow it to be drawn forward by the weight.

Improved Toy Blocks for Object Teaching.

Nicholas Müller, New York, city.—This invention relates to apparatus designed to facilitate the study of geometry, in the formation of geometrical figures, and to familiarize the minds of both the young and old with such figures, and also to afford recreation and amusement; and it consists in two triangular shaped blocks, made of any material and of any size, by the use of which (and no other) various figures are formed by laying them together.

Improved Standard for Stools, Tables, etc.

Samuel H. Newcomb, Port Williams, Nova Scotia.—The invention consists in an improved stand adapted to support different articles of furniture. The supporting stand consists of four curved legs, of which one is firmly connected to the central shaft. The other legs are hinged side-wise to each other, so as to fold nearly parallel to the stationary leg, and they are arranged to close accurately around the shaft. They are also provided with recesses around the shaft, and projecting lugs at their outer top ends. These lugs enter recesses of a round support which rests on the legs and binds them strongly together. A central circular aperture of the support, together with the recesses around the shaft, allow the insertion of the sockets of the different parts which are to be connected to this supporting stand. A hook of the outer folding leg closes into an eye at the lower side of the support, and prevents thereby the lifting off or otherwise disconnecting of the same.

Improved Plow.

Andrews Rivers, Barnesville, Ga.—The standard bars are set into recesses of the beam, pivoted to it by a strong cross bolt, and are connected rigidly at their lower ends so as to form a strong, rounded-off support for the under side of the plowshare. A curved brace is rigidly attached to these bars, passing up between them and through a recess of the beam, above which it is provided with perforations and locked, according to the angle of inclination under which the plowshare is set. An adjusting rod passes between standard bars along the rear of the brace and up through the beam, and is raised or lowered by a crank. Different shares may, in this manner, be attached to the plow, as necessitated by the various requirements of farming, and their angles of elevation and depression be determined by simply adjusting the fore end of the brace.

Improved Slide Valve.

William Stephens, Pittston, Pa.—The valve is truncated and wedge-shaped. The walls between which it is arranged constitute a double seat with double induction ports and exhaust. The steam enters ports at the ends of the valve, which moves far enough to open them in that way. At the lower edge the valve rests on a flat seat, and at the top it may or may not be provided with flanges to bear on the top of the seat. It is fitted on these parts so that it just wedges into the cavity between the seats steam tight. Channels are in the corners of the valve at the lower edges, and in the corners of the seat at the top, to admit steam as a check, which prevents the leaking of the valve to some extent. Such channels can also be employed to limit or balance the down pressure. It is believed that the pressure on the top will be governed by the area of the cross section of the ports at the line and it can be reduced to the requisite amount for keeping the valve steam tight by such channels, admitting the steam under it. The double seats afford greater length of ports with a valve and cylinder of a given size than can be had with the ordinary arrangement. The double ports will unite in one passage in any suitable way.

Improved Packages of Powder Charges for Blasting.

Henry M. Boies, Scranton, Pa.—This invention consists in packing the powder, in convenient quantities, in long tubes of paper or any fabric or material of sufficient strength, rendered waterproof if necessary, of a proper shape and size to be used as a cartridge, and of such a length in excess of the powder inside as shall allow of its being folded into a compact form, and divided for use into cartridges of any desired length or weight. Each cartridge tube or package may be easily marked with the size, and quantity, and brand of its contents; and when it comes to the consumer, he can measure off from either end the quantity desired for a blast, slide the powder away from this point, divide the tube, fold back the ends, and the cartridge is ready for use, proceeding in the same way until the whole package has been used. Thus the danger of preparing the cartridge over the open keg and the liability to damage of the exposed powder are avoided, and the time and labor of making the cartridge, as well as the materials of which it is composed, are saved.

Improved Mold for Fancy Buttons.

Frederick Maass, Newark, N. J.—This invention has for its object to furnish an improved fancy button, the mold of which shall be so formed that the cover may be put on, held in place, and ornamented with cord or thread without sewing. The invention consists in the grooves formed in the outer surface of the molds, and in cords or threads in combination with the grooves of the molds, for securing the cover in place upon said molds.

Improved Drill for Well Boring.

Timothy Phillips and Joseph G. Metz, Leavenworth, Kansas.—The drill is made tubular and somewhat flaring, so as to cut a hole a little larger than its body. The lower edge is serrated so as to cut a ring groove into the stratum through which it is boring, the core or central part of the cut passing up through the cavity of the drill. The upper end is rabbeted, and on it is screwed the lower end of a tube, in the sides of which are formed a number of holes to allow the water to flow out, and thus lessen the weight. In the upper end of the tube is screwed a section of pipe, and other sections may be added as the hole increases in depth. To the upper end of the drill is hinged a valve, opening upward into the tube, so as, when the drill is raised, to carry the contents of the tube and pipe with it. With this drill, it is stated, a hole may be sunk by hand to the depth of two hundred feet, and with a lever to any desired depth. This drill also enables the operator to know exactly the kind and depth of strata through which a hole is being sunk.

Improved End Gate for Wagons.

Joseph C. Baird and Merritt Miller, Heaton, Ill.—This invention is an improvement in devices for securing end boards or gates of wagon boxes and consists, chiefly, in a lever pivoted to the gate by a link or bar, and having, at one end, claws or hooks for taking into notches in one of the side boards, and at the other end a slot to receive a staple which projects from the gate.

Improved Soap Cutting Machine.

Joseph Seibert, New York, city.—The object of this invention is to furnish to soap factories and drapers in soap an improved machine for cutting the soap blocks into pieces of any required size. The invention consists of a feeding frame provided with adjustable block carriers for forcing the soap against a suitable cutting frame, on which the cutting wires are rigidly applied by a stretching device, which consists of a supporting piece which carries a crank shaft. The wire is wound upon the shaft by turning it with a small crank, and retained in stretched position by a ratchet and pawl.

Improved Churn Dasher.

George Eldler, Rickardsville, Iowa.—This invention consists in an improved form of churn dasher formed of bars crossing each other, which are made V-shaped with V grooves in their under side. It was fully illustrated and described on page 538 of the current volume of this journal.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From November 8 to November 15, 1873, inclusive.

CONDENSING MILK, ETC.—G. Borden, White Plains, N. Y., et al.

GAME.—G. S. Lee (of Worcester, Mass.), London, England.

GAR.—G. W. Morris et al., Baltimore, Md.

LOOM.—E. Oldfield, Norwalk, Conn.

PAPER BAG MACHINE.—L. C. Crowell, Boston, Mass.

PRESERVING MILK, ETC.—G. Borden, White Plains, N. Y., et al.

RAILROAD BRAKE.—W. M. Henderson, Philadelphia, Pa.

SPADE BAYONET, ETC.—F. Chillingworth, Springfield, Mass.

NEW BOOKS AND PUBLICATIONS.

ORIGIN AND METAMORPHOSES OF INSECTS. By Sir John Lubbock, M.P., F.R.S., Vice Chancellor of the University of London. With numerous illustrations. Price \$1.25. London and New York: Macmillan & Co.

The author of this book is the head of a large London banking firm, and chairman of the Committee of the Bankers' Clearing House, besides fulfilling the duties of the positions mentioned in the title; and he yet finds time to pursue, to its uttermost details, one of the most complicated and voluminous branches of natural history. His numerous contributions to the literature of entomology have been read before the Royal Society, the British Association, the Ray Society, and many other learned bodies. This treatise, now issued in an elegant form, with numerous engravings, was originally published in the pages of *Nature*.

HOW TO MAKE MONEY BY PATENTS. By Charles Barlow. Third Edition. London: E. Marlborough & Co., 14 Warwick Lane.

It is not necessary to give a detailed description of this excellent little treatise, as we published a résumé of its contents on page 266 of our volume XXVII. The demand for two further editions is an indication of its continued utility.

NOTES OF A METALLURGICAL JOURNEY IN EUROPE. By John A. Church, Engineer of Mines. With illustrations. New York: D. Van Nostrand, 23 Murray and 27 Warren Streets.

The author here reviews the systems in use in Germany and Italy, especially in the Hartz, at Freiberg, and at Agordo. The notes were first published in the *Engineering and Mining Journal*.

MATHEMATICAL AND PHILOSOPHICAL MANIFESTO, concerning a Lacking Link in the Demonstration of the Pythagorean Problem, Disproving its Absolute Truth, etc. By Theodore Faber. New York: E. S. Dodge & Co., 84 John Street.

We have carefully looked through this pamphlet for the 41-proof of the Pythagorean argument, and we must admit that there is still a "lacking link." But as the matter is in the hands of the Royal Society of England, we will await the discussion of the subject by that learned body before venturing a final opinion.

Business and Personal.

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

Protect your Buildings with Patent Liquid Slate Roof Paint. Fire Proof and Elastic and very Cheap. Send for Circular of Prices and Certificates. New York City Oil Co., 116 Maiden Lane, New York, Sole Agents.

Wanted—A first or second hand Engine Lathe, 14 ft. bed, 30 in. swing; screw cutting B. G. and cross feed. Freeman & Jackson, Louisiana, Mo.

Every Machine Shop and Manufacturing Establishment should have a "Universal Hand Planting Machine," attached to any vice, or to the work itself, for the saving of Files and time of workman. Jacob E. Sutterlin, Manufacturer, 60 Duane St., New York.

Flour, Feed, Paint, Ink, and all other kinds of Mills. Ross Bros., Williamsburgh, N.Y.

An Engineer, Machinist and Draughtsman, having \$10,000 to invest, is desirous of purchasing an active interest in an established manufacturing business. Address Engineer, Danville P. O., Pennsylvania.

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For Sale—Part interest in a valuable Patent, or will exchange for Western land. E. J. Sprague, P. O. Box 17, Youngstown, Ohio.

"Just Published," Treatise on Watch-Work, Past and Present. By H. L. Nelthrop. Engravings, 8vo., cloth, \$2.50. E. & F. N. Spon, 416 Broome St., New York.

Engines for Sale, Cheap—Three 8x12 horizontal stationary; one 14x15; one 5x8. Enquire at D. Frisbie & Co., New Haven, Conn.

A patent for the best tyre bender out for sale: it is a compound lever self feeder; bends to a gauge; nearly all cast iron; weighs 100 lbs. Terms moderate. Address G. J. Hublet, Boothville, W. Va.

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Iron Steam Boxes for Stave Bolts & Veneer Cutting Machines. T. R. Batley & Vail, Lockport, N.Y. Boulton's Unrivalled Paneling, Variety Molding and Dovetailing Machine. Manufactured by Battle Creek Machinery Company, Battle Creek, Mich.

We sell all Chemicals, Metallic Oxides, and Drugs; directions on Nickel, in pamphlet form, we mail on receipt of fifty cents; a Bottle on "Soluble Glass" we mail for \$1. Orders will receive prompt attention by L. & J. W. Feuchtwanger, 25 Cedar Street, New York.

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Buy for your boys, for Christmas, the Tom Thumb Telegraph, complete for practical use, with battery, wires, keys, and instructions, price \$3. Neatly boxed and sent to all parts of the world. F. C. Beach & Co., 290 Broadway, New York. See engravings in last week's "Scientific American."

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., or Uttergraph, etc.

Bac n's Hoisting Engines for Mines, Contractors, Blast Furnaces, &c., adapted to every possible duty. Earle C. Bacon, Gen. Agt., 26 Cortland St., N.Y.

For Bolt Forging Machines, Bolt Holding Vices to upset by hand. J. R. Abbe, Manchester, N.H.

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

Brass Gear Wheel, s, for models, &c., made to order, by D. Gilbert & Son, 213 Chester St., Phila., Pa.

Superior to all others—Limet & Co.'s French Files. They are cheaper than English files. They are heavier, better finished, and better tempered. Send for price-list. Homer Foot & Co., Sole Agents, 20 Platt Street, New York.

Telegraph & Electrical Inst's—Cheap inst's for learners—Models and light Mach'y. G. W. Stockley, Sec., Cleveland, Ohio.

Brown's Coal-yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro., 414 Water St., N.Y.

Beltting—Best Philadelphia Oak Tanned. C. W. Army, 301 and 303 Cherry Street, Philadelphia, Pa.

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Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The larger sizes have a range of over two miles. These arms are indispensable in modern warfare.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 69 Grand Street, New York.

Damper Regulators and Gage Cocks—For the best, address Murrill & Kistner, Baltimore, Md.

Steam Fire Engines, R. J. Gould, Newark, N.J. Peck's Patent Drop Press. For circulars, address Milo Peck & Co., New Haven, Conn.

Parties wishing Patented articles manufactured on royalty or otherwise, address Box 810, Gloversville, N.Y.



G. W. L. can anneal his lamp chimneys by the process described on p. 42, vol. 25.—C. F. E. will find the directions for transferring pictures to glass on p. 238, vol. 25.—H. C. M. will find a recipe for fireproof paint on p. 321, vol. 25.—F. W. E. can stop the leak in his pipe by the process described on p. 354, vol. 25.—R. A. D. will find a recipe for black ink on p. 106, vol. 27. For violet ink, use a decoction of logwood, to which a little alum or chloride of tin has been added.

S. C. H. says: I have a 1/2 inch pipe, 2 miles in length; and at one end there is an atmospheric pressure of 10 lbs on the square inch. What amount of time would be required, to produce a pressure of 5 lbs. at the other end of pipe? A. A question of this kind could only be determined by experiment. Formulas have been established for the velocity of discharge of air through long tubes, but the constants have not been determined with sufficient precision to apply to this case. You will find the flow of air through tubes discussed in Weisbach's "Mechanics and Engineering."

W. E. M. asks: How many pounds will a steel screw 2 inches in diameter with 1/4 inch thread be capable of raising? A. If you mean that the thread is cut half an inch deep, the screw will lift about 60,000 lbs.

G. W. J. asks: 1. How many revolutions does the screw of an ocean propeller make in a minute? 2. How is the screw made to revolve with the desired rapidity? A. 1. In the case of large ocean steamers, the number of revolutions per minute is generally between 30 and 65. 2. By having sufficient power in the engines. Governors are commonly fitted, to correct a tendency to change the speed.

F. J. S. asks: How can I prepare mustard with vinegar, for table use? A. The common practice of preparing mustard for the table with vinegar, or still more with boiling water, checks the development of the peculiar principles on which its strength almost entirely depends. Prepare as follows: Mustard (ground) 3/4 lbs., water sufficient to form a stiff paste. In half an hour, add common salt, rubbed very fine, 1 lb. Then reduce to a proper consistency with vinegar, grape juice, lemon juice or white wine. A little soluble cayenne pepper, or essence of cayenne, may be added.

L. & H. say: We have a tubular boiler 12 feet long, 31 inches diameter, with 30 three inch tubes. We would like to know how to set it so as to economize fuel. We find our shavings and waste insufficient to run it. It has been suggested to set the grate on a level with the floor, without a front, or at least with a door of full size, so that the furnace may be easily and quickly fed; with the ash pit connecting with a passage leading outside of building to supply draft. A. We think the plan proposed will answer very well. In regard to grate bars, you had better order them from some manufacturer who makes a specialty of building boilers for places where sawdust and shavings are to be used as fuel.

G. Q. asks: 1. How can I find out when sand contains gold, and how is the gold separated from the sand? 2. What is whitening? 3. What are the proportions of alcohol and chloride of lime used in making chloroform? 4. Is there such a thing as gold wash? If so, how is it made? 5. How can I make lemon soda water, to bottles? 6. Can you give me a recipe for making bronze ink? 7. Can I make alcohol from rotten potatoes? If so, how? 9. What are cornices made of? A. 1. You can see the fine glittering grains of gold, if they exist in the sand, and you can separate them by washing in a pan. This pan is best made with sloping sides, and a circular depression in the center, into which the grains of gold settle, while the sand and earth are washed along on the edge. 2. Whitening is elaborated chalk. 3. Chloroform can be prepared as follows: Chloride of lime in powder 4 lbs., water 12 lbs.; mix in a capacious retort or still, and add 12 fluid oz. of rectified spirit (strong alcohol). Continuously distill the mixture as long as a dense liquid, which sinks in the water which passes over with it, is produced. Separate this dense liquid, which is chloroform, from the water, agitate with a little sulphuric acid, and lastly rectify from carbonate of baryta. 4. A gold wash can be made by agitating ether with a solution of terchloride of gold for some time. Allow it to repose and pour off the supernatant liquid. When this liquid dries, it leaves a coating of gold. 5. By using a carbonic acid gas generator and a bottling machine, with receptacles for strap. Soda water is only put up conveniently in this way on the large scale. 7. Grind up bisulphide of tin, or bronze powder, with a little gum water. 8. Not from those portions of the potatoes which have undergone putrefactive fermentation. The sound portions left can be used. 9. Cornices are generally moulded in plaster of Paris.

R. T. M. asks: Is there anything that will remove the tattoo marks, made in the flesh with common Indian ink, without leaving a scar? I have heard that they could be made to disappear by first rubbing the marks with a saline of pure acetic acid and lard, then with a strong solution of potash, and finally with hydrochloric acid. Is this so? A. There is little doubt that tattoo marks could be made to disappear by the application of the chemicals you name, but the entire cuticle and something more would undoubtedly be sacrificed in the operation, and we therefore advise you by no means to be imposed on by applying corrosive chemicals to the skin. The difficulty of removing the carbon which lies buried under the outer or scarf skin, without removing the skin at the same time seems unsurmountable, but perhaps some correspondent may be able to suggest a practical and painless method.

A. K. says: I have two upright (external tubes) boilers, connected at steam and feed water. Each boiler is provided with a stop valve on steam pipe, so that either or both can be shut off. I find that, when both valves are closed, the water will fall in the one and rise in the other and run out of safety valve, when the pressure on steam gages indicates the same for each boiler, with no fire under either of them. Can you explain this? 2. Should the bottom of a circulating boiler, such as is used in connection with a cook stove or range, be set higher than the highest part of the water back exposed to heat of the fire; or is it only necessary to have the pipe, that carries the hot water into boiler, higher where it enters boiler than highest part of water back? A. 1. You do not send enough particulars to enable us to answer this question. 2. The boiler should always be kept full of water; and provided there is sufficient pressure in the tank or main to secure this, it probably makes no difference at what point the connections are made.

J. W. asks: 1. What are the relative strength and freedom from vibration of two hulk frames to carry machinery (especially the burr harks of flouring mills), one built with timbers all standing perpendicular to the base, and the other with the sides vertical? 2. What is the best work for a millwright's guide? A. 1. From your statement it seems to us that you desire to compare two identical arrangements. 2. "Machinery and Mill Work," by Professor Rankine, and "Mills and Mill Work," by Sir William Fairbairn, are both excellent books. Ryne's "Practical Model Calculator" is also a useful work.

H. W. asks: 1. What is the philosophy of soap taking grease spots out of cloth? 2. Is there any profit in manufacturing lemon extract on a small scale, and how is it made? 3. Can you give me a recipe for making an oil for light machinery? A. 1. There is an excess of alkali in the soap. This mixes with the grease on the cloth, and forms more soap. 2. You can readily try it. For an account of the method, see page 321, current volume. 3. It would probably be cheaper and more satisfactory for you to buy it.

L. R. asks: Can you explain the working of a steam trap? A. Steam traps are frequently arranged with floats, so that when they become filled with water to a certain height, a valve is opened below the water line. Thus the water escapes, but the steam is not permitted to do so; and when the water level is lowered to a given point, the float is not sustained, and the valve closes.

G. J. asks: How can I find the radius of a wheel to make any number of turns, when worked by a worm or screw, the pitch being given? A. To find the radius of the wheel to make any desired number of revolutions in a given time, knowing the number of revolutions of the screw by the pitch in inches, and divide the product by 62832 times the number of revolutions made by the wheel. Example: Suppose a screw with one inch pitch makes 140 revolutions per minute, what should be the radius of the wheel so that it shall make 2 revolutions per minute? Radius = $140 \times 1 \div 62832 \times 2 = 11.441$ inches, nearly.

J. J. P. asks: How is Pepper's ghost produced? Can I perform the experiment with a common magic lantern? A. The real figure is situated below the stage, at A, and has a strong light thrown on it, from B. C is a mirror, and a piece of plate glass. The spec-

tator in front of the stage, as at S, the figure appears to proceed from a point G, behind the glass. Really, the figure would appear to be back of the glass as far as the image formed in the mirror was in front of it, and thus the spectator does not perceive the plate glass.

T. thinks that, in the manufacture of shot, the melted lead, when it drops from the top of the shot tower, ought to assume an elongated form, and asks what prevents, or what makes the shot so round. A. The spherical form is due to the addition to the lead of a small amount of arsenic, which hardens the lead and causes it to assume the spherical form when poured through the strainer. The air fills the shot, which falls into the vessel of water below.

O. A. F. asks: 1. How can photographs be taken on another piece of paper without injury to the original photograph? 2. I have a small engine, 1 inch bore x 1 1/2 inch stroke; it makes 400 or 500 revolutions per minute with 60 lbs. steam when loaded. The fly wheel is 5 1/2 inches diameter. What is the actual power of it? A. 1. We have seen several recipes for this purpose, but are not sure that they are reliable. 2. The engine, at 530 revolutions, probably develops about one fourth of a horse power. In answer to your steam gage question: It would be possible to test them by such an apparatus as you describe, but great care would be required in the experiments, and it would probably be necessary to apply several corrections for differences of temperature, and variations in the bore of the tubes. A column of mercury, having one inch area of base, and a height of 2 7/8 inches, weighs one pound, at a temperature of 62° Fahrenheit. Every change of temperature will affect the height of this column, since mercury expands about 9 000000 of its volume for each degree that its temperature is increased.

W. J. S. asks: 1. What degree of heat is required to hatch eggs? 2. How can I construct an oven for this purpose? A. 1. 107° or 104° Fah. 2. See Science Record for 1873.

J. E. H. asks: How is lard oil made? A. By subjecting lard to pressure. In answer to your other query, enquire for employment in a machine shop, and study Bourne's works on the steam engine.

J. W. F.—Your general design of guide pulleys is correct, except that, unless the connection is very long, it will not answer to have their shafts vertical; but they must be placed at such an angle that the belt will not have a tendency to change its plane of action and thus run off.

T. Y. S. asks: Can a fly wheel be too large for an engine? I have an eighty horse engine which I have been using at only twelve or fifteen horse power. Since it has been doing so little, it has broken the bed plate, loosened the foundation, and otherwise damaged the engine. I use about 80 lbs. of steam. My idea is that the momentum of the wheel is so great that it wants to get ahead of its work, which the steam will not allow, thereby keeping the engine moving on the foundation.

A. We have an idea that the trouble arises from improper setting of the engine, or from the fact that you use such a high grade of expansion as to strain the engine seriously.

P. S. asks: Is it dangerous to make oxygen gas (for a stereopticon light) from chlorate of potash and black oxide of manganese? A. If the pipes from the retort and washer are all of liberal dimensions, we think there is little danger. We call to mind a few explosions, one of a very serious nature, due to clogging of the pipes owing to their small dimensions.

M. D. asks: How is it possible that a grindstone can wear away into angles, so that as many as thirteen corners are seen in it? A. There are probably soft and hard places alternately in the stone from which it was cut.

J. E. S. W. asks: 1. How can I dissolve gum so that I can spread it on the soles of leather shoes, and what kind of gum shall I use? 2. What will take ink blots off paper? 3. How can I make a blackboard? 4. What can I make a mold of, to mold a leaden piece to set type in, with a level surface and without flaw? A. 1. You can dissolve India rubber in bisulphuret of carbon, and use it in the way you suggest. 2. Dip a camel's hair brush in dilute oxalic acid and paint the blots over with it. 3. See p. 199, vol. 28. 4. Lead is apt to form flaws in casting. Cast your plate on a smooth piece of iron, with a border of putty or clay.

A. A. B. asks: If a stove has no air to its furnace except what is delivered through an airtight pipe, the other end of which runs into water in a barrel, with a smaller barrel turned bottom up on the water, in the manner of a gas holder: Will the fire in the stove draw air from the barrel and burn it, and thereby allow the smaller barrel to fall down entirely inside of the larger? A. If the air in the chimney is heated, it will be lighter than the surrounding atmosphere; hence the stove will draw air from the barrel, or the barrel will draw air from the chimney, until the weight in each is the same.

C. R. asks: When and where did a race between the Niagara (American) and the Agamemnon (British) war vessels take place? A. We do not find any account of this race, but suppose it took place when the Niagara and Agamemnon were engaged in laying the Atlantic cable. Captain William L. Hudson commanded the Niagara at that time. Possibly some reader may have the particulars.

J. A. E. asks: Can a steam engine give more horse power than its nominal duty? Some persons claim that a 10 horse engine can be geared up to 20 horse power. A. The engines of reputable builders will generally do the work at which they are rated, with a given steam pressure and piston speed. Hence by increasing one or both of these elements of the power developed, the engine could do more.

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

R. H. R.—No. 1, barites and fluorspar. No. 2, celestine. No. 3, analime. No. 4, limonite. No. 5, magnesite. No. 6, serpentine.

F. H.—Your specimens are crystals of quartz. Quartz is pure native silica, and is an important constituent of granite and other rocks, and of ordinary sand. The transparent variety, like the two larger specimens, is called rock crystal.

J. R. G. asks: Can you give a simple practical rule for finding the exact position of the wrist in the shaft of a nail machine?—C. F. S. asks how to make a blue stamping ink for marking knitted goods.

COMMUNICATIONS RECEIVED.

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

On the Science of Iron and Steel. By C. C. Jr.

On the Currency. By J. W. H.

On Reconstructing the Navy. By W. Y.

Also enquiries from the following:

J. B. H.—C. G. E.—J. C.—McG.—H.—S. H. A. F.—O. R. & S. P.—F. G.—R. H. M.—S. A. B.—J. O.—H. A. M.—E. H.—H. R.—C. E. H.—W. L. R.

Correspondents in different parts of the country ask: Who makes life coats from willow and cane? Whose is the best shingle machine? Who builds lime kilns? Where can I get stove machinery? Where is oil well boring machinery sold? Whose is the best cement for making cornum wheels? Who makes a hand willow peeler? Who makes a good velocipede, or a similar machine to be worked by the hands? Who makes platinum plates for Smee's batteries? Who makes steel runners for ice boats? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

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 "address" 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

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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:

27,241.—PHOTOGRAPH CAMERA.—A. Semmendinger, Feb. 4.

27,291.—SEED PLANTER.—J. S. Huggins, Feb. 11.

27,406.—CULTIVATOR.—E. Craig, Feb. 18.

EXTENSIONS GRANTED.

26,177.—MAKING RUBBER BELTING.—D. C. Gately.

26,178.—RUBBER BELTING.—D. C. Gately.

DESIGNS PATENTED.

6,996.—LOCK CASE.—W. H. Andrews, New Haven, Conn.

6,997.—WHEEL HUBS.—J. B. Locke, Amesbury, Mass.

6,998 to 7,001.—C. T. & V. E. Meyer, Bergen, N. J.

TRADE MARKS REGISTERED.

1,527.—ICE PITCHERS.—Adams & Co., Brooklyn, N. Y.

1,528.—SOAP POWDERS.—B. T. Babbitt, New York city.

1,529.—BAKING POWDER.—B. T. Babbitt, New York city.

1,530.—COMPOUND SPICE.—E. R. Durkee & Co., N. Y. city.

1,531.—MEDICINE.—W. H. Gregg & Co., Elmira, N. Y.

1,532.—KID GLOVES.—F. Hegle, New York city.

1,533.—CUTLERY.—I. T. Meyer & Co., New York city.

1,534.—GOLD AND SILVER SOLUTIONS.—B. M. Morrison, Portland, Me.

1,535.—AGRICULTURAL IMPLEMENTS.—Rumsey & Co., St. Louis, Mo.

1,536.—DRYERS, ETC.—G. C. Liszka, Williamsburgh, N. Y.

SCHEDULE OF PATENT FEES.

On each Patent.....	\$10
On each Trade Mark.....	\$25
On filing each application for a Patent (37 years).....	\$15
On issuing each original Patent.....	\$20
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On appeal to Commissioners of Patents.....	\$20
On application for Retention.....	\$30
On application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (3 1/2 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

(Specially reported for the Scientific American.)

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA FROM NOVEMBER 13 TO NOVEMBER 24, 1873.

2,841.—J. M. Killin, Pittsburgh, Pa., U. S. Improvement on molder's gates or sprues, called "Killin's Molders' Gate." Dated Nov. 13, 1873.	
2,842.—O. Sherwood, Jr., Bromo township, P. Q. Machine for coupling railway cars, called "Sherwood's Self Railway Car Coupler." Nov. 13, 1873.	
2,843.—D. DeCastro, of Mortlake, Surrey county, Eng. and R. Burton, Camden town, Middlesex county, Eng. Im-	

provement on gas meters, called "The Imperial Compensating Wet Gas Meter." Nov. 13, 1873.	
2,844.—W. A. Telling and Samuel Johnson, Wood Green, Middlesex county, Eng. Improvement on gas meters, called "The Imperial Dry Gas Meter." Nov. 13, 1873.	
2,845.—J. Brunet and L. Bellefeuille, Montreal, P. Q. Machine a presser la tourbe, called "Machine a Presser La Tourbe de Brunet et Bellefeuille." "Machine for pressing peat." Nov. 13, 1873.	
2,846.—J. K. Home, Almonte, Lanark county P. Q. Improvements on patterns for pipe elbows, describing the swift to form miter joints of elbow pipes at various angles, called "J. H. Holmes' Patterns for Pipe Elbows." Nov. 13, 1873.	
2,847.—D. C. Baker, Fulton, N. Y., U. S. Improvement on cultivators, called "Baker's Cultivator." Nov. 13, 1873.	
2,848.—D. C. Baker, Fulton, N. Y., U. S. Bolt holders for railroad rails, called "Baker's Railroad Bolt Holder." Nov. 13, 1873.	
2,849.—S. Rue, Philadelphia, U. S. Improvements on injectors for steam generators, called "Rue's Little Giant Injector." Nov. 13, 1873.	
2,850.—J. W. Stockwell, Portland, U. S. Machine for the manufacture of cement pipe, called "Stockwell's Cement Pipe Machine." Nov. 13, 1873.	
2,851.—J. W. Stockwell, Portland, U. S. Improvements in mixing machines, called "Stockwell's Improved Mixing Machine." Nov. 13, 1873.	
2,852.—S. B. Munson, Jr., Chicago, U. S. Improvements on fireproof shutters, called "Munson's Fireproof Shutter." Nov. 13, 1873.	
2,853.—G. W. Cottingham, St. Mary's, Texas, U. S. Machine for ironing clothes, called "Cottingham's Ironing Machine." Nov. 13, 1873.	
2,854.—H. Bolton, Brantford, Ontario. Improvements on piano stools, called "Improved Double Adjustable Piano Stool Bench." Nov. 13, 1873.	
2,855.—H. Spear, Elizabeth, Cumberland county, Maine, U. S. Improvements on pumps, called "Spear's Pump." Nov. 13, 1873.	
2,856.—N. C. Locke, Salem, Mass., U. S. Improvements on pressure regulators for steam or water, called "Locke's Pressure Regulator for Steam or Water." Nov. 13, 1873.	
2,857.—M. Merrick, Oswego, U. S., assignee of H. Tilden, Philadelphia, U. S. Improvements on gas machine, called "Tilden's Improved Gas Machine." Nov. 14, 1873.	
2,858.—Ed. Beanes, Toronto, Ontario. Extension of Patent No. 341, for improvements in brewing. Nov. 14, 1873.	
2,859.—G. Borden, White Plains, N. Y., U. S., and J. G. Borden, South East, Putnam county, N. Y., U. S. Improvements on the manufacture or product of condensed milk, called "Borden's Manufacture or Product of Condensed Milk." Nov. 14, 1873.	
2,860.—G. Borden, White Plains, N. Y., U. S., and J. G. Borden, South East, Putnam county, N. Y., U. S. Process of preserving and condensing milk, called "Borden's Process for Preserving and Condensing Milk." Nov. 14, 1873.	
2,861.—W. G. Dunn, Hamilton, Ontario. Movable self feed attachment for coal cooking stoves, called "Dunn's Removable Self-feeding Attachment for Cooking Stoves." Nov. 14, 1873.	
2,862.—T. O. Kemp, Clinton, Lincoln county, Ontario. A boiler attachment for removing steam and other impurities from boilers of steam engines, and also for preventing scale attaching to boilers and their tubes, called "Kemp's Patent Boiler Attachment." Nov. 15, 1873.	
2,863.—E. C. Flint, Bellville, Ontario, assignee of E. P. Needham, New York city, U. S. Key for musical instrument, called "Needham's Improved Key for Musical Instruments." Nov. 15, 1873.	
2,864.—J. R. Finley, Delphi, Ind., U. S. Improvements on gates, called "Finley's Improved Gate." Nov. 15, 1873.	
2,865.—C. Kendall, Beloit, Wis., U. S. Machine for renovating and drying feathers, called "Kendall's Paragon Feather Renovator." Nov. 15, 1873.	
2,866.—R. Burdett, Erie City, Pa., U. S. Improvement in reed organs, called "Burdett's Improved Reed Organ." Nov. 15, 1873.	
2,867.—J. C. Ford and A. D. Cable, Montreal. Improvement on attachment for securing horses, called "Ford's Adjustable Leg Halter." Nov. 15, 1873.	
2,868.—A. Pelletier, Washington, U. S., Rev. J. B. A. Brouillet, Walla Walla, Washington Territory, U. S., and H. Ladeur, Yamaska, P. Q. Composition of matter for the manufacture of artificial stone and for other purposes, called "Pelletier's Artificial Stone and Cement." Nov. 15, 1873.	
2,869.—M. Henry, Parkhill, Ontario, and J. B. Steele, Montreal. Composition of matter for lighting fires, called "Henry's Fire Kindler." Nov. 21, 1873.	
2,870.—J. West, Maidstone, Kent county, Eng. Method of manufacturing gas and the apparatus to be employed therewith, called "West's Improved Gas Manufacturing Apparatus." Nov. 21, 1873.	
2,871.—C. Vandandaigne, dit Sabois, Baltic, Conn., U. S. Improvement on washing machines, called "The Baltic Washing Machine." Nov. 21, 1873.	
2,872.—A. Wilson and E. M. Law, Bell Ewart, Simcoe county, Ontario. Improvement on sash fasteners, called "Wilson and Law's Improved Sash Fastener." Nov. 21, 1873.	
2,873.—E. B. Sims, Antwerp, Jefferson county, N. Y., U. S. Improved door bells, called "Sims' Improved Door Bell." Nov. 21, 1873.	
2,874.—W. Vincent, Arbroath, Berkshire, Eng. Apparatus for manufacturing gas, called "Vincent's Gas Apparatus." Nov. 21, 1873.	
2,875.—H. Brewer, East Parsonfield, York county, U. S. Improvement on wagon brakes, called "The Brewer Wagon Brake." Nov. 21, 1873.	
2,876.—A. J. Sorenson, Erie, Pa., U. S. Improvement on cases for cabinet organs, called "Sorenson's Improved Case and Sliding Fall." Nov. 21, 1873.	
2,877.—W. R. Peck, Chatham, Kent county, Ontario. Machine for molding the frame work of vessels, ships and other material, called "Peck's Adjustable Frame Mold." Nov. 21, 1873.	
2,878.—C. B. Hunt, Springfield, Susquehanna county, Pa., U. S. Improvement in drills, called "Hunt's Hammer Twist Drill." Nov. 24, 1873.	
2,879.—H. Gregory, Rockland, Maine, U. S. Improvement on elastic friction bands for booms of vessels, called "Gregory's Elastic Friction Band for Booms of Vessels." Nov. 24, 1873.	
2,880.—H. Hinds, Ottawa, Ontario, assignee of H. Johnson of same place. Improvement on drum heaters for stoves and pipes, called "Johnson's Improved Stove Drum Heater." Nov. 24, 1873.	
2,881.—J. Lewis, Manchester, Eng. Improvement on locomotive engine, called "Lewis' Improved Locomotive." Nov. 24, 1873.	
2,882.—C. Carpenter, Hamilton, Wentworth county, Ontario. Attachments for door knobs and spindles, called "Carpenter's Door Knob and Spindle Attachments." Nov. 24, 1873.	

2,883.—L. O. Thayer, Montreal, assignee of J. Duval, St. Joseph, Laprairie county, Quebec. Improvement on breech loading fire arms, called "Duval Thayer Breech Loading Rifle." Nov. 24, 1873.

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Vol. XXIX.—No. 26.
(NEW SERIES.)

NEW YORK, DECEMBER 27, 1873.

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IN ADVANCE.

THE MANUFACTURE OF PLASTER OF PARIS.

BY J. F. GERRER, M. A.

Gypsum is a mineral, very widely and abundantly disseminated, whether as the snow white, translucent, and massive alabaster, the transparent, crystallized selenite, the fibrous, beautiful satin spar, or the ordinary amorphous, rather soft plaster stone. It is only when ground and calcined that the term plaster of Paris is applied to it, from the great extent of gypsum existing at Montmartre, near Paris, where it has been worked for a long time.

The many beautiful objects of art into which alabaster is formed, such as vases, monuments in churches, statues, etc., are familiar enough to many. The softness of the stone, and its rapid deterioration when exposed to the weather, render it adapted only for statuettes and other small works of art, or for those which are not intended to be exposed to excessive moisture or climatic influences.

The crystallized and transparent form of gypsum, frequently found in large deposits of the ordinary stone, is known as selenite, from *selenē*, the moon, on account of its reflecting a soft moon-like luster. This variety is capable of splitting up into thin laminae or leaves, sometimes of large size.

The beautiful satin spar is a fibrous variety of gypsum, and exhibits a fine play of light, like lustrous satin. It is used for necklaces, inlaid work, and other ornamental purposes, though it is easily scratched and its beauty destroyed. Anhydrite is the term applied to a hard compact variety, which is remarkable from the fact of its containing no water; it is consequently inapplicable, as will be seen more clearly presently, for the process and uses which we are about to describe.

cular way in which this water is held, its easy expulsion by a moderate heat, and the subsequent readiness of the material to combine with the abstracted water, when again presented to it, and assume the solid state, that give to gypsum its importance in the useful arts, and make its manufacture on the large scale a great and increasing industry.

In its composition will be noted how substances, highly corrosive in themselves, sometimes unite to form inert and harmless compounds. Confectioners largely adulterate their sugar plums with very finely ground or elutriated gypsum. Gypsum, in the ordinary state, as largely quarried, resem-

bles good limestone or carbonate of lime; but it differs from it in not, when pure, effervescing with acids and in being softer. It is indeed unattacked by acids; but by the action of water it is gradually dissolved and washed away, 1 part requiring 400 parts of water for its solution.

When crude gypsum in any of its forms, except anhydrite, is heated to 212° Fah., it begins to lose its combined water, and parts with it entirely at 272° Fah. If it be now withdrawn from the source of heat and, in a powdered condition, mixed with water, it combines with the same quantity previously expelled, and sets or becomes solid as at first. The operation of driving off this combined water is termed calcination.

The great demand for calcined plaster, and its cheapness for building purposes, have caused large steam mills to supersede the old-fashioned method of manufacture.

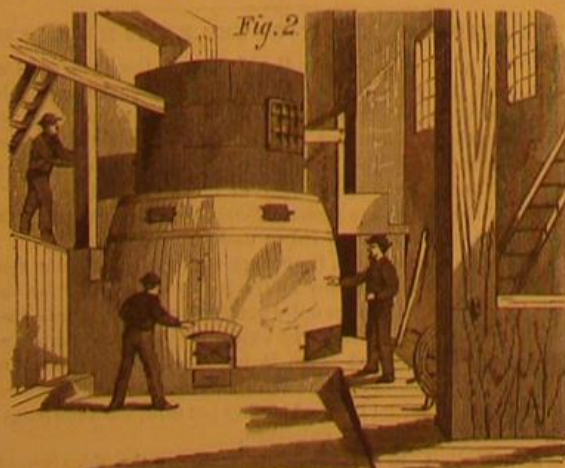
By the kindness of Messrs. Wotherspoon Brothers, proprietors of the Phoenix Plaster Mills, in West Thirteenth street, New York city, our artist has been enabled to make a series of drawings which will help to explain the various processes of the manufacture. The large illustration (Fig. 1) shows the operation of breaking and crushing.

The crude gypsum which, when brought to the mill, is in masses weighing from 20 to 100 lbs. or over, is broken up by the hammer into pieces rather smaller than an ordinary paving stone, and thrown by the workman into the crusher. This consists of an upright shaft expanding below into heavy iron cogs, which turn in an exterior iron shell, as seen in Fig. 1. The stone is here rapidly reduced to powder, but not yet sufficiently fine for the calcining process. A pulley below conducts the powdered material, by means of cleats revolving in an inclined wooden pipe, termed a conveyor, to the floor above. This style of conveyor is used in flour mills, and



THE MANUFACTURE OF PLASTER OF PARIS.

is located on the left of the crusher in the engraving. Here the crushed plaster is fed by a hopper, like wheat, to a burr stone mill, which reduces it to a fine powder, ready for the calcining process. Another conveyor, similar to the one described, carries the fine raw plaster to a bin at the top of the



The ordinary amorphous form of gypsum, or plaster stone, of which we have to treat in this article, is a sulphate of lime, containing, in 100 parts, 46.51 parts sulphuric acid, 32.56 parts of lime, and 20.93 parts of water. It is the pe-

bles good limestone or carbonate of lime; but it differs from it in not, when pure, effervescing with acids and in being softer. It is indeed unattacked by acids; but by the action of water it is gradually dissolved and washed away, 1 part requiring 400 parts of water for its solution.

We come now to the processes connected with the treatment of gypsum for rendering it available for the arts. The principal treatment, on which everything may be said to depend, is the calcination, or the exposing of the stone to that degree of heat which is just sufficient to expel enough water, so that the powdered material, when mixed with water, will set rapidly into a solid mass. This can be effected in two ways, either by exposing the hard crude stone, in small lumps, to the direct action of flame, or by submitting the crude powdered material to an indirect source of heat. The first method is practiced in Europe, where the crude gypsum is burned in kilns, similar to those used for lime, or sometimes in those of more improved construction, but in which the stone is still exposed to a direct fire.

The disadvantages attending this method are that the lower layers of stone are "dead burnt," so that their powder will



building, where it is delivered in successive charges to the kettles. These, as shown in the illustration (Fig. 2), consist of large cast iron receptacles, capable of holding 45 barrels as a charge. They are set in brick furnaces and their bot-

toms are constructed in a peculiar manner and of stout iron, to withstand the heat of an anthracite fire. Revolving stirrers, almost in contact with the bottoms and sides, are kept in motion to prevent caking.

Care and skill are requisite in the calcination process, to avoid either over or under burning. If all the water be driven off, the plaster will not harden so rapidly as that which has been heated so long as the tumultuous expulsion of vapor lasts; and if only half the contained water be expelled, the plaster will have entirely lost its power of hardening with water. Properly calcined gypsum seems to retain one fourth of its combined water. When the calciner judges the process to be complete, the calcined plaster is drawn out into a bin, where it is conducted to the bolt, which is a revolving cylindrical drum made up of three different finenesses of wire cloth set on an incline. The finest sieve is first encountered, and then the material falls upon the others in turn. Directly below, corresponding to the width of each particular fineness of the sieve, are bins which receive the calcined plaster of three degrees of fineness, known as superfine, casting, and common. From these bins the article is rapidly shoveled into barrels and packed for the trade.

The method of packing is seen in the illustration, Fig. 3. The workman first prepares the barrel by lining its interior by hand with a few sheets of brown paper, wide enough to overlap one another. These project above the top of the barrel, and are folded over in a very secure manner, thus answering the purpose of a head. Barrels for distant transportation are headed in the ordinary manner.

The barrel to be filled is first fitted with a wide mouthed funnel, and then placed on a revolving platform, and, while rotating slowly, is tapped rapidly by a hammer actuated by a spring and ratchet wheel. Each shovelful is thus well packed.

This manufactory of the Messrs. Wotherspoon has been in operation over forty years, and utilizes the product of two quarries, one at Wentworth, near Windsor, Nova Scotia, and the other at Hillsboro', New Brunswick. The establishment is capable of turning out about 2,000 barrels per week.

Among the uses of plaster of Paris may be noted its employment for a hard finish to walls and the molding of cornice ornaments, for which purpose, to prevent its too rapid setting, it is usually mixed with a due proportion of slaked lime.

A remarkable fact connected with calcined gypsum is that the addition of two per cent of alum or borax delays its setting three or four hours, but the material then becomes a stone-like body, heavier than ordinary plaster. In Germany, Italy and England, beautiful cements are made in this way, known as parian. In taking casts, and in stereotyping, plaster of Paris is largely used.

Besides its use for molds in potteries, gypsum is employed for glazing porcelain; and, being an excellent non-conductor of heat, for filling fireproof safes. In Spain and France, made into a mortar with sand and quicklime, it is used for cementing floors and vaults.

In the United States, gypsum is extensively used as a fertilizer, and is found to be very efficacious on some soils. It is used as a top dressing for grasses, and for potatoes and turps, but the grains do not require it. Liebig has pointed out the fact that it fixes the ammonia of the soil as well as that of the atmosphere, thus conveying nitrogen to the roots.

The best gypsum quarries that are worked on this continent are on the Bay of Fundy, Nova Scotia, and Hillsboro', New Brunswick. Over one hundred thousand tons of the finest quality are annually imported into the United States.

MR. SETH ADAMS, long identified with the commercial and mechanical interests of Boston, died at his residence in Newton a few days ago after a long illness. Mr. Adams was the inventor of the celebrated power press bearing his name, but left it for improvement to his brother Isaac, who afterward became celebrated among printers for his many contrivances for facilitating the art of printing. He had a large property, which was invested in various corporate enterprises.

PUBLISHERS' CARD.

With this issue of our journal, the time for which a large number of our subscribers have prepaid will expire. In order that our readers may experience no stoppage in the receipt of the journal, and that we may not miscalculate the quantity of the paper to print at the commencement of a new volume, we hope our friends will signify their intention to continue the paper by early remittances.

The plan of discontinuing the paper when the time expires for which it is prepaid, we think preferable to the course adopted by many publishers, of continuing their paper indefinitely and collecting afterwards. The latter course is too much like having a bill presented for a suit of clothes after it is worn out. We shall be gratified to have every old subscriber renew, and doubly grateful if each will send one or more new names with his own.

The safest way to send money is by postal orders, bank checks, express, or draft on New York, payable to the order of Munn & Co. Little risk is incurred in sending bank bills by mail, but the above methods are safe beyond any contingency.

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MEASUREMENT OF THE INITIAL VELOCITY OF PROJECTILES.

The initial velocity of a projectile is its rate of motion through the air, at or near the muzzle of the piece from which it is fired, expressed in feet per second.

The solution of this most interesting problem in the science of gunnery has, of late years, been brought to a surprising degree of simplicity and accuracy by the application of electricity to instruments designed for the purpose. Formerly the problem was solved by determining the quantity of motion of the gun with its charge, etc., suspended as a pendulum, and, afterwards, the results were verified or corrected by receiving the impact of the projectile on a butt, suspended also on a pendulum, and calculating its quantity of motion. Both methods have been employed separately and in conjunction, but they required costly permanent structures, and gave but indifferent results.

The importance of this problem, without a knowledge of which no true estimate of the effects of a projectile can be formed, led to the search for a more accurate solution of it, which has resulted in the production of the electro-ballistic pendulum and chronoscopes now used by the artillery experts of all nations.

Many different instruments have been employed, some of which are still in use and are favorites with the artillerymen of different countries. In the United States service, the "Navy," "Bruton," "Vignotte," "Schultz," and "Boulenger" instruments have been and, with the exception of the "Navy," are still used.

All these instruments measure very short intervals of time; some, by means of a falling weight under the influence of gravitation; others, by the oscillation of one or more pendulums of known length; and others, by the isochronism of musical vibrations; and, besides measuring an interval of time, enable us to divide it into fractional parts and record its beginning and end, by means of electricity, either through the influence of electro-magnets, or by the spark from an induction coil.

As a representation of the first class, the Bruton instrument will serve for description. It consists of a graduated semicircle, supported on a tripod vertically, in front of which two pendulums, of equal length, are suspended on journals whose axes are on the same plane. The pendulums oscillate freely, close to the arc. The inner has an arm or marker on its end, which is struck by the outer one as they pass one another. An electro-magnet at each end of the diameter of the semicircle serves to hold the pendulums in a horizontal position, ready for recording. Each magnet is connected with a frame, the first near the muzzle of the piece and the second 100 feet farther on in the path of the projectile. Across each frame, the wire from its respective magnet and battery is passed to and fro, at such distance as will insure its being broken by the projectile in passing through. The battery circuits can be closed and broken at will, by means of a disjuncter.

To test the adjustment of the instrument, the circuits are closed, and the pendulums brought into contact with their respective magnets, where they remain in a horizontal position. The disjuncter is made to break both circuits simultaneously, the magnets become passive, and the pendulums begin their oscillation; they meet or pass one another at the lowest point of the arc, which for convenience is called the zero of the graduation; and at this point a mark is found, near the scale, indicating the place at which they passed. A spring receives each pendulum as it completes a single oscillation and holds it until released for another experiment. The trial thus described having shown that all is in order, the circuits are again closed, the pendulums suspended from their magnets, and the word "fire" is given. The projectile passes through and breaks the first target, and the corresponding magnet releases its pendulum, which begins an oscillation; meanwhile the projectile has advanced to

the second target, breaks it, and the corresponding magnet and pendulum are similarly affected. In this case the pendulums, not beginning their oscillations together, do not meet at the zero point of the arc, but some distance to one side of it, where the mark indicates the number of degrees from zero at which they passed. The time of oscillation of the pendulums being known, the short arc enables us to find the time between the fall of the first and second pendulum, which equals the time occupied by the projectiles in passing from the first to the second frame or target; and the space between the targets divided by the interval of time gives the initial velocity. For example, suppose the value of the interval to be one tenth of a second, and the space passed over to be 100 feet, then: $100 \div 0.1 = 1,000$ feet per second.

The Benton instrument was invented by Major J. G. Benton, of the United States Ordnance Corps. It is probably the best of the pendulum instruments; and, for measuring velocities by means of a single interval of time, is unequalled for general accuracy and ease of manipulation; but a pendulum instrument is limited to this use, and involves sources of error which later ones of different construction are intended to overcome, by discarding the pendulum and adopting a more sensitive agent to indicate the very small intervals of time required.

Preeminent among these stands the instrument invented by Captain Schultz of the French artillery, and known as the "Schultz chronoscope." It consists of a bed plate on which is mounted a cylinder with clockwork and a screw to give it simultaneously a rotary and lateral motion on its axis; a vibrating fork, whose function it is to trace a scale of time on the surface of the cylinder (which has been previously smoked by the flame of an oil lamp), by means of a quill point attached to one of its arms and resting lightly on the surface of the cylinder, in front of which the fork stands, clamped to the bed plate. The fork is made to vibrate, without fluctuation, by an electro-magnet mounted near the end of each of its arms, which alternately attracts and releases them without contact. The electro-magnets are controlled by an "interrupter," which closes and opens their battery circuits as often as the fork vibrates, which is about 500 times per second.

The rotary and lateral motion of the cylinder cause the fork, when at rest, to trace a fine line on its surface from end to end in the form of a helix or spiral, and, when the fork is in vibration, the sinuous line it traces intersects this fine line at the beginning and end of each vibration. The "rate" of the fork is found by connecting a break circuit seconds pendulum with the primary wire of the Ruhmkorff coil, whose secondary wire delivers an induction spark on the surface of the cylinder, beside the trace, every second; the number of vibrations between each spark shows the rate of the fork per second, which rate is constant for the same fork.

In like manner the rupture of the target wire (which is in circuit with the primary wire of the coil) by the bullet gives a spark for each, and the number of vibrations traced between the two sparks indicates the time the projectile took to pass from the first to the second target. A micrometer microscope is provided to read fractions of a vibration, and by its use the value of the interval can be determined to within $\frac{1}{100,000}$ part of a second.

This instrument is not so easy to manipulate as the one previously described, but it yields more accurate results and is susceptible of more extended use. It will record intervals continuously for 25 or 30 seconds, and so permit of investigating the motion of a projectile through its entire time of flight, and yield data for determining the resistance of the air on its cross section. It has been used to measure the time of passage of a musket bullet over the space of one foot, the average of ten trials being 0.000914." It may also be used to investigate the motion of the projectile within the bore of a gun, an experiment which has been recently made by Captain Noble, of the English service, with a chronoscope of his invention, in which rapidly revolving disks, of almost uniform motion for short periods of time, serve to receive the electric record from the targets.

The data furnished by such experiments are of the highest importance in the selection of suitable powder for guns of various calibers and the best forms of projectiles, and the instruments just described are fully equal to the solution of all the problems of modern gunnery lying within their field of research, and may well be expected to hold their preeminence for many years to come.

THE PRACTICAL ASPECT OF THE EIGHT HOUR LAW.

Supervising Architect A. B. Mullett of the Treasury Department, in his recent annual report, cites various forcible objections to the eight hour system, gleaned from his experience in the employment of labor in the construction of government buildings, since the passage of the act of Congress fixing the above number of hours as a legal day's work. He draws the general conclusion that the practical operation of the law has led to undesirable results.

In brief and generally, it appears that the eight hour system means not merely two hours less toll per day for the workman, but two hours daily practice in habits of idleness with their attendant train of evils; while to the employer and the community at large it indicates a deprivation of useful and valuable labor in a proportion constantly increasing, above its initial limit of twenty per cent, with the length of time the plan is in existence.

Mr. Mullett, in his communication to the department, states the more especial objections to the law, as follows:

"I desire once more to call attention to the eight hour law, believing it to be alike injurious to the best interests of the government and to the workmen themselves. It frequently happens that mechanics and laborers employed by

the government and those employed by contractors are required to work on the same building, and at the same time. Those employed by the government work but eight hours, while those employed by the contractors work ten hours *per diem*. This causes much feeling, and it needs no argument to prove that it is unjust, and that the mechanic who performs ten hours' work is taxed for the benefit of the more favored workman who has friends and influence sufficient to obtain employment for him on government work. It is also in direct violation of the principle of civil service reform, inasmuch as it converts the employment of mechanics and laborers from a business question of competency and industry to a question of political patronage and personal influence. I do not hesitate to say that it has cost the government millions of dollars, without benefiting the mechanic or laborer in the slightest degree, or, as far as I am advised, any other persons than perambulating or paid agitators, or the claim agents who have instigated litigations and claims for their own benefit. The law has been fairly and fully tested; the experience of this department, as well as of private establishments, has shown that it is not only impossible for a man to perform as much labor in eight hours as in ten, but that he absolutely performs less work per hour under the eight hour system. It is a matter of neither interest nor importance to me whether mechanics and laborers perform eight or ten hours' work, provided the hours of labor are the same on public as on private works. It is, however, impossible to conduct work in a proper manner under a system that increases the compensation of mechanics and laborers employed by the government 20 per cent above market rates, and thus makes them a favored class, without, as I have previously shown, obtaining any advantage therefrom. I would therefore recommend that such modification of the law be obtained as will entitle all persons employed by the government to the highest market rates for their labor, and the benefit of all local rules and regulations in regard to the hours of labor, or otherwise. If this rule is, however, to be the permanent policy of the government, and its mechanics and laborers are to be compensated at the rate of 20 per cent above the highest market rates, I see no reason why officers, clerks, and other employees of the government should not be paid by the same rule. Under the present system, gentlemen of education, who occupy positions of trust and great pecuniary responsibility in the different bureaus, actually receive less than mechanics' wages, and are discriminated against in favor of men who, as a rule, exhibit little interest in the performance of their duties, and have no responsibility whatever. It is also a fact that many mechanics receive, under the present system, not only more than their foremen and master mechanics, but more than the superintendent of the work on which they are engaged, the latter classes being allowed no compensation for extra labor performed."

JONAH AND THE BELGIAN ACADEMY.

Les Mondes devotes four pages to a piously indignant and argumentative editorial on a recent dissension in the Royal Academy of Belgium, regarding the rather antique subject of Jonah and the whale. A member of that institution took occasion, in the course of a paper upon South American travel, to allude to the habits of the dolphin; and in the copy of his remarks submitted for publication, he added a foot note, to the effect that an ancient European legend attributes to these fishes the habit of bringing to land the bodies of drowned persons, which their instinct teaches them to recognize. From this circumstance, says the author, doubtless arose the fable of Jonah. The unlucky word "fable" seems to have set the learned members of the Academy by the ears. Two have resigned, and now an internecine war, aided and abetted by *Les Mondes* and other scientific journals, is raging fiercely.

As we are sufficiently removed from this important controversy to enable us to regard it with dispassionate and philosophical calmness, we may venture, with all humility, to observe that it is utterly immaterial to the progress of modern science whether that whale did or did not swallow the prophet, and that we are unable to perceive why the single member's belief regarding Biblical traditions should so stir up the gall of the *savans* of France and Belgium, to the extent indicated by the elaborate and bitter argument in support of the story published in our contemporary. Has Science grown so poor as not to furnish material enough for profitable discussion, that *Les Mondes* and the Belgian Academy must thus employ their talents in wrangling over a dubious legend of the far past?

HINTS FOR CHEAP FLORAL DECORATION.

The introduction of natural ornaments into our houses is of comparatively recent date. Fashion in her changing moods has willed it, and the conventional and artificial have had their day. Rustic baskets of trailing ivy, stands of gaily tinted growing flowers, mimic ponds teeming with finny life, and vases of autumnal leaves and grasses have replaced the cumbersome china or queer old ornaments of burl and marqueterie; and even in art, the graceful negligence of nature is imitated in the decoration of our modern dwellings, in showy contrast to the geometrical embellishments and prim finery of the houses of half a century ago. And this is true alike in public as well as in private edifices. One of the recently built theaters, in this city, in place of the meaningless frescoes surrounding its proscenium arch, substitutes huge palm trees with their broad leaves (of tin) drooping from their summits; another fills its lobby with vases of flowers and trailing plants, while a third arranges similar ornaments in conspicuous places in its auditorium, and rumor says a fountain is to be constructed in the center of the parquet!

Like all fashionable articles, however, and especially in cities, the question of the expense of such decorations is by no means an unimportant one, and doubtless many of our country readers would stand aghast at the prices demanded by New York florists for baskets of the commonest wild grasses and ferns, even such as flourish in abundance on every brook side. Fifteen dollars is the usual cost of a simple rustic stand, filled, and hanging baskets range from five to ten dollars each. The more elaborate devices, which include bowls of gold fish, or cages of birds, with, perhaps, a few exotic plants, bring sums which are far beyond the reach of ordinary purses. Paying these prices is, however, not at all necessary, if one has a little mechanical ingenuity coupled with a fair share of good taste. We have made beautiful flower baskets from old wooden chopping trays that have survived their turn of usefulness in the kitchen, though perhaps clean new ones would be better. All the materials needed are some sticks of red cedar with the bark on, or, if this variety of wood cannot be obtained, almost any kind can be pressed into service, except alanthus and kindred sorts, the bark of which peels off badly; a few bits of rattan, some gnarled roots, a paper of brads, and a little varnish, complete the requirements. A good plan is to cut the cedar sticks into pieces, say three inches long, split them, sharpen both ends, and nail these neatly around and outside the upper edge of the bowl. Then fasten bits of root or twine the rattan around beneath and finish with an irregular knob below. For handles, select three strong pieces of rattan, and secure them firmly to the bowl, letting them extend about two feet above the same and meet in a neat knot. The bowl should not be less than six inches deep, in order to give the roots of the plants plenty of room to grow downward. After the construction of the basket is finished, give it a coat of varnish and the work is done. Dried walnut skins, pine cones, acorns, split butternuts, or even chestnut burrs may be used as ornaments instead of pieces of root. We have also seen some very neat arrangements made entirely of the shells of English walnuts, which had been carefully removed. In filling the basket, first place some broken stone or bits of china at the bottom to serve for drainage, and above add loose earth made of two thirds garden soil and one third sand. As regards plants, unless the basket be large, or a stand (which, by the way, can be made of a soap box, lined with zinc and mounted on feet) be used, we do not believe in any large variety of flowers in a single receptacle. It is nonsense to mix exotics with wild ferns and grasses, because the nature of soil which suits one is generally not beneficial to the other; and very often the warm uniform temperature, necessary for delicate plants, is fatal to the more hardy varieties from the woods and pastures. Fill a basket entirely with English Ivy or smilax, and a luxuriant growth can be obtained, particularly if too many shoots be not set in. City florists aim to cram as much as possible into their baskets, and are totally regardless whether the broad leaves of the begonias shade the stems and roots of the more delicate creeping vines. In first setting in the plants, however, place them for a few days in a cold room until new shoots appear. Remember also that plants, and especially ivy, will not grow without light, particularly in the house. Place a pot of ivy, after it has begun growing, for a few days in the shady part of a room, and the young shoots will speedily turn white, while the older leaves will begin to drop off. There is another fact that amateur house gardeners forget, and that is that the roots of a plant need plenty of air; and hence pretty pots of painted china or majolica ware will not answer to contain the earth for their reception. If such vessels be used, the common earthenware pot must be set inside of them, with plenty of intermediate space between; while care should be taken that the higher edges of the outer pot do not shade the base of the plant. Weak vegetation may be rejuvenated with a little ammonia, but it must be used with care, as too much kills. About two drops in a teacupful of water given once a week, we have found to be plenty for a good sized plant, particularly if the earth around the roots be kept loose and not allowed to pack hard.

A very pretty adornment for picture frames is German ivy, a common trailing vine which grows with great luxuriance. All the old medicine phials which infest out of the way closets may be utilized for this purpose. These should be filled with water and hung behind the pictures, and a slip of the ivy inserted. The vine is quite hardy. We have seen a single slip, in a pint bottle, grow until it ran along the entire length of a moderate sized room. In the back volumes of our journal will be found described a host of ingenious ideas of this description. We recently noted a way to raise oak trees in hyacinth glasses, it being merely necessary to suspend the acorn inside and a little above the water. A sponge moistened and with fine seed scattered in its pores, soon becomes a mass of living verdure, though a prettier ornament we think can be made of a large pine burl, similarly prepared and hung, like the acorn, over water. Fine grass seed is the best to use. Wardian cases are very easily made. A shallow box lined with zinc, with some holes on the sides to ventilate the soil, and a large glass shade, easily obtained for a small sum, answer the purpose. The plants take care of themselves, the water which they evaporate condensing on the glass and running back to the soil, so that a species of circulation is constantly maintained. Insect fanciers can combine animal and vegetable life very nicely in one of these cases, as quite an assortment of bugs may be kept alive in them even through the winter. Of course such varieties should be selected as will not feed on the plants.

About as pretty a vine as can be selected for window dressing may be obtained from the ordinary sweet potato. The bulb need only be set in a hyacinth glass, and it will soon send out shoots. Hyacinths look very pretty on a window

sill; but in raising them in glass, it should be remembered to keep them in the dark until the roots are two inches long, and also to change the water frequently, never allowing the new supply to be colder than that removed. Dried leaves and vines also make tasteful ornaments if they are properly prepared. Doubtless many have gathered fall leaves, and are waiting for a convenient rainy Saturday to arrange them. To such we may remark that the best plan is, not to use varnish, because the leaves thus treated soon lose their color. Wax is preferable, and is easily laid on with a warm sadiron. Group the leaves in bouquets with plenty of fern, fasten them at the back to a piece of cardboard, and tack them against the wall. We recently gave a description of how very pretty leaf pictures may be made, to which the reader should also refer. German ivy, dried in sprays, looks nicely over pictures in places where the plant will not grow in the bottle or where the living vine is not desired.

AN EASY TELEGRAPH CODE.

The following is suggested as an easily learned code for general use, by which messages of all kinds may be transmitted with certainty, by means of the ordinary electric telegraphic instruments, by means of bells, by whistles, by fire-arms or cannon, by lights, lanterns, rockets, or flames, by the flash of reflectors, by flags and levers, by the motion of the human limbs, arms, hands, or fingers. It may be written on paper, communicated by touch, drummed on the table, or transmitted by any of the known means of signaling. It may be employed with facility by the blind, the deaf and dumb; and will enable people who must talk in church to do so without disturbing their neighbors. It may be learned by anybody in five minutes.

The code is formed by dividing the alphabet into five sections, represented by the five vowels, A, E, I, O, U. Everybody can remember the vowels. For the first vowel, A, make one stroke, flash, sound, or motion; for E two strokes, I three strokes, O four strokes, U five strokes. Make the motions for these section letters quickly, but evenly.

For the remaining letters, give the signal for the section letter, as above, and follow with one stroke for each letter belonging to that section until the letter wanted is reached.

THE SCIENTIFIC AMERICAN TELEGRAPHIC CODE.

The Section letters are:	A	E	I	O	U
B	F	J	P	V	
C	G	K	Q	W	
D	H	L	R	X	
	M	S	T	Y	
	N			Z	

Example: To signalize the letter D, give one stroke for the section letter, A, and follow with three slow strokes, the last being the signal for D.

To signalize L: Give three quick strokes for the section letter I, followed by three slow strokes, the last being the signal for L.

To signalize W: Give five quick strokes for the section letter U, followed by two slow strokes, the last being the signal for W.

The quick strokes are to be made twice as fast as the slow strokes. Practice slowly. Speed will follow accurate practice. After each complete letter signal is given, a space or pause, equal in duration to one quick and one slow stroke, should be made. The space or pause between words is equal to two long strokes.

Example of written message:

T	H	E	S	C	I	E	N
T	I	F	I	C	A	M	E
R	I	C	A	N	T	E	L
E	G	R	A	P	H	C	O
D	E						

NUMERALS, ETC.—To signalize numerals, give two quick double strokes, followed by one slow stroke for each numeral until the figure wanted is reached. Thus:

1		6		Period	
2		7		Attention	
3		8		Repeat	
4		9		Yes	
5		0		No	
				All right	

This alphabet involves the use of many more signals than the Morse; but it is much more easily learned and remembered than the Morse, or any other that has come under our notice.

DEATH OF PROFESSOR AGASSIZ.

We but reflect the sentiments of the whole country in expressing our deep regret at the news of the death of Professor Louis Agassiz. For nearly a week past the medical bulletins extended no hope of improvement, and it is stated that paralysis had affected the organs of the throat and incidentally almost the entire body. There were fears that, even if life had been spared, the physical system would be so shattered as to render it a total wreck, leaving the patient utterly helpless and condemned to a languishing existence, worse even than death. He died in his sixty-seventh year.

In the deepest sorrow that this terrible affliction has not been averted, we know that every reader of our journal will most cordially join with us. The loss of the man who, above all others, has been universally considered the representative and exponent of American scientific progress, and to the grandeur and vastness of whose mastery over thought and knowledge the world did homage, will indeed be irreparable.

THE WEEPING SOPHORA OF JAPAN.

As yet we do not know the full value of weeping trees. It is a peculiarity of most weeping trees not to show their full beauty of character till they have attained a considerable age. Who knows anything of a weeping beech who has seen only a young specimen recently planted? Why, it is passed by as a mere curiosity. But give it a generation, and it becomes as picturesque as a gale-tossed ship. So it is with the weeping mountain elm. Some species, it is true, show their beauty from an early age; but the above named marked examples point to the probability that we cannot judge of the effect that will finally be produced by kinds obtained in recent years.

One of the most beautiful of all weeping trees is the weeping form of that fine tree, the Japanese sophora (*sophora japonica pendula*), of which we present an engraving. When well developed, it is attractive in winter or summer. It is more picturesque in outline than the weeping willow, while the shoots hang most gracefully. It is rather a slow grower, its only fault; like the normal form, it would thrive well on dry soils.

As to the position suited for this tree, says *The Garden*, there is no fairer object for isolation in some quiet green bay of the pleasure ground or lawn. It should never be crowded up in a plantation or a shrubbery with a number of ordinary trees, which, if they do not rob it at the root, or shade it at the top, will prevent its beauty from being seen.

Huge Cuttle Fish.

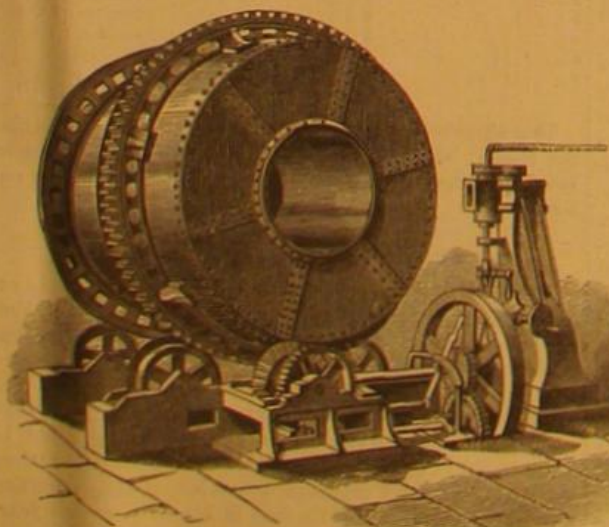
Mr. Harvey, of St. John's, Newfoundland, reports that, on the 26th of October last, two fishermen, who were out in a small boat, observed some object floating on the water at a short distance, which they supposed to be a large sail or the debris of a wreck. On reaching it, one of the men struck it with his gaff, when immediately it showed signs of life and reared a parrot-like beak, which they said was as big as a six gallos keg, with which it struck the bottom of the boat violently. It then shot out from about its head two huge, livid arms, and began to twine them around the boat. One of the men seized a small ax and cut off both arms as they lay over the gunwale, whereupon the fish backed off to a considerable distance and ejected an immense quantity of inky fluid, that darkened the water for a great distance around.

The men saw it for a short time afterward, and observed its tail in the air, which they thought to be ten feet across. They estimate the body to have been sixty feet in length and five feet in diameter, of the same shape and color as the common squid, and moving in the same way as the squid, both backward and forward. One of the arms which the men brought ashore was unfortunately destroyed, but a clerkman who saw it assured Mr. Harvey that it was ten inches in diameter and six feet in length. The other arm had six feet of its length cut off before leaving St. John's; the remainder, which measured nineteen feet in length, is but three inches in circumference, except at the extremity, where it broadens like an oar to six inches in circumference.

As usual in the cuttle fish, the under surface of the extremity of the arm is covered with sucking disks, the largest of which are an inch and a quarter in diameter. The men estimated that they left about ten feet of the arm attached to the body of the fish, which would make it about thirty-five feet long.

FRICTION GEARED CENTRIFUGAL PUMP.

We give herewith an engraving of a centrifugal pumping engine, constructed by Messrs. Marquis Brothers, of Glasgow. The engine and pump are fixed on the same bed plate, and are connected by frictional gearing, the fly wheel of the former being grooved around its periphery and gearing into a correspondingly grooved pinion on the pump spindle. The



arrangement is very compact, and provision is made for obtaining ready access to the pump disk by removing a side door with which the casing is fitted. The piston rod, connecting rod, and pump spindle are of steel, and large bearing surfaces are provided. The particular pump shown is intended for use on shipboard for pumping out water, ballast, etc., or for circulating the water in surface condensers

In some cases, Messrs. Marquis Brothers substitute ordinary for frictional gearing, while in others, as, for instance, when the lift is low, they connect the engine direct to the pump spindle.—*Science Record* for 1873.

A New Gas Apparatus.

MM. Muller and Eichelbrenner, of Paris, are the inventors of apparatus for producing illuminating gas from coal, etc., which will probably find much favor among gas engineers. Already fifteen gas works in France have adopted it, and it



THE WEEPING SOPHORA OF JAPAN.

has generally met with much approval. The inventors require no change in the ordinary arrangement of the works, but they do away with the old furnace and replace it by one of considerably smaller dimensions, placed at the back of the bridge, and surmounted by a receptacle of a slightly conical form. This can be filled with coke by its lower door, which is ordinarily kept closed, and its capacity is such that it does not require charging more than once in eight or ten hours. This plan is exceedingly advantageous for small gas works, preventing as it does the necessity of firing during the night.

This furnace is literally a gas producer, the fuel being kept in such a state of combustion, by regulating the admission of the air, that, practically, distillation of the volatile products is carried on. When leaving the furnace, the carbonic oxide and other combustible gases that have been generated enter into a cylinder at the back of the bridge, whence they pass into the oven by a series of openings, distributed over the entire length of the bottom. By means of other openings air can be admitted, which has already been heated during its passage from the external atmosphere, into the apparatus. The amount of air, and consequently of the combustion of the gases that must ensue, is regulated by a register placed on the exterior of the oven. By means of refractory earthenware plates, that can be forced against each of the openings to stop the passage of the gas, the rate of combustion can be more completely regulated, and the temperature of all parts of the oven equalized. This heating of the air, effected by a method already familiar in the heat-economizing furnaces of Siemens, Ponsard, and others, is less complete than theirs, but less expensive in its first construction. According to a report by M. Launay, the ease of working the furnace is great, the expenses generally are much reduced, and the removal of cinders and ash is not required. The principles applied are not new, but MM. Muller and Eichelbrenner have the merit of having combined a variety of conditions of simplicity, efficiency, and economy that had not previously been realized. M. Launay visited the gas works of Montreuil, where one of these new furnaces had been erected alongside one of the old system, and expressed himself surprised at the results just mentioned, and generally gratified with its success.—*Engineering*.

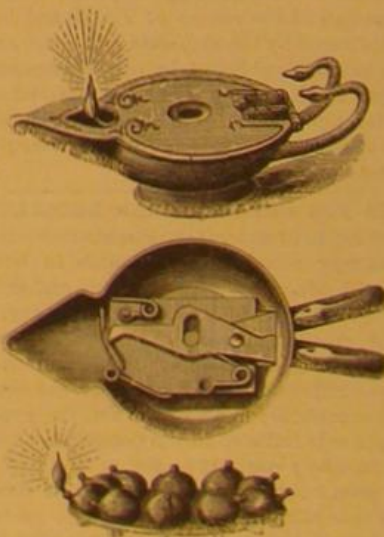
We call our readers' attention to Messrs. Harper Bros. advertisement on the last page of this issue, and to their terms of subscription for their three widely renowned periodicals, which maintain their excellence and their reputation as examples of the highest class of American literature.

What Measure of Expansion will require Least Steam per Horse Power?

We reply to this question that the best measure of expansion lies somewhere between six times and ten times, but it is generally nearer the first limit than the last, and that in fact the gain to be had from working up to a tenfold expansion is so small, as compared to the gain to be had with a sixfold expansion, that it is not worth the trouble. If we were called upon to design an engine of maximum economy—we mean an engine of considerable power and one expected to perform its duties under ordinary conditions—we should not think of adopting a grade of expansion higher than eight times—though we should provide for the earlier cut-off in order to give the governor the control of the engine—and under no circumstances should we permit the terminal pressure to fall lower than 10 pounds above a vacuum. For a tenfold expansion, this contemplates an initial pressure of 100 pounds, and for an eightfold expansion a pressure of 80 pounds absolute, or safety valve loads of 85 pounds and 65 pounds; and it is more than probable that in both cases better results could be had with a sixfold expansion only, giving a terminal pressure, in the first case of 16.6 pounds, and in the second of 13.3 pounds. Having thus stated our opinions, it now becomes our duty to explain why we have formed them. Unfortunately, the whole question is more or less one of opinion from beginning to end. We base those we have expressed on the fact that the entire experience of sea-going engineers and marine engine builders is to the effect that little or nothing is to be gained by expanding steam more than five times. For example, the Elbe, with an expansion of about twelvefold, burns, we believe, about 2.25 pounds of coal per horse power per hour; but we have engine room logs in our possession which show a consumption of but 2 pounds, and even less, with a sixfold expansion, or one half that used in the Elbe. Indeed, there is scarcely a well authenticated instance on record where better results have been got with very high measures of expansion than with much larger admissions. On the contrary, very careful and elaborate experiments, carried out in the United States and elsewhere, all demonstrate that measures of expansion much exceeding sixfold give no advantage whatever; and when once this point has been reached, there is a tendency to an increased consumption of steam, which becomes well marked as earlier cuts off are reached, unless the pressure of steam is very high to begin with, as, for example, in Perkins' engines. If any of our readers can cite cases where large measures of expansion did in themselves secure exceptional economy, a statement of the facts will constitute a very interesting contribution to our correspondence columns. It may be urged that in the engine using a high measure of expansion, the economy effected in the use of steam will quite counterbalance this loss, and leave a large margin of profit. Nothing is easier than to prove this—on paper. In practice, however, we believe, nay, we know, that the consumption of steam would be absolutely larger in the more expansive engine than in its rival. This, it is impossible to prove on paper; but our readers may rest assured that it is consonant with experience, and we have no doubt that the proposition will be endorsed by many competent engineers.—*The Engineer*.

THE AUTOMATIC TAPER LAMP.

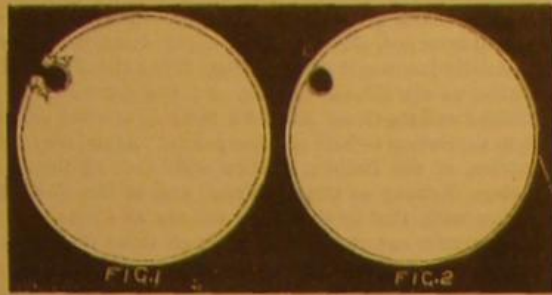
There has recently been invented, says the *Science Record* for 1873, a taper lamp for the instantaneous production of a flame or light, which is accomplished by simply pressing together the two handles shown in the upper figure of the annexed engraving. The interior mechanism is shown in the figures below. Each tube consists of a little ball of fatty material from which protrudes a short match. These tapers are all set on a rotating plate, under the lamp cover, and are so arranged that, when the handles are pressed together, the plate rotates, and one of the matches rubs against the inside of the case near the spout or opening in the cover, which rubbing or friction ignites the match and communicates fire to the ball, which thereupon burns, producing a light that lasts from five to seven minutes. This is a very curious as well as a useful little example of mechanism.



AN AUTOMATON TRANSIT OF VENUS.

The Astronomer Royal has recently designed and constructed a working model to show the phenomena of the transit of Venus, of a peculiarly complete and simple character, which we show in Fig. 3. A few words only are necessary to enable any of our readers to appreciate its object and scope. A transit of Venus occurs only twice in about 120 years; and hence the importance of observing this phenomenon. The feature to note is the exact instant at which the edges or limbs of Venus and the sun are in contact during the passage of the former across the disk of the latter.

Very great difficulties have been found on the occasion of



previous transits in obtaining reliable observations, owing to the peculiar optical effects accompanying the phenomenon and the consequent difficulty in insuring the observation of the same particular phase in the transit by all observers, as well as the doubt arising from the exact effect of the peculiarities of each telescope and each observer. So great indeed have been these difficulties that the observations of the transits that have hitherto taken place—observations made at great trouble and expense—have been found of very doubtful value. It is, therefore, most important that uniformity in habit of observation should be acquired by all the officers and others leaving England to observe the transit of Venus in 1874. To this end systematic practice of some kind is desirable. How is this to be obtained with a phenomenon occurring only twice in 120 years? Careful observations of the transits of Jupiter's satellites have been recommended, but Sir G. Airy has met the difficulty by a device which appears to give a singularly close copy of the transit of Venus, and on which observers may try their powers to their heart's content. Before giving a description, however, it is well to understand the difficulty to be dealt with in the observation of a transit of Venus. Fig. 1 represents the sun with Venus coming on to it about the moment of internal contact. There is a ligament connecting the black disk of Venus with the sky at the point of contact. This ligament is the main cause of the trouble. It is nearly, if not always, seen, and is explained in the following way:

Any brilliant object dazzles the eye, and by irradiation appears to be larger than it really is; thus, in Figs. 1 and 2, we suppose the real size of the sun to be indicated by the dotted line, while the apparent disk is the size of the larger circle. So again Venus should be seen the size of the small dotted circle, but the sun so far encroaches on her that she only appears to be the size of the black disk whenever her edge is seen against the sun. But up to the moment that the entire edge of Venus enters within that of the sun, the light cannot encroach at the part that, as yet, is not projected against the sun but only against the sky. Consequently, the limb of Venus that last enters on the sun's disk is for a time seen its full size; and the light, as the limb of the sun concealed by it, can neither encroach on the sky nor on Venus. In short, at this point the edges of Venus and the sun are those shown by the dotted circles, and thus the black sky and black disk of Venus meet where the circles, *s s* and *v v*, meet, and thus the ligament is formed. It has been supposed that directly Venus enters within the sun's disk, as shown in Fig. 2, the light rushes in and encroachment takes place. Supposing this to occur immediately after internal contact, it is clear that, when understood, the peculiarity of the phenomenon would greatly facilitate its being accurately observed and recorded. It is clearly necessary, however, to ascertain the truth of this supposition.

Fig. 3 shows the apparatus designed by Sir G. Airy to represent the transit of Venus, at which the officers and other observers now practise. A glass slide, *A A*, with a black disk (to represent Venus) fixed on it, is drawn by clockwork across the opening, *S₁ S₂*, cut in a screen. The curves, *S₁* and *S₂*, correspond to the limbs of the sun at the moments of ingress and egress. By means of the looking glass, *D*, the reflected beams of the sun are thrown through the opening, *S₁ S₂*, and the result is that the phenomena of encroachment of light and ligament, or "black drop," is seen in an actual transit. The rate of motion and size of Venus are calculated so as to give the same apparent dimensions and movement when seen on the main building by observers on the top of the magnetic buildings in the Royal Observatory, Greenwich, as those of Venus at the expected transit. The limbs of the

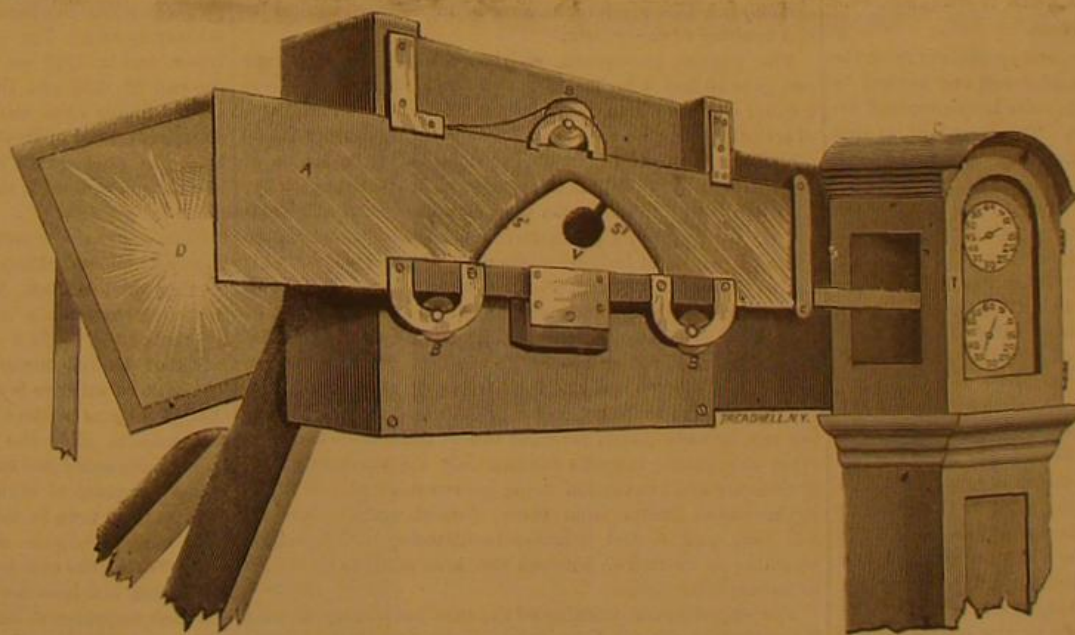
sun are brought together and make an arch, in order to give ingress and egress without unnecessary loss of time. We have said that our observers are practising daily at this model, and it may be expected that their personal equations and the effects of peculiarities in telescopes will be clearly established. We may add that some rather unexpected facts have come out, which seem to indicate that a modification of the generally received explanation of the behavior of the black drop, which we have given above, may be necessary. For example, it is found that with a smaller telescope Venus is seen to leave the limb and enter within the sun's disk later, and come in contact again at egress earlier, than with a larger glass. Then, again, it is found that, with a brilliant blaze of sunlight, a ligament is seen in a position when with a faint light it would have disappeared. This is rather contrary to the generally received ideas. It is premature, however, to say much now. A few weeks' work may establish very valuable results.—*The Engineer*.

RECENT GEOGRAPHICAL NOTES.

During the past year, MM. Stuebel and Reiss have explored the Andes of Ecuador, and ascended Mounts Chimborazo, Aetaz, Cotopaxi, and Tungutagua. Among the volcanoes of the chain, three exhibit especial characteristics and only one, Pichincha, retains a moderate activity. We note no especial results of the labors of these explorers, beyond the determination of the altitudes and physical characteristics of the mountain range, and certain trigonometric calculations or observations having for their object the completion of accurate maps of the country.

H. B. M. ship Basilisk has taken possession in the name of the Queen of England of the western coast of New Guinea. This great island is peopled by a long haired black race known as Papous, and is said to be very fertile. The Basilisk explored the coast for a distance of 140 miles and discovered the bay of Youl, to which the name Port Moresby was given. A channel was also found, which, it is believed, will materially improve the route now followed by steamers between the Asiatic and Western American coasts.

There exist in Copenhagen and Moscow remarkable ethnological museums. That in the former city is comprised of forty rooms, in which are exhibited, all the objects and documents relative to the arctic regions. The Moscow museum has sixty wax figures showing the different races existing in the Russian Empire, of which thirty represent types found in European Russia and the Caucasus. The comparison of the contents of the two museums has recently led to a discussion regarding the Ainos, a race now inhabiting the Saghalien Yesso and the Kurile Islands. M. de Quatrefages states that the people once formed a great nation, which extended itself over the Indian Archipelago, conquering the country and founding the present Japanese



AUTOMATON TRANSIT OF VENUS—Fig. 3.

Empire. The Japanese, however, soon became a distinct race, through intermarriages with the Chinese, and the Ainos gradually disappeared, until only a remnant of the pure stock now exists. They clearly belong to the Caucasian division of mankind, and are also believed to be the progenitors of the Esquimaux of North America.

Dr. Nachtigal, a German traveller, at present engaged in exploring central Africa, has been recently heard from. He has traversed the shores of Lakes Tchad and Chosi, and arrived at a capital city called Abon-Chen. The inhabitants are violent, quarrelsome, and intemperate, hating strangers, and only ruled by the tyrannical power of their sultan. The commerce consists in slaves, ivory, and ostrich feathers, and flows mainly to Egypt.

M. Delesse announces the discovery of new silver mines at Caracol, near the frontiers of Chili and Bolivia. Sulphides and sulphates of silver are found associated with argentiferous lead. The mines were found by Frenchmen, and a capital of thirteen million dollars is to be raised for their exploration.

J. W. writes that 400 men were killed in the State of New York, in seven months, while coupling cars.

CARELESS PLUMBING.

We should advise such of our readers as are plumbers to cut out the accompanying little engraving and post it in a conspicuous place in their shops, so that all their journeymen may have it constantly before their eyes. It indicates about as disgraceful a botch as any mechanic who pretends to the smallest degree of intelligence could hope to accomplish.

The piece of piping represented was recently removed from a building, situated in this city and owned by a gentleman with whom we are well acquainted. For some time past, continual complaints have been made by tenants of a



failure in the proper water supply. An experienced mechanic was set to work to discover the trouble. After exhausting his ingenuity in trying to remedy the defect, he finally concluded that the main pipe was too small, so a larger connection was laid at great expense; still the difficulty continued. It was finally determined to cut away the joints of the conduits through the building. This was partially done, when the piece shown in our engraving was removed, and the cause of the trouble at once made apparent. The individual who mislaid the joint (we cannot do violence to our feelings by calling him a plumber) carelessly fitted the connection to the larger pipe, and by so doing allowed his solder to fall into the bore of the latter, choking it up almost completely. The fragment is now before us; and estimating the pipe to be about $\frac{1}{8}$ inch originally in internal diameter, it is evident that the solder has reduced it to an opening of probably barely a tenth of an inch.

It occurred to us that doubtless many of our readers are experiencing difficulty with the water arrangements of their buildings, and vainly seeking just such a hidden cause as this; hence we have had the annexed engraving made in the hope that it may serve as a suggestion of value. In any event, it will do for a warning to plumbers to be careful in soldering pipe joints.

A Tower Taller than Babel.

Messrs. Clarke, Reeves & Co., proprietors of the Phoenixville Bridge Works, Philadelphia, Pa., propose to construct a wrought iron tower, one thousand feet in height, to be completed for the American Centennial Exhibition in 1876. The tower is to be circular in section, one hundred and fifty feet in diameter at the base, diminishing to thirty feet at the top. It is proposed to have spiral staircases winding around the center tube for those preferring to walk up; but elevators will be provided, which are calculated to ascend to the top in three minutes. We have in process of engraving a full page illustration, representing the tower in contrast with St. Peter's Cathedral, Rome, St. Paul's Cathedral, London, Bunker Hill Monument, the Pyramids of Egypt, and other existing tall structures, all of which, alongside of the thousand feet tower, look like pigmies.

This is one of the greatest engineering projects of the age, and it is in the hands of constructors capable of completing whatever they undertake. The beautiful engraving we are having executed will be ready for publication in the SCIENTIFIC AMERICAN within about two weeks. We calculate that it shall be the handsomest wood engraving that has appeared in any American newspaper. The copy of paper containing this engraving will be worth a whole year's subscription.

Frigorific Effects of Capillarity and Evaporation.

By directing upon a sheet of spongy paper, wet with bisulphide of carbon, a spray of pure water, hoar frost is not formed; but if the conditions be reversed and the bisulphide applied in a finely divided spray, (according to M. Decharme) a circle of arborescence becomes quickly apparent. The same jet, directed on the bulb of a thermometer, produces first hoar frost and then arborescence, together with a lowering of temperature from $+50^{\circ}$ to -7° Fah. Arborescence thus formed upon a glass plate may be retained long enough for examination by the microscope. Other liquids which are capable of producing similar effects to bisulphide upon spongy paper are chloroform and rectified sulphuric and bromhydric ethers. The icy arborescence is believed to be purely aqueous. Its point of fusion corresponds exactly with 0° C. (32° Fah.), and it has no taste or odor after the evaporation of the volatile liquid with which it is impregnated.

Correspondence.

A New Route between America and Europe.

To the Editor of the Scientific American:

On page 294 of your current volume, I notice a proposed new route between New York and London. This route, I think, was first proposed by Sandford Fleming, C. E., when he conducted the preliminary survey for the Intercolonial Railway, about six years ago; and it was specially made on behalf of the upper provinces of the Dominion, and before the line was constructed from Bangor to St. John. I question whether Mr. Fleming now entertains the project. As a line from New York, it cannot compare with that which is hereinafter proposed. Although Shippegan is counted an excellent summer harbor, its value for such a purpose would be greatly reduced by the fact that it is only open about eight or nine months in the year. Then it would require to be connected with Bathurst with a branch of nearly fifty miles in length, which will not probably be soon constructed.

If the people of the United States wish to see the ocean traveling between the two continents reduced to a minimum, they can safely reckon on the lines of railway already constructed *via* Bangor, Vanceboro', St. John, Sussex, Moncton, Amherst, etc., to Truro, and thence by branch to Pictou, instead of going to Halifax. From Pictou a line is contemplated to Whitehaven, or some other suitable port near the Strait of Canso, which would materially shorten the ocean voyage; or it would be better still to tunnel the Strait of Canso (this is believed to be quite practicable where it does not exceed a mile and a half in width), thence by railway (to be constructed) to Louisbourg, a port said to be open all the year round, near the eastern extremity of Cape Breton and more than 200 miles nearer Europe than Halifax. Now Louisbourg is much nearer St. George's Harbor than Shippegan, without being so far back in the cold; and with this connection by steamer, and a railway thence, say 250 miles, to St. John's, the great object would be accomplished. Perhaps a further improvement in this line could be secured. Should Aspy Bay, or some other point in the vicinity, prove to be a good ocean terminus for the railway, it would still further shorten the passage by water to Newfoundland. And this is the direction in which improvements should be looked for in the line of travel between New York and Europe. The tunneling of the Strait of Canso need not be regarded as a very formidable affair, after what has been accomplished at Mount Cenis and the Hoosac. The only other break in the proposed continuous line of railway would be at St. John's, where a good suspension bridge of 620 feet span, for ordinary traveling, now crosses the river. There a suitable structure for railway purposes is only a question of time.

Petitcodiac, N. B. GEO. W. MCCREADY.

Preserving Zoological Specimens from Insects.

To the Editor of the Scientific American:

The difficulty of preserving zoological specimens from the depredations of insects is a matter of regret and anxiety to every collector, and various methods have been proposed for accomplishing this desirable object. The compositions into which arsenic and corrosive sublimate enter are well known to be very effectual when properly applied; but unless used with caution, they are apt to injure the natural pliancy of the skins, and are hardly effectual in protecting collections of insects. I have known these substances, even in the hands of the most expert, to produce such tenderness of the skins as to form a considerable obstacle in setting up specimens. To render them effectual they must be carefully applied to each specimen, by which the labor of collecting and preserving is considerably increased.

Every substance which I have tried seems inferior in efficacy and ease of application to the rectified oil of turpentine, and my method of using it is as follows: I put the turpentine in a bladder, the mouth of which is firmly tied with a waxed string; and nothing more is necessary than to place the bladder thus prepared in the box with the birds, or to tie it to the pedestal on which the birds are perched in a case. If there be any maggots on the birds, I have invariably found that they will soon be dislodged from the feathers, fall to the bottom of the case, and die in the course of two days. I have also made the experiment of introducing the common house fly, the large blue bottle fly, and moths into a case of birds so defended, through a small hole in the bottom of the case. The moment the flies enter the box they begin to vomit a whitish, glutinous matter, they are much agitated, and the largest of them dies in a few minutes. I have repeatedly introduced, in like manner, active cockroaches; and these strong insects soon became uneasy, often rubbed their sides with their hind feet, and usually died in about an hour and a half. I next got a bird skin full of living maggots and placed it in my defended case; in about three hours, they were seen coming out in all directions, and fell to the bottom of the case, where they died. For large cases of birds, a pig's or sheep's bladder is sufficient. The turpentine evidently penetrates through the bladder, as it fills the case with its strong smell.

New York City.

G. W. B.

A Remarkable Copper Spring.

To the Editor of the Scientific American:

Inclosed you will find a nickel five cent piece that was coated with copper, as you see it, by a spring in Monroe county, Tenn., in what is known as the Coker Creek gold region. I was traveling through the mountain regions of North Carolina and Tennessee this fall, and had heard a great deal of talk about the rich mineral resources of that part of the country, and had a great curiosity to visit it; and I was astonished to

find such rich indications in the way of gold and copper. The spring which coated this coin with copper is a great curiosity; it ebbs and flows every twenty-four hours. In the evening it scarcely runs at all, but in the morning it runs quite briskly, and all around its border you can pick up small pieces of blue stone. There are also rich specimens of quartz in the same range. The spring is situated between the Chilhowee and Unaschacha mountains, about three miles from the North Carolina line, and about eighteen miles from the celebrated Duck Town copper mines. I was told that an English miner had been to look at it, and had offered fifty thousand dollars for the lot to one of the partners who owned it; but he went to Europe, and on his return he learned of his death, and did not know where the other partner lived. It is astonishing that such valuable mineral wealth should lie undeveloped when, by a little energy and capital, there could be made a large profit on the investment of time, labor, and money.

JOS. YOUNG.

[REMARKS BY THE EDITOR.—The specimen sent by our correspondent consists of a nickel five cent coin, thickly covered with a deposit of copper.]

THE ATMOSPHERIC RAILWAY IN LONDON.

In addition to thirteen miles of three inch bore pneumatic tubes, for sending telegraph messages between various stations, there is also in operation in that city a line of pneumatic railway, the capacity and operation whereof we find described as follows in a recent number of the London Times:

The pneumatic tube extends from the London and North Western Railway station at Euston square to the General Post Office in St. Martin's-le-Grand. The central station is in Holborn, where is also the machinery for effecting the transit of the trains. Here the tube is divided, so that in effect there are two tubes opening into the station, one from Euston to Holborn, and the other from the Post Office. The length of the tube between Holborn and Euston is 3,080 yards, or exactly a mile and three quarters, a greater length than was originally contemplated, but which was rendered necessary by the avoidance of certain property on the route. The tube is of a flattened horseshoe section, 5 feet wide and 4 feet 6 inches high at the center, having a sectional area of 17 square feet. The straight portions of the line are formed of a cast iron tube, the curved lengths being constructed in brickwork, with a facing of cement. The gradients are easy; the two chief are 1 in 45 and 1 in 60, some portions on the line being on the level; the sharpest curve is that near the Holborn station, which is 70 feet radius. The tube between Holborn and the Post Office is 1,658 yards in length, or 102 yards less than a mile, and is of the same section, and similarly constructed to the first length. The gradients of 1 in 15 occur on the Post Office section, but this steep inclination is in no way inimical to the working of the system.

The wagons, or carriers, as they are termed, weigh 22 cwt., are 10 feet 4 inches in length, and have a transverse contour conforming to that of the tube. They are, however, of a slightly smaller area than the tube itself, the difference—about an inch all round—being occupied by a flange of india rubber which causes the carrier to fit the tube exactly, and so to form a piston upon which the air acts. The machinery for propelling the carriers consists of a steam engine having a pair of 24 inch cylinders with 20 inch stroke. This engine drives a fan 22 feet 6 inches in diameter, and the two are geared together in such a manner that one revolution of the former gives two of the latter, or, in technical terms, the engine is geared at 2 to 1 with the fan. The trains are drawn from Euston and the Post Office by exhaustion, and are propelled to those points by pressure. The working of the fan, however, is not reversed to suit these constantly varying conditions; it works continuously, the alternate action of pressure and exhaustion being governed by valves. The engine takes steam from three Cornish boilers, each 30 feet long and 6 feet 6 inches in diameter. Telegraphic signaling is carried on between the three stations by means of needle instruments.

The experimental working of the tube has already formed the subject of careful investigation with several engineers, whose opinions are highly favorable to the system. In the early part of 1872, Mr. W. H. Barlow, the consulting engineer to the Midland Railway Company, instituted a series of experiments with the pneumatic tube, which extended over several days. The results thus obtained led Mr. Barlow to the conclusion that the greatest working economy of the pneumatic tube was obtained in moving a great amount of weight at low speeds. In other words, with the same number of revolutions per minute of the engine and the same pressure, a very large increase made in the load, produced a comparatively small decrease in the speed. In the Post Office section of the tube two gradients of 1 in 15 occur; but notwithstanding this, the heaviest loads were those which produced the best commercial results. Mr. Barlow's experiments showed that 20 tons of goods were conveyed through the Euston tube in 8 minutes, and 12 tons through the Post Office tube in 44 minutes. Hence, with the engine working on each tube separately, two trains of 12 tons each might be brought through the latter tube in 9 minutes, and might be sent forward in one train of 24 tons to Euston in about an equal space of time. That is to say, 24 tons of goods might be conveyed through the entire length of the tube in 18 minutes, or, allowing a delay of six minutes at the station for shifting the trucks from one line to the other, the practical result would be the transport of one ton of gross load per minute.

The practical conclusions to which the preceding remarks

point are that there exists at the present time, in good working order, a rapid and efficient means of transit for parcels between one of our leading railways and the Post Office, with an intermediate station. The system is now open to the public for the conveyance of goods, and the public are availing themselves of the benefit it confers. The comparatively limited extent of the district served means, of course, for the present, proportionately limited commercial results. It remains, however, for the Pneumatic Company to prove the soundness of their scheme by regular systematic working, and so to gain the confidence of the Postal authorities and the railway companies, to whom the pneumatic tube should prove a great boon. Useful as the system is as at present arranged, it requires but slight extensions to very materially increase that usefulness. It has already one of its termini at the Euston Station, and the proximity of the Midland and the Great Northern Stations at once suggests short extensions to both of those points. Again, the relative position of the Holborn Station with that of the South Eastern Railway at Charing Cross, and of the Post Office station with that of the same railway at Cannon street, would render an extension in either of these directions no very difficult matter, while all parties would apparently be benefited by the result. Then there are the district offices of the postal system, most of which might be placed in direct communication with the chief office by means of the pneumatic tubes, in the same way that, to some extent and by means of small tubes, the postal telegraph offices are connected at present time. Should the satisfactory results of of experimental working be borne out by the practical trial the system is now undergoing, there appears to be no reason why it should not be generally extended to all parts of the metropolis and the suburban districts.

Railways in Great Britain and the United States.

The recent financial panic in the United States has naturally directed much attention to the railway system, which has been accused as the cause of all the disasters. It is not within our province to enter within the mere financial question, except so far as engineering enterprise may bear on it. The object of this article is chiefly to examine into the statistical history of the system, compared with our own, in regard to construction, population, commerce, etc., and thus to give prominence to certain facts which, so far as we know, have not hitherto been placed in such a position for the professional and general reader.

In 1830, there were but some 23 miles of railway existing in the United States; and at the end of 1872, there were 67,000 miles in existence.

In 1870-72 nearly 20,000 miles were constructed, or considerably more than the whole railway mileage of the United Kingdom at the present day.

The above statistics bear a striking contrast in rapidity of progress when compared with the extension of the British railway system. For example, in 1842 we had but 1857 miles; and in 1870 we had 15,540 miles, nearly. Between the end of 1864 and the end of 1872, the increase in the United States lines was about 33,000 miles, or just about double the total of British railways existing at the end of 1870. In other words, American enterprise had constructed, in eight years, double the mileage that we have effected in about forty years.

Next comes the question of the comparative cost of the two systems, and this is one of great importance in an engineering point of view. We are as nearly correct as we can be in stating that, while our 15,540 miles of railway involved by the end of 1870 a capital of \$2,650,000,000, the 67,000 miles of United States railway cost only \$3,150,000,000. The ratio of mileage is as 1 to 4.31; it consequently follows that, if the cost of the United States lines had been per mile the same as ours, the capital they would have involved would have amounted to \$11,421,500,000. Taking the subject in another point of view, we shall find that, if the cost of our lines had been in the same ratio as that of the American lines, our expenditure would only have been some \$730,000,000. Taking the cost per mile, the United States lines average 47,000, and here the contrast with us is very great. The cheapest constructed line in this kingdom is the Highland, which cost \$61,300; the average is about \$180,000 per mile. This would have confirmed our previous estimate of the cost as being over four times that of the United States, had we included shorter but more expensive lines in the United Kingdom. These figures have certainly a startling appearance, and this is increased if we take into consideration the difference of dividend that would have accrued to British shareholders had it been possible for the English lines to have been so cheaply constructed; but in considering this matter, the far larger proportion of single lines in the United States must be born in mind, while it must be remembered that the station buildings and general fixed plants of a large proportion of the cheaper American lines are such as would be quite incompatible with the traffic to be accommodated here.

In respect to the engineering department, the advantages the Americans possess are very great in the majority of cases. Stone and iron for solid work, and brick where it is easily procured, are the sole materials employed by us. In America, on the contrary, wood, which can be obtained at a much lower rate, was at first almost universally employed for bridges, stations, and other constructions. Another point of great importance is the fact that, while the great majority of American railways are only single lines, ours, with scarcely an exception, are double lines and now triple lines, as on the London and North Western, are becoming common where great traffic exists. The cost of earthwork of all kinds, bridges, etc., increases greatly with the increased

width, and the cost of the single lines would be much less, even if labor and material were at the same price in each case. Practically, the United States traffic is moderate, and spread over a large area of line, while ours is enormous, and spread over a very limited area. Hence, with us solidity and durability are of absolute importance, qualities which, as a rule, do not distinguish American railway construction.

Sleepers are an item of serious cost also with us; and the geological structure of our islands is such that cuttings, embankments, and tunnels are of constant occurrence, a level piece of line, except in the east of England, being of very rare occurrence. In the United States, on the contrary, the contracted contour of our country becomes expanded. Level plains are of enormous extent; and if there are obstacles, such as hills and mountains, the cheapness of land and construction permits a *détour* which would be simply ruinous, if not impossible, with us.

An interesting question, and one of great importance, as effecting railway enterprise, is that involving area, population, and commerce; and in this the comparisons between the United States and ourselves is remarkable. In 1861 our population was 29,321,288; in 1860, that of the United States was 31,443,321. In 1871, ours was 31,817,108, and that of the States in 1870 was 38,555,983. The latter, therefore, increased by seven millions, while our increase in the same period was about two and a half millions; the American increase was thus nearly three times that of ours. Comparing the respective areas, ours is 121,115 square miles against 3,034,459 of the States (exclusive of Alaska), of which about one fourth only is under civilization; but this area is six times that of ours, say 750,000 square miles. Our ratio per square mile is 250 persons against about 51 on the limited area just estimated. It results that, while both goods and passenger traffic is carried on in a compact area with us, the reverse occurs in the States. If precisely the same traffic took place for an equal population, at the same cost of material, wear and tear, etc., in both countries, it is evident that the States lines would be ruinously expensive. But fortunately for them the general cost of management and repairs is much less.

The management of the United States railways has been a subject of much complaint, and blame has been cast alike on engineers, directors, and other officers of the companies. We are not disposed to dip our hands into dirty water, of which abundance has been scattered about lately.

On the other hand, however, the resources of the country are enormous. Generally the soil is of inexhaustible fertility for the growth of corn, cotton, tobacco, etc. The forest districts afford endless supplies of almost every kind of useful and ornamental woods. In the mineral kingdom few valuable products are absent; coal, iron, copper, lead and most metals being found in abundance and frequently of the richest ores. All these natural products will tend to foster railway enterprise; and if this, in future, be restricted in its extension to the actual wants of the country, instead of its supposed distant necessities, it is impossible but that railway enterprise in the States can be other than of the most profitable and prosperous character at no distant period.—*Engineering.*

Gas Purifier and Mixer.

M. D. Colladon says: Gas requires to be freed from particles of solid matter, naphthalin, coal tar, ammoniacal salts, etc., as well as from gases such as carbonic and sulphurous acids. For washing it, vessels have been employed similar to Woolf's bottle, in which the gas traverses water or a suitable solution through a metallic network, in the form of bubbles or continuous currents. This arrangement is insufficient for working on a large scale; because the bubbles of gas take a spherical form, and consequently present a minimum of surface for a maximum volume.

Further, this method requires a decided increase of pressure, which is inconvenient. The chemical cascades, in which the gas passes upwards through a fine rain of the washing liquid, act much better, but they require too large a quantity of liquid. Coke towers (scrubbers) produce a more complete effect, but the action is very irregular. The new mechanical washing apparatus has the advantage of producing very powerful action without requiring large dimensions. At Geneva it yields coal gas, superior both in illuminating power and in a sanitary point of view. Less purifying matter is also required than on the old system. The same apparatus will doubtless prove useful when it is required to saturate a gas with the vapors of a liquid, for example, hydrogen with the vapor of petroleum. The system rests on the principle that the best arrangement either for washing a gas or saturating it consists in making it strike, in the form of currents as thin as possible, against solid walls kept perpetually moist. The currents are broken against these surfaces, and are prevented from moving on in a straight line. The gaseous particles are thus always kept in a rotatory movement, and are pressed against the moist walls, so that they either absorb the substance diffused over these walls or may deposit there a part of their own substances, according as it is required to saturate the gas or to wash it.—*Chemical News.*—*Comptes Rendus.*

New Method of Tempering Steel and Regenerating Burnt Iron.

M. H. Caron says: A piece of steel is generally tempered, and then reheated more or less according to the hardness and the elasticity which it requires to receive. The dry temper, as commonly practiced, that is to say, plunging the red hot metal into cold water, has the drawback of developing cracks and crevices injurious to its tenacity. Reheating does not remove these flaws; and subsequently, on use, these fissures, though invisible at first, increase and terminate in fractures.

It has already been discovered that, in order to escape danger, it is preferable to temper the steel a little softer and afterwards to reheat more slightly. The author has succeeded in producing the combined effects of temper and reheating in one operation, and of removing as far as possible the chances of flaws. This is done by heating the water, into which the red hot metal is plunged, to 55°. Tempering in hot, or even boiling, water modifies soft steel containing from two to four thousandths of carbon. This process augments its tenacity and elasticity without sensibly altering its softness. The texture is changed and becomes fibrous, even if previously crystalline. The author's method for restoring burnt metal is likewise to plunge it at a red heat into a hot liquid.—*Ibid.*

New Dyeing Recipes.

(Belmann's Färber Zeitung.)

This number contains a recipe for a safflower rose on glazed calico. The dressing consists of 50 lbs. of wheat starch, 20 lbs. of wheat flower, 4 lbs. of white wax, and 6 lbs. of cocoa nut oil, a little sulphuric acid being added to the water in which the starch is mixed.

There are also recipes for light and deep Prussian blues on glazed calico; for a green (extracts of indigo and of quercitron) on jaconnet; a peach wood crimson on glazed calico and jaconnet; a brown on calico with Bismark brown and magenta; a gray drab on wool, and a scarlet on woolen cloth and flannel; also a blue (soluble aniline blue) and a coffee brown on plush; a violet on woolen yarn. The mordant in this case consists of 1½ ozs. of tannic acid, dissolved in hot water in which ½ oz. of Marseilles soap is next dissolved; ½ oz. rape oil is next added, and stirred up till it forms an emulsion. The liquid is used at 167° Fah. The bleached yarn is worked in this mordant for fifteen minutes, and then withdrawn. The color bath, at the same temperature, is prepared with 5 ozs. of alum and the clear solution of 1 oz. of methyl violet.

There is also a prescription for a light green on cotton yarn, the color being methyl green fixed with tannic acid.

The editor gives a recipe for a brown on shoddy containing a mixture of cotton, called on the continent *velour*. To 100 lbs. of this material, make up a bath of 30 lbs. of fustic, 3 lbs. of alum, 2 lbs. of prepared tartar, and 1 lb. of blue vitriol, in which the shoddy is boiled for half an hour. To the same lot are then added 1 lb. of chromate of potash and ½ lb. of aniline red, ruby, or aniline crimson, known on the continent as *rosain*. The dyeing is carried on at a gentle boil, and turmeric added to modify the shade. Logwood may be used, if needful, to darken. Aniline is refuse magenta; it is dissolved in hydrochloric acid and boiled in water previous to use.—*Chemical News.*

Alleged Presence of Iron Filings in Tea.

In several cases of prosecution under the adulteration act which have recently been reported, the analyst has been able to demonstrate that a magnet thrust into a specimen of tea would attract certain particles which were stated to be iron filings, and held to be indisputable proof of a fraudulent admixture. That this inference is necessarily correct has, however, been disputed in more than one quarter. Mr. Treffry, of Exeter, England, writing to the *Grocer*, asserts that the mineral matter found in tea is not iron filings but a native titaniferous oxide of iron, and he states that "it is probably titaniferous iron sand, which is very abundant in China." Mr. Alfred Bird, F. C. S., of Birmingham, says that he has separated particles of mica and quartz from the magnetic oxide of iron found in tea, his inference being "that, as magnetic oxide of iron forms part of the soil of China, it would rise with the dust of the country, and coming in contact with the damp leaves would adhere to them when they are dried, and thus make the dried leaves stick to the magnet as if there were iron filings mixed up amongst them." Speculative, to say the least, as this may seem, it would appear to receive some support from an experiment made by Mr. Bird upon some French bean leaves grown in his own garden. One hundred grains were dried, and upon testing with a magnet were found to be attracted by it in a similar manner to that reported of some specimens of tea leaves. A closer examination of the matter adhering to the leaves showed that it was magnetic oxide of iron, and 0.02 of a grain was obtained from the 100 grains of bean leaves. An investigation of the black mold of the garden in which the plants were grown showed that it contained an abundance of magnetic oxide of iron.

If all that the opponents of the adulteration act say against it were true, it would be but little to be able to reply that it is not an unmitigated evil; but still it is a fact that the act has given a great impulse to the investigation of food substances, the benefit of which must appear in an acquisition to our store of knowledge respecting this important subject. For even should Mr. Bird's speculations prove correct, it would not be the only instance that has recently come under our notice where the presence of a gross adulterant has been alleged upon insufficient grounds.—*Pharmaceutical Journal.*

DENTIST'S SOLDERS.—I. H. P. says: For gold solder, use 8 grains American silver coin and 4 grains best copper wire (or copper from an old style cent) to each pennyweight of gold plate of the same fineness as that to be soldered. For silver solder, use 8 grains best brass wire to each pennyweight of silver coin. Melt with borax, cool, and roll into plate.

THE HOOSAC TUNNEL alignment proves to have been very accurately made. The error in vertical alignment was only nine sixteenths of an inch, and that in the level was one inch and a half. This result is very creditable to the engineers.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW WEATHER VANE.

The old weathercock has three essential faults; it indicates a direction when there is a dead calm, it gives no means of learning the force of the wind, while it fails to show the true course of the same, by exhibiting merely its horizontal component. M. Tany proposes the arrangement to be attached to the ordinary lightning rod. Just above a suitable shoulder on the latter is placed a copper ring, grooved and made into a pulley easily rotated in a horizontal plane. Around this passes a knotted cord, the ends of which are secured to the extremities of a short stick or metal rod, to which is secured a simple streamer. Thus constructed, the vane indicates a calm by falling vertically, and besides shows the strength of the wind by being blown out more or less from the lightning rod. As is evident, it is capable of motion in every direction, so that if there exist in the wind an upward tending vertical component, the same will be shown.

NEW MODE OF SHOWING NODAL POINTS IN SOUNDING TUBES.

Bourbouze proposes, as an improvement upon the König capsule generally used for the above purpose, the employment of a simple membrane of rubber on which is attached a very light silvered mirror which oscillates with it. If rays from a luminous point be reflected upon the mirror, and the image passed through a lens, the image is lengthened, and often transforms itself into an ellipse. It reaches its maximum elongation when the mirror is placed at a node, but retains its immobility when reaching the points corresponding to ventral segments. The device, it is stated, can be placed at the extremities of Helmholtz's resonators, or of the rubber tube attached to these instruments, and the mirror vibrates when a mixed sound is produced, containing the note proper to the resonators, to which it is applied.

AQUEOUS EXHALATION OF PLANTS.

M. Barthélemy, after a series of experiments on the above subject, concludes that in plants there is an insensible exhalation throughout the entire cuticular surface, through the medium of a true gaseous dialysis; that there is an abrupt emission of saturated gases which escape by breathing apertures when the plant is submitted to a rapid elevation of temperature, especially when under a bell glass; and that there is finally an accidental exudation, the result of defects in equilibrium between the absorbent action of the roots and the work in the aerial portions for the fixing of the carbon added to the elements of the water, a labor which ceases when light disappears.

SIMPLE METHOD OF DETECTING ADULTERATION OF WINE.

Into a small quantity of the wine to be tested, says *Le Temps*, drop a piece of potash. If no deposit is formed, and the wine assumes a greenish tint, it has not been artificially colored. If, however, a violet deposit appears, elder or mulberries have been used. If the deposit be red, the adulteration is sugar beet; if violet red, campeachy wood; if violet blue, privet berries; if clear blue, coloring matter obtained from sun flowers.

IMPROVEMENT IN PHOTO-LITHOGRAPHY.

M. Paul proposes the substitution of albumen for gelatin in the bichromate process. The paper is covered with a thin layer of albumen, to which a concentrated solution of bichromate is added. After sufficient exposure under the negative, the sheet is covered with lithographic ink and then immersed in cold water in order to dissolve the unaltered albumen, which is removed by fine sponge. A very clear image, it is said, is thus obtained, ready to transfer to the stone.

PHYSIOLOGICAL PROPERTIES OF CAFFEIN.

The physiological action of coffee, according to MM. Aubert and Haase, should not be attributed to caffeine, but to other principles. An injection of 0.6 cubic inch of coffee containing 0.6 grain of caffeine killed a rabbit in a very short time, producing acceleration of the pulse and respiratory organs, uneasiness, and finally convulsions. An injection of 0.75 grain of pure caffeine, however, did not produce death nor even any symptoms of sickness. An infusion of 770 grains of very hot coffee, corresponding to 6.3 grains of caffeine, acts upon a man far more intensely than a stronger dose of pure caffeine. Headache, vertigo, trembling, and similar symptoms are produced, which last upward of four hours. Coffee extract, deprived of caffeine by chloroform and injected into the jugular vein of a rabbit, causes strong convulsions, but never tetanus, such as is produced by an overdose of caffeine singly.

JAMES VICK, the Rochester (N. Y.) seedsman and florist, informs us that he manufactures and sells the tent roof garden chair illustrated in this journal some time ago. It will be remembered that we recommended its introduction in this country. We are glad that our suggestion has been anticipated.

MR. A. FELL desires such of our readers as have old numbers of the *SCIENTIFIC AMERICAN* which they do not want, to send them to No. 18 East 30th street, New York city. Any papers sent will be distributed in the Bellevue Hospital and other charitable institutions, where they are frequently asked for and eagerly read by the patients.

A **STRONG** colony of bees has been known to build one hundred square inches of comb in twenty four hours; at that rate, over sixty sheets of comb a foot square could be constructed in three months. The *Annals of Bee Culture*, mentions a swarm that built nine sheets of comb, ten by thirteen inches, in ten days.

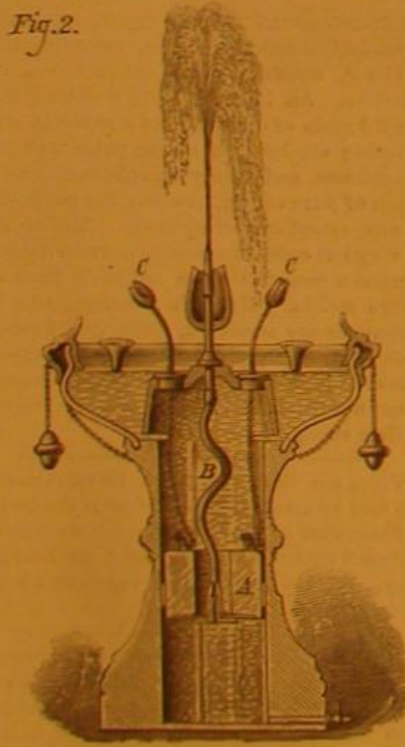
THE CRYSTAL SELF-ACTING TABLE FOUNTAIN.

Nature's ornaments are the standard of beauty; and the more closely art copies her ever varying forms, the higher and purer does it become. A spray of ivy creeping over a cornice, a handful of flowers, not imbedded in a stiff mass but allowed to rest loosely in a simple vase, a jet of crystal water dancing and playing like a shower of diamonds in some sunny corner, are far more exquisite than the most elaborate decorations or gorgeous fittings that the most skillful of workmen can produce.



But nature may be assisted by art, so that her handiwork may exist in places where it would otherwise be absent; and the ingenuity of the inventor is not at a loss to find a way of bringing into our parlors the beauties which we admire in the garden. Such indeed is the object of the ornamental little device to which our engravings refer, and by which we are enabled to place a miniature fountain, with its floral accompaniments, in the center of our dining tables, if we so desire it. Apart from its beauty as an ornament, it may here be noted that a jet of water in the room tends toward moistening the atmosphere, and relieving it of the dry nature especially due to furnace heat, while, besides this, the fluid has a tendency to absorb the foul gases due to respiration. Hence the invention is desirable both from an aesthetic and a sanitary point of view, while it has, as we are informed, the further merit of being within a moderate limit of cost.

In our illustrations, Fig. 1 shows the apparatus entire and Fig. 2 is a vertical section. There is a pedestal, which may be of imitation bronze or any other desired material and made in any handsome design. In this is a cylindrical space in which fits a heavy plunger, A. Through the latter is an opening into which passes a rubber pipe, B, of smaller diameter, and which terminates below in a flap valve. The valve, however, is pierced, so that the opening from the water below, through the pipe and to the spout above, is clear.



To start the fountain, in which clear, colored, or perfumed water, or even eau de cologne, may be used, the plunger is drawn up to the highest position by means of the chains which connect with the movable metal tulip buds, C. While this is being thus elevated, the water above passes through the annular space between the pipe and the periphery of the orifice in the plunger, and escapes below, the valve, of course, opening downward. The plunger, however, on being left to itself, descends by its own gravity, pressing upon the water

below, which, unable to ascend through the annular space on account of the closing of the valve, is forced through the small central opening in the latter, through the pipe, B, and, finally, out at the spout in a fine jet sixteen or eighteen inches high. The basin communicating with the cylinder, of course, never overflows, and the play of the fountain continues until the plunger has reached the bottom, which, with a small jet, occupies a period of about forty-five minutes. The lifting of the plunger is very easily done, and is hardly two seconds' work. The glass tulip shown near the jet is designed to hold flowers, and the same are also arranged in holders attached to the side of the basin. By being continuously sprinkled with water, they are thus kept fresh for quite a long time. At the bottom is a conduit and cock for drawing off the water, and a suitable strainer is provided at the jet to prevent the same from clogging.

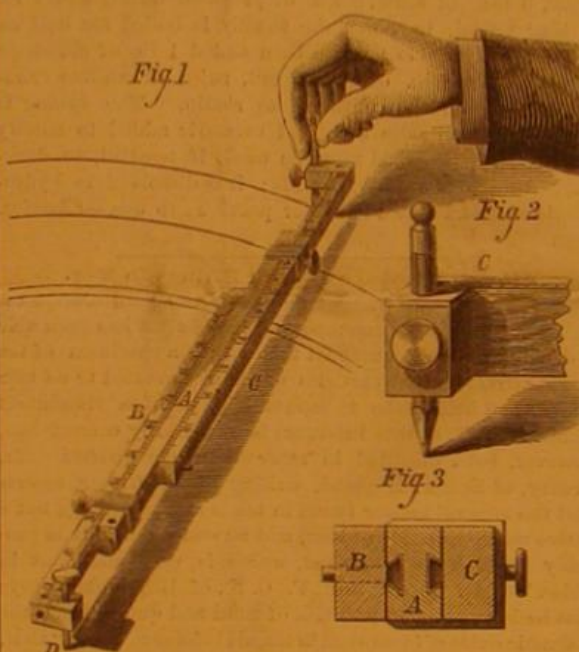
The decorations are quite tasteful, and the ornament, as a whole, will be a handsome addition to any parlor.

Patents for the fountain are now pending. For further particulars, address the American Fountain Works, New Haven, Conn.

COMBINED EXTENSION MEASURING ROD AND DIVIDER.

The object of the invention herewith illustrated is to facilitate the taking of measurements between rigid surfaces, and the striking of circles, arcs, ovals, or ellipses. It appears to be quite a handy little instrument, and will doubtless prove a convenient device for builders and mechanics.

There is a center piece, A, Fig. 1, in each of the two opposite sides of which is made a dovetail groove for the reception of metallic dovetails attached to the inner sides of the extension pieces, B and C. This arrangement is clearly shown in section in Fig. 3. Secured also to the center piece are suitable bands for holding the extension arms, which are provided with thumbscrews, so that the latter may be fastened in any desired position. The pieces, B and C, are graduated in inches and fractions, so that the length of the rod may be at any time easily ascertained. At D is a removable point secured by a thumbscrew, and at the opposite



extremity of the apparatus, shown in Fig. 2, is a simple arrangement for holding an ordinary pencil. The mode of using the device for striking circles is obvious from our engraving. In making ellipses, the third point is attached to the end of the center piece. When not used as a tram, the points and pencil may be disposed of in suitable holes made in the ends of the pieces.

Patented through the Scientific American Patent Agency, November 4, 1873. For further particulars address the inventor, Mr. George H. Discher, Mobile, Ala.

The Sea Mouse.

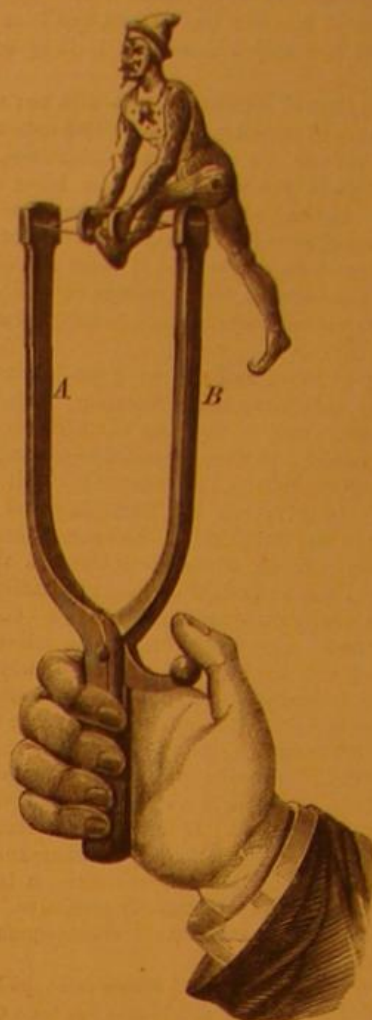
The sea mouse is one of the prettiest creatures that lives under the waters. It sparkles like a diamond and is radiant with all the colors of the rainbow, although it lives in the mud at the bottom of the ocean. It should not have been called a mouse, for it is larger than a big rat. It is covered with scales that move up and down as it breathes, and glitters like gold shining through a flocky down, from which fine silky bristles wave that constantly change from one brilliant tint into another, so that, as Cuvier, the great naturalist, says, the plumage of the humming bird is not more beautiful. Sea mice are sometimes thrown up on the beach by storms.—Hearth and Home.

TOY GYMNAST.

This is one of those ingenious mechanical toys which are sure to amuse and please children of all ages, though it is nothing but an articulated figure which, supported between two upright bars, goes through a variety of ludicrous antics. The performer is made of pasteboard, and has his legs and arms pivoted to his body. The hands are kept apart by two short tubes through which pass a couple of strings which are secured to the tops of two bars, A and B. Bar A is curved and projects downward into the handle. The other, B, is also curved, and its lower end terminates in a thumb piece, which enters and is pivoted in a groove in the upper part of the handle of bar A.

All that is necessary to do in order to make the figure execute a number of astonishingly impossible gymnastic feats

is to press down the thumb piece, as shown in our engraving. By this means, the upper ends of the bars are forced apart, and the motion of the gymnast regulated according to the quantity of pressure applied. The inventor also adds hooked



toes to the feet, so that the latter will catch in the tubes between the hands, and thus give the performances of the figure a more grotesque appearance. This is just the article to find ready sale during the holidays.

It was patented November 18, 1873, through the Scientific American Patent Agency, by Mr. Frederick A. Bancker, of whom further particulars may be obtained by addressing P. O. box 180, Brooklyn, N. Y.

MOISTENING DEVICE FOR LAME ANIMALS.

Mr. George J. Harris, of New York city, has recently patented an apparatus by means of which the legs or feet of a horse, or other animal, may be kept moist for any desired time. He arranges an india rubber water bag around the neck and leads therefrom flexible pipes, which extend to the legs of the animal. These pipes, at A, are connected to tubular sprinklers, which are so constructed that they can be conveniently secured either below the knee or below the ankle joint. They are also perforated with a number of



minute holes, and are enveloped in flannel or other suitable absorbent material, so that water or liniment, which oozes slowly out, is distributed over the entire surface of the legs or feet.

By this means a sufficient quantity of liquid is supplied to keep the extremities of the animal damp for a considerable period of time; and when the device is once adjusted, it needs no further attention until the receptacle is empty.

CHINESE FRESH WATER FISH.

There is a common belief that the queer animals represented in the grotesque designs of Chinese artists are in the main chimerical, and have no existence save in the imaginations of their delineators. It is a fact, however, that the reverse is, in some instances, the case, and that many of these beings really live, though perhaps in a form hardly so exaggerated as depicted in the works of celestial art. A French pisciculturist, M. Carbonnier, has recently succeeded in transporting several strange varieties of fish to France, and, as we learn from *La Nature*, has found it possible to acclimatize them, and hence to study their habits of life, reproduction, etc. Four species of these odd animals are represented in the accompanying engraving. The pair nearest the surface of the water are *macropodes*, small fish, pale gray in color, and, at first sight, having little about them to attract attention. As soon as the animal becomes excited, however, the long fins on the back and belly straighten out and assume a rich purple hue tinted with green; the long and fork-shaped tail spreads into a kind of fan, and the stripes upon the sides of the fish become yellow, red, and blue, constantly changing in color. The scales seem to become opalescent, and reflect the light with the greatest brilliancy, while the eyes appear illuminated with a bluish green fire. These beautiful peculiarities of the fish have gained for it the popular name of Fish of Paradise.

The habits of the animal are as odd as its appearance. The males take charge of the young and build the nest. The latter is simply a clot of foam floating upon the water, and is made by the fish rising to the surface and alternately absorbing and expelling air, until a little cluster of fine bubbles, hardly three tenths of an inch square, is formed. The female then deposits her eggs, which are at once seized upon by the male, who carries them in his mouth to the nest. Then he watches their incubation, carefully guarding and distributing them with wonderful sagacity evenly throughout the mass of foam. When they clot together, he pushes them apart with his nose, and, besides, keeps up a continual manufacture of bubbles until the eggs are lifted up above the water and rest only upon their soft couch. As soon as the embryos appear, his care is doubled. He watches that none escape; and in case some become separated, he chases them, catches them in his mouth, and replaces them carefully in the nest. If one becomes injured, he removes it from the others, and gives it a separate air bubble to itself, and apparently nurses it until it regains strength.

The *macropodes* belong to a family known as *labyrinthiform pharyngiens*, and their peculiar construction enables them to keep their gills moist for a very long time. They can pass through half dry marshes by maintaining their equilibrium with their fins and propelling themselves by the sharp toothed points with which the latter terminate.

The two grotesque-looking fish represented in our engraving, just below the *macropodes*, are of the genus *cyprinus*, and are termed telescope fish. The body is apparently gilded on its lower portion and of a deep velvet black above, while its form is globular. The dorsal fins are double, and the tail extends into a long curved fan. The eyes project sometimes as far as an inch and a half beyond the head, and resemble the lens and tube of a telescope. The habits of this strange animal are as odd as its shape, and it is said that its equilibrium in the water is very unstable, so that it even swims with difficulty.

The two species shown near the bottom belong to the same genus *cyprinus*, and are known to science as the *leuciscus idellus* and the *hypophthalmichthys molitrix*. There seems to be nothing extraordinary about the habits or form, and the value of the fish lies in its quality as food. Its flesh is said to be excellent, and the animal, when adult, often attains a weight of fifty pounds. The Chinese raise these fish in great numbers in artificial ponds.

How the Heathen Chinese catches Fish.

M. de Thiersant, lately a French consul in China, has published in France a quite interesting work on pisciculture and the mode of fishing in that country. He states, among other facts, that over 850 different kinds of fish exist in Chinese waters, many of which are of species hitherto unknown to European naturalists. Several varieties have for centuries been selected as fit for food and cultivation, and hence pisciculture or the ordinary domestic raising of fish, an industry here in its infancy, is far from a novel idea in the Celestial Empire. The author presents a vast number of interesting details on his general topic, from among which we select the following curious ideas:

The cormorant is largely employed as an assistant to the fisherman, and is carefully educated to its work by professional trainers. When thoroughly trained, a pair of birds is worth 40 dollars, the high price being explained by the cost and labor of instruction. During the first seven months of

fishermen keep their feathered assistants at work as long as daylight lasts. Occasionally the birds become tired and refuse to dive, a proceeding which occasions a series of frightful yells and beating of the water with a stick by their master, which frightens them to such an extent that they resume labor instantly. This mode of fishing, which is not interrupted even by severe cold, is quite lucrative, as twenty or thirty birds can readily catch about a dollar and a half worth of fish per day. In general the fishermen are associated, and the birds belong to a society which marks them with a peculiar brand of its own. Oil of sesame is said to be the panacea for all ills of the cormorant, which continues its career of active work until about ten years of age.

The Chinese have also queer ways of catching water fowl. Sometimes they spread great vertical nets with large meshes near the surface of the water, so that the wings of the birds become entangled therein just before they alight. Another arrangement is a sort of net trap held open by the bamboo

sticks which, when the birds perch upon them, fall and allow the game to become entangled in the meshes. Perhaps the most ingenious idea is carried out by men who enter the water entirely nude, wading in up to their necks. Over the head is placed a sort of helmet, which is pierced with holes for sight, breathing, etc.; and resting on the man's shoulders is a wooden shelf on which, just in front of the sight orifices of the helmet, is placed a number of cups containing corn or seed. The bird, attracted by the bait, alights upon the shelf, when the fowler grabs his prey by the legs with his hand, draws it under the surface, and secures it in a net bag which is worn about his waist.

Hairy Men.

Two remarkable instances of hairy men arrived recently in Berlin. They are Russians, father and son, and have excited so much interest that Professor Virchow has delivered a lecture upon the phenomenon, an abstract of which appears in the *Edinburgh Medical Journal*.

They are peculiarly remarkable in being edentulous. They are not hairy men in the ordinary acceptance of the term, but more resemble some of the monkey tribe (the Diana monkey, cuxio, etc.); while their edentulous condition carries them yet lower in the animal scale. The eldest is a man aged over 55, Andrian by name, said to be the son of a Russian soldier from the district of Kostroma. He was born during the period of service of his reputed father, and has no resemblance to him, to his mother, or to a brother and sister whom he possesses. To escape the unkindness of his fellow villagers, Andrian fled to the woods, where he lived in a cave, and was much given to drunkenness; even yet he is said to live chiefly on sauerkraut and schnapps; but his mental condition, which is truly none of the sharpest, does not seem to have suffered, and he is, on the whole, of a kindly disposition, and affectionate to his son, and to those about him. Andrian was married, and had two children, who died young; one of these was a girl resembling her father; but of the other, a boy, nothing can

be ascertained. Fedor, the boy, exhibited with him, is three years old, and comes from the same village; he is said to be Andrian's son, born in concubinage; and it is most probable that this is the case, as it would be singular were two such creatures to originate independently in one small village. The peculiarity of these individuals is that they have an excessive growth of hair upon one particular part of the body, namely, the face and neck; on the body and lower extremities there is also a stronger growth of hair; and particularly on the back and arms of the child, there are sundry patches of 0.15 inch to 0.24 inch in diameter, covered with soft yellowish white hair 0.13 to 0.24 inch long. Andrian himself has on his body isolated patches strewn, but not thickly, with hair 1.5 inches to 2 inches long. But all this is trifling and subordinate compared with the hair growth on the face, to which attention is mainly directed. Andrian has only the left eye tooth in the upper jaw; Virchow has not stated how many teeth are in his lower jaw, but from the



CHINESE FRESH WATER FISH.

context it is improbable that he has more than his son, namely, four incisors. The son has no teeth, hardly any alveolar process, and the upper lip is very narrow, so that the upper jaw appears depressed; the father presents the same appearance. It is somewhat singular that a singular family has long been known to exist at Ava, and was first described by Crawford in 1829, and since then by Belgel. Three generations of this family are now known to exist. The grandfather, Shwa-Maon, had a daughter Maphoon, and she again a son, all of whom present precisely the same peculiarities as in the family of Andrian, not only as to the growth of hair, but also as to the teeth. The grandfather has in the upper jaw only four incisors, in the lower jaw four incisors and one eye tooth; and these teeth did not appear till he was twenty years of age. Maphoon has only four incisors in each jaw; the eye teeth and molars are wholly wanting; the first two incisors appeared during her second year. The peculiarity of the hairiness in these individuals is of the same type as in Andrian and his son, in whom every part of the face and neck, usually only covered with lanugo, is covered with long hair, the very eyelids being so covered, the eyelashes being normal, while flowing locks come out of both nostrils, and also out of the *meatus auditorius externus*. At first sight, the occurrence of two such families in two such distinct parts of the world, seems to point them out as "missing links"—as the unreformed descendants of an earlier race of man. And our thoughts are carried back to the Ainos or hairy Kuriles, who are believed to be the remains of the aborigines of Japan, and who now inhabit the northern parts of the Island of Yesso and the southern part of the Island of Saghalien. At first these aborigines were stated to be as hairy as our wild men; but from more accurate information, obtained by the Berlin Anthropological Society through the German resident Herr Von Brandt, accompanied by numerous photographs and Japanese pictures of these Ainos, and from an examination of a skull recently obtained through Privy Councillor Von Pelican, Virchow is able to state with positiveness that, neither in respect of the formation of hair nor in regard to the teeth, have the Ainos any analogy with the Russian or Burmese hairy men. The Ainos are certainly hairier on the chest and extremities than the nations around them, but there is nothing peculiar in the distribution of the hair, and the males have hair only on the typical parts peculiar to man. There is not a shadow of a race connection between the Ainos and the Russian hairy men, and only the most prurient imagination could connect the latter with the Burmese family. No doubt, careful breeding could raise a new race of men from this accidental variety, just as various new races of domestic animals, dogs, for instance, have been propagated from accidental varieties. Virchow, however, believes that the peculiarities, belonging to the Russian as well as to the Burmese families, depend upon idiosyncrasies of innervation, and these upon accidental congenital abnormalities in the *trigeminal*, within whose domain all these features present themselves, only to be ascertained by careful dissection.

Recent American and Foreign Patents.

Improved Scrubbing Brush.

Carl Hrold, formerly of Pittsburgh but now residing with Mr. Vock, 53 Ludlow street, New York city.—This invention is designed to furnish a scrubbing brush which contains a reservoir to hold water, soap, or other cleaning liquid. This reservoir is in the brush back, in which a small air hole is made, the closing of which by the finger, while the brush is in use, will stop the flow of the liquid; or the hole may be provided with a valve. The improvement may be applied to blacking brushes, for which it is especially suitable. Further information may be had by addressing Mr. Herold above.

Improved Grain Separator.

Joseph Egan, New Auburn, Minn.—This invention is an improved grain separator, constructed so as to thoroughly separate the grain from the straw as they come from the thrasher, clean the grain and remove it, and carry the straw to the side of the machine and deposit it upon the stack. The frame of the machine is rectangular in form, and is incased upon its top and sides. The frame is from twelve to fourteen feet long, about four and a half feet high, and from three to four and a half feet wide. Two shafts revolve in a side bar, and to each are attached two wheels, which work in circular spaces in the frame of the machine, so that the straw and grain cannot escape. The wheels are connected near the rims, at their upper and lower parts, by two rods, the points of attachment of which form an angle with each other of one hundred and sixty degrees. The upper rods connect with the separator rack, the slats of which are provided with teeth, inclining forward, so that as the rack moves upward and forward it may carry the straw with it and may slide beneath the straw as it moves downward and rearward. While construction, as the shafts are rocked, the rack receives the vertical horizontal movements necessary to properly separate the grain from the straw and carry the straw forward. To the lower rods is attached the separator which receives the grain from the rack and conducts it to the eyes. To the forward end of the separator are attached fingers to break up the sheet of grain as it falls to the shoe or sieves. The separator has the same vertical and horizontal movement as the rack. By suitable mechanism, the horizontal and vertical movements of the rack and separator may be regulated at will. This adjustment enables the forward movement of the straw to be accelerated or retarded, as required.

Improved Corn Planter.

Charles Hennes, Aubrey, Kan., assignor to himself and Abram Large, of same place.—The seed dropping mechanism consists of a slide which moves to guide slats in the hopper, at the bottom of the same. The slide is arranged with a hand spring, to which is connected a log which is acted upon by knobs attached to the spokes of the wheels, according to the distance at which the corn is to be planted. The knobs carry the spring and slide forward, and drop the seed inside of plow to the ground. As soon as the spring is released, the slide closes the hopper till actuated again by a knob. Cross pieces are attached to the circumference of wheels diametrically opposite to the knobs, for the purpose of marking the exact place at which the corn has been dropped. The driver is thereby enabled to see at any time whether he is planting in rows or not. As soon as he finds himself not exactly in line, he can, by placing his foot on the lever, raise the front wheels on the pivots, and regulate the planting by simply turning the wheels forward or backward, which allows him to plant as straight one way as the other. The broad concave hind wheels are placed back of the plows, and serve to cover the corn dropped in the furrows. By means of a lever which is operated by the foot of the driver, the pivoted frame with the wheels is raised, and thereby the planting interrupted at will, as required, turning the planter or moving from place to place.

Improved Reciprocating Engine.

Samuel J. Jones, Helena, Montana Terr.—The piston rod extends through both cylinder heads, and disks fit thereon, one each side of the piston, and work airtight in the cylinder. On the upper side of the latter are induction ports for the air, and valves for opening and closing them, which are connected by a valve rod. Short rods project into either end of the cylinder, by which the levers are thrown to work the valves, by means of the disks, which strike the rods when forced against the cylinder heads. The steam ports are on the lower side as is also an injection port for water, to condense the steam after having thrown the shuttle to expel the air through the check valves and shift the air valves. Supporting the engine to be standing with its piston at its forward end, and the valve shifted to admit steam at the front port, the rear disk will thereby be driven to the other end of the cylinder, expelling the air; and just before arriving at the piston head, it will strike the short rod at that end, and close the right hand air port, and open the left hand port; at the same time, if the injecting port be opened and water admitted, the steam will be condensed and a vacuum formed, so that the air admitted will drive the piston and other disk over to the right, with all the force due to the difference of the pressures on the two sides of the piston, which, in practice, will probably be about twelve or thirteen pounds to the square inch. At the same time the injection port should be closed to shut off the water; then if steam be admitted between the rear disk and the piston, it will be driven back to the left, expelling the air and water at that end, and taking their place to form a vacuum again by being condensed by water admitted; so that, as soon as the rear disk arrives at the end of its movement and strikes the rod, the air would be admitted behind the piston, and drive it back to the place of beginning, and so on.

Improved Safety Valve.

James Hoffman, Belvidere, N. J.—A short vertical pipe rises up from the top of the steam chamber, having a considerable enlargement near the upper end, which is bored out cylindrically, and, at a suitable distance above the bottom, perforated with numerous holes. The safety valve proper is seated at the top of the small bore of the pipe, and is provided with a cylindrical attachment fitted to the bore, as nearly steam tight as it can be and work up and down a short distance without friction. After the steam has lifted the valve, it cannot escape until the attachment rises as high as the lateral holes. By this means, the lifting of the valve high enough to insure the opening of the escape to the full capacity of the bore will be caused.

Improved Wood Molding.

Leonard Bushnell, New Bedford, Mass.—This invention consists in a wooden or other molding, provided with stamped ornamental figures or signs in intaglio, having the sides of the recesses beveled and inwardly inclined, to facilitate the operation of gilding.

Improved Wheel for Vehicles.

Joseph H. Glover, Freedom, Ky.—An octagonal tube has a screw thread cut upon each end, and is lined at each end with antifriction metal, to form the bearings for the axle. The two hubs have octagonal holes formed through their centers, to fit and slide upon the tube; and in their outer side are formed dovetailed recesses to receive the dovetailed inner ends of the spokes, which are kept in place by plates bolted to the hubs. The inner part of the plates is rabbeted to receive the flange formed upon the axle, which hold the hubs and plates in place, and also move said hubs and plates out and in. The corresponding spokes from the two hubs meet at their middle parts, and their outer parts are connected together. The outer ends of the spokes have tenons, which enter holes in a rim, which is made convex upon its inner side and concave upon its outer side, which construction prevents the wheel from slipping. By this construction the spokes are shortened by spreading their inner forked ends apart by turning the nuts outward. This shortens the spokes and loosens the rim. By turning the nuts inward, the inner ends of the forked spokes will be moved toward each other, the spokes will be lengthened, and the rim tightened.

Improved Car Coupling.

Xavier St. Pierre, Ophir City, Utah Terr.—This invention consists of a pair of spring jaws, side by side, with heads or enlargements near the front end between which a double headed coupler enters. The latter is secured by the heads of the jaws engaging it behind its enlargement, the jaws being confined against springing open by a forked locking key, which drops down with one of its prongs on each side. The forked locking device is raised and lowered by a handle elbow lever; and a catch is combined with said lever, to engage it just after it has raised the locking device, and hold it up until the cars are to be coupled again. This catch is so coupled with one of the spring coupling jaws that, when it is swung back by the lever to allow it to pass beyond said catch, the latter is caused to withdraw the said coupling jaw, to allow the coupler to escape freely and uncouple the cars. A spring is combined with the elbow lever of the locking device, to insure the return of the latter to confine the coupling jaws when the elbow lever is released by the spring catch.

Improved Overalls.

Emil Well, New York city, assignor to Stern & Co., of same place.—The object of this invention is to furnish overalls readily applied without the use of buttons, suspenders, etc., fitting the body of the person, and self-adjusting to the position of the same. It consists of short elastic bands, inserted and applied into the band piece of the overalls, and closed by a common belt buckle, which is drawn through a slit of a flap attached to the lower front edge of the overalls, and covered by the same.

Improved Apparatus for Puddling Iron.

Joseph Davies, Knoxville, Tenn.—On the rod or shaft of the puddling tool is a pulley for revolving it. The pulley is fitted by a journal at one end in a bearing in a standard, and the shaft is fitted in the pulley so as to slide freely endwise, and has a long key or spline working in a groove in the pulley, to be revolved at the same time. The standard is joined to a section which is seated by a collar on the bench, and has a cylindrical extension passing down through a long slot in the bench top, which is secured by a pin. The bench ranges parallel with the front of the furnace, and is pivoted just above the ground so as to swing toward and from the furnace. The handle portion of the puddling tool rod does not revolve with it when held by the attendant for directing the tool. It will be seen that the tool can be moved in and out by sliding in the pulley in which it is supported; also, by swinging the bench forward and backward on the pivots, that it can be swung horizontally on the bench by turning the section of the support, and that it can be shifted along the bench parallel with the furnace, and thus all necessary movements can be made to work the tool in all parts of the furnace to manipulate the iron for puddling and balling.

Improved Portable Stove.

Rice Moore, Nashville, Tenn.—This invention relates particularly to the arrangement of a damper and apertured horizontal diaphragm in an upper chamber of the stove, whereby the course of the heat and products of combustion is controlled with reference to their effect on a culinary vessel set into said chamber. A small vertical rectangular case is mounted on short legs and contains a fire pot, flue, oven, and chamber. The fire pot extends downward a little below the bottom of the other portion of the stove, and has a perforated bottom and sides. The combustion chamber extends up through the oven space at one side, and discharges into the heating chamber, and a door opens into it for supplying the fuel. On the side of the stove opposite to the fuel door is the oven door. The boiling and stewing vessels are made long enough to extend through the heating chamber into the oven, through the top, to utilize the heat of the oven for boiling, stewing, etc. A plate is arranged in the chamber, parallel to the top of the oven, dividing it horizontally into two parts. Immediately over the combustion chamber said plate has an opening which can be partially closed by a sliding damper. By adjusting the damper, a large share of the products of combustion will be diverted to pass beneath and around the end of the plate before reaching the flue, while the remaining portion will pass vertically into the same through the openings on each side of the damper.

Improved Tomb.

Joseph C. Taylor, Roanoke, Ala.—This invention has reference to a tomb or grave cover which is composed of a base or pedestal of masonry, upon which is placed a slab of artificial stone resembling marble, formed by molding upon said base a composition of hydraulic cement, sand, and water, or their equivalents.

Improved Horse Power.

John S. Tadlock, Belmont, Texas, assignor to himself and J. M. Howell, same place.—This invention relates to railway horse powers; and it consists of cog wheels on the drums over which the endless chain travels, gearing with large multiplying wheels, one on each side of the chain. Between these wheels is a drum on the same shaft, on which the chain rests, so as to be carried in returning to the upper side; and the multiplying wheels are geared with a counter shaft having pinions and transmitting pulleys, from which the motion is taken by belts. The frame supporting the endless chain rests by the wheels of its drums on the large multiplying wheels, and can be shifted so as to ascend from either side to run the machine in either direction, and to change the inclination for varying the speed. The drums of the endless chain are weighted to prevent them from jumping out of gear with the multiplying wheels.

Improved Apparatus for Filling Cans with Tomatoes, etc.

Charles B. Backlin, Red Bank, N. J.—There is an inclined tube, tapering or funnel-shaped, at its lower end, which terminates in a small pipe. An adjustable can holder is placed in front of the end of the tube and provided with a movable cut-off plate. In the tube is a piston, connected with a counterpoise. The tomatoes being placed in the receptacle through a suitable arranged hopper, the piston, being caused to descend by pressing a treadle, forces the contents out of the tube and into the can. When the latter is full, the cut-off plate is placed so that its opening no longer corresponds with the end of the tube, so that its solid portion prevents the escape of the tomatoes after the can is removed. A trough is placed in such a position as to receive any of the substance being canned that may escape from the tube, or may be spilled while filling the cans, and conduct it to a receptacle placed at the rear of the machine.

Attaching Stereotype Plates to Blocks.

Marshall J. Hughes, New York city.—A stereotype plate is cast on and around a wooden block or blocks, and thus attached thereto so that, when an impression is taken, it can be "locked up" without the delay and preliminary labor required to attach the ordinary stereotype plates to blocks or backing. The invention is important to printers, especially to proprietors of country journals and others who use selected matter, also to advertisers in general.

Improved Cotton Chopper and Cultivator.

Mansfield L. Nearn, Double Bridges, Tenn.—This invention is an improvement in the mode of attaching shovels to the standards of cultivators, more especially those employed in cotton culture. The invention consists in forming two parallel vertical slots in the shovels, through which bands or straps of sheet metal are passed, and in forming notches or recesses in the sides of the standards in which said bands or straps are laid and secured.

Improved Car Coupling.

William R. Covert, London, Pa.—This invention is an improvement in the class of car couplings formed mainly of arrow-headed links or draft bars, and pivoted latch blocks engaging therewith. The invention consists in connecting a draft bar to a pivoted block having a ratchet mechanism for elevating it, so that the pin which connects the two will be disengaged from the draft bar when the pivoted block is raised.

Improved Farm Gate.

Jacob C. Rohrer, Gomer, Ohio.—The frame consists of two vertical side pieces, of which the stronger piece is placed sidewise of the main post of the gate, turning with its lower end in a recessed block which is set securely into the ground. The upper part of the piece is recessed and turns in arms, which are applied to the top of the main post. The two vertical pieces are laterally connected by a top piece, diagonal brace, and horizontal piece. The vertical pieces, and also the diagonal brace, are recessed sufficiently for the passage of the horizontal pieces. The upper piece of the gate is carried by rollers, so that the gate slides easily in the frame forward and backward. The vertical end pieces limit the extent of sliding the frame, being, however, so constructed that that part of the gate which extends beyond the stronger piece balances the fore part of the gate and frame, so that the whole gate swings readily and easily in bearings.

Improved Composition for Removing Incrustation in Boilers.

Charles Burtitt, New Wimbledon, England.—The composition is made in three different forms—that is to say, in block, in liquid, and in paste. The block composition is compounded of oak galls, Australian bark, soda, glue, Irish moss, and filtered water; to be set by the application of 170° of heat. Into the vessel in which the above ingredients are mixed is put a small quantity of arsenic. The liquid composition is oak galls, Australian bark, soda, Irish moss, and filtered water, boiled together for three hours. The paste composition is oak galls, Irish moss, Australian bark, soda, and filtered water, boiled to 120°. Tannic acid from vegetable matter is finally added.

Improved Shaving Mug.

Andrew J. Furr and Walter C. Knaus, Boonsborough, Mo.—This invention is an improved shaving cup, so constructed that the water may be warmed and kept warm by a small lamp connected with the cup itself. A suitable chimney, as well as receptacles for brush and soap, is provided.

Improved Glove.

Thomas G. Foster, Gloversville, N. Y.—This invention relates to gloves made of buckskin or other material; and it consists in the palm side and finger pieces cut in a single piece, with the finger and thumb pieces sufficiently long to turn over the ends of the finger and thumb, and be attached to the material on the back.

Improved Overflow Alarm.

Thomas Mayes, Albany, N. Y.—The alarm mechanism may be of any suitable kind. There is a lever for holding it when it is not required to be sounded, and a catch for tripping said lever. A float is arranged in the drip pan to disengage said lever when the fluid rises in the pan nearly to the point of overflowing. It is proposed to use a tilting pan to raise the lever by receiving the drip from another pan upon it, the said tilting pan being weighted so that the drip falling on it at the other side of the fulcrum will raise the trip latch.

Improved Composition for Purifying Illuminating Gas.

Samuel P. Farham, New York city.—Sawdust is mixed with lime, to which a solution of copperas in water is added, and the same, together with oxide of iron, thoroughly mixed and stirred, producing thereby a reddish brown composition. This composition is placed into large purifiers, which are alternately brought into use, so that the contents of one may be taken out, and, by exposure to the air, be revived and charged again, till gradually, by long and repeated use, the absorptive power is spent. The sulphureted hydrogen gases are distributed and absorbed in such a manner by the composition that no annoying smell is noticeable at all, and the gas issues from it purer than from the lime purifiers.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From November 15 to November 27, 1873, inclusive.

BOLT MACHINE.—A. Wood, Worcester, Mass.
BRAKE.—G. Westinghouse, Jr., Pittsburgh, Pa.
CONCENTRATOR, ETC.—J. A. Peor et al., San Francisco, Cal.
CONTROLLING DRAFT OF LOCOMOTIVE.—J. Richards et al., Philadelphia, Pa.
ELECTRIC TELEGRAPH.—J. B. Stearns, Boston, Mass.
FURNACE, ETC.—J. F. Harley, Washington, D. C.
GAS ENGINE.—T. B. Fogarty, Warren, Mass.
HARDENING STEEL, ETC.—S. S. Lewis (of New York city), London, Eng.
IRONING MACHINE.—G. W. Cottingham, Refugio, Texas.
MAKING IRON, ETC.—H. M. Baker, Williamsburgh, N. Y.
MAKING SCREWS.—C. M. Spencer, Hartford, Conn.
OCEAN ACTION.—T. Winans, Baltimore, Md.
NAIL MACHINE.—National Horse Nail Company, Vergennes, Vt.
PIPE TONGS.—J. R. Brown, Middlesex county, Mass.
PRESERVING FIBERS.—T. Sim, New York city.
PRINTING MACHINE.—G. P. Gordon, Woodbridge, N. J.
RAILWAY AND CARS.—C. W. Hunt, West New Brighton, N. Y.
SHAPING BOOT SOLES.—J. B. Johnson, Lynn, Mass.
WATERPROOF BOOTS, ETC.—F. M. Shepard, New York city.

Business and Personal.

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

The Universal Hand Planer is recommended in most favorable terms by all using them. Saves its cost in files and time of workman in a short time. Attached to any vice. Jacob E. Sutterlin, Manufacturer, 80 Duane Street, New York.

Wanted, Agents in Foreign Countries, to sell my Bolt Forging Machines, J. H. Abbe, Manchester, N.H.

Wanted to purchase—A small machine, to be worked by steam power, for sawing trees in the woods, for fire wood. Address Drawer 48, Post Office, Montreal, Canada.

Machine Manufacturers acquainted with Clothes Pin Machinery, address Julius Smith, Rock Falls, Ills.

Wanted—A Manufacturer who can supply clean cut paper tape for "printing telegraph instruments." Address G. L. Wiley, 125 East 41st St., N.Y. city.

2nd hand Iron Planer for Sale, planes 16 ft. long, 42 in. wide. In first rate condition. Price low. Address New Haven Man'g Co., New Haven, Conn.

I will give \$2,000 a year, cash, and furnish Horse and Wagon free, and \$500 worth of goods, not to be paid for till sold. An agent wanted in each county in the U. S. Send stamp to J. C. Miller, Pittsburgh, Pa.

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

Wanted—A responsible Party desires to purchase Patents, or manufacture on royalty, Household articles of Glass or Iron, such as Lamps or Table Furniture. Address P. O. Box 781, Pittsburgh, Pa.

Flour, Feed, Paint, Ink, and all other kinds of Mills. Ross Bros., Williamsburgh, N.Y.

Brown's Coal Yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W.D. Andrews & Bro. 414 Water St. N.Y.

Millstone Dressing Diamond Machines—Simple, effective, economical and durable, giving universal satisfaction. J. Dickinson, 64 Nassau St., N.Y.

Nobody will buy the metal Truss with its pitiless Iron Finger. The New Elastic Truss, 63 Broadway, New York, holds the rupture easy till cured. Pressure all around the body.

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Tool Chests, with best tools only. Send for circular. J. T. Pratt & Co., 53 Fulton St., New York.

Root's Wrought Iron Sectional Safety Boiler, 1,000 in use. Address Root Steam Engine Co., 24 Avenue and 28th Street, New York.

Drawings, Models, Machines—All kinds made to order. Towle & Unger Mfg Co., 30 Cortlandt St., N.Y.

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

Engines for Sale, Cheap—Three 8x12 horizontal stationary; one 1x18; one 5x8. Enquire at D. Frisbie & Co., New Haven, Conn.

Wanted—To let three new patents on royalty. Machinery popular. Cyrus H. Kirkpatrick, Lafayette, Ind.

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

Parties needing estimates for Machinery of any kind, call on, or address, W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

At the "Scientific American" Office, New York, they use the Miniature Telegraph. It greatly facilitates the transaction of business. By touching different buttons on the desks of the manager, he can communicate with any person in the establishment without leaving his seat. Splendid for offices, factories, shops, dwellings, etc. Price only \$5. Made by F. C. Beach & Co., 290 Broadway, corner Warren St., New York.

Iron Steam Boxes for Stave Bolts & Veneer Cutting Machines. T. R. Bailey & Vail, Lockport, N.Y.

Boulton's Unrivetted Paneling, Variety Molding and Dovetailing Machine. Manufactured by Battle Creek Machinery Company, Battle Creek, Mich.

We sell all Chemicals, Metallic Oxides, and Drugs; directions on Nickel, in pamphlet form, we mail on receipt of fifty cents; a Treatise on "Soluble Glass" we mail for \$1. Orders will receive prompt attention by L. & J. W. Feuchtwaenger, 25 Cedar Street, New York.

Wanted—To manufacture, under contract, heavy Machinery, Steam Engines, Ore Crushers, &c., &c. Address Herman & Herchelrode M'g Co., Dayton, Ohio.

Buy for your boys, for Christmas, the Tom Thumb Telegraph, complete for practical use, with battery, wires, keys, and instructions, price \$3. Neatly boxed and sent to all parts of the world. F. C. Beach & Co., 290 Broadway, New York. See engravings in last week's "Scientific American."

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

For Bolt Forging Machines, Bolt Holding Vises to upset by hand. J. H. Abbe, Manchester, N.H.

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

Brass Gear Wheel & Sprocket, &c., made to order, by D. Gilbert & Son, 212 Chester St., Phila., Pa.

Superior to all others—Lime & Co.'s French Files. They are cheaper than English files. They are heavier, better finished, and better tempered. Send for price-list. Homer Foot & Co., Sole Agents, 20 Platt Street, New York.

Subscribe for "The Mechanical Advocate," Boston, Mass.

Telegraph & Electrical Inst's—Cheap inst's for learners—Models and light Mach'y. G. W. Stockly, Sec., Cleveland, Ohio.

Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Mercurial Steam Blast & Hydraulic Gauges of all pressures, very accurate. T. Shaw, 913 Ridge av., Phila.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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

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

Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The larger sizes have a range of over two miles. These arms are indispensable in modern warfare.

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

Damper Regulators and Gage Cocks—For the best, address Murrill & Keizer, Baltimore, Md.



W. H. H. will find a recipe for blackboard composition on p. 299, vol. 23.—M. W. S. will find a description of phosphor bronze on p. 327, vol. 29.—A. G. can soften lead by melting a little tallow with it.—P. A. B. will find the proportions of an astronomical telescope on p. 279, vol. 27.—J. W.'s explanation of the creeping rail difficulty seems to be a correct one.—C. P. H. should refer to our prospectus on p. 410 of this issue, under "Copies of Patents."

S. W. G. asks: 1. In order to turn the face of a circle arm pulley smooth, which side should run towards the tool, the rounding or hollowing side of arm? 2. Which is the proper side to run a circle arm pulley on a shaft, to make it stand the most work? A. 1. The rounding side. 2. In the other direction.

B. C. says: I wish to experiment in making a glass composition, and I do not know in what way to construct a furnace to hold three or five barrels of material. I want a draft that will cause sufficient white heat, and that will allow access to the material in the crucible. If possible, I should wish to draw off the melted composition by means of a sluice gate. 2. What material should I use for the pot or crucible? A. In the manufacture of glass, fire clay crucibles are used, placed in a reverberatory furnace. The glass is generally removed by the workmen in small quantities at a time, adhering to iron rods which are thrust into the crucibles.

J. B. asks: Of what kind of wood should a vat to hold silver solution be made? What should it be covered with inside, asphaltum or paraffin? 2. What kind of a vat is required for nickel solution? I have tried to dissolve nickel with strong oil of vitriol and water. One pint of vitriol with water has only dissolved 1 ounce nickel in 14 days, and that lies at the bottom in powder and not in crystals. A. 1. The trough is generally made of pine, and coated with asphaltum, applied so hot that it will run freely. 2. You will find instructions in regard to nickel plating, on page 356, current volume.

H. C. D. says: Observation has led me to believe that the earth in its yearly motion does not go around the sun. I notice that the earth's terminal points of motion are about December 21 and June 21. The books on astronomy teach that "if the earth is in any point of its orbit, the sun will always seem in the opposite point in the heavens. When the earth moves one degree to the west, the sun seems to move the same distance to the east." Now the sun's apparent terminal points of motion are southeast and northeast, and the real terminal points of the earth's motion are southwest and northwest. What is your opinion? A. The earth's orbital motion could not be arrested or its direction changed without vaporizing it by the conversion of motion into heat. Observations similar to your own were doubtless made by the Druids, who erected Stonehenge, a circular assemblage of stones, representing the year. When it was perfect, the sun probably rose from the top of certain altar stones at the solstices and the equinoxes, to a person in a certain position.

L. asks: What is the size of the largest gun yet made in the United States? A. The largest gun made in this country has a bore of 30 inches, and its solid shot weighs about 1000 lbs.

A. B. C. asks: 1. Can a main belt work on the balance wheel of an engine? 2. What kind of belt is best? A. 1. Yes. 2. Any kind of a belt, flat, round, or angular, will answer, if the balance wheel is constructed with reference thereto.

J. N. Q. asks: What is soft iron, used in the construction of an electromagnet? If I want to make an electromagnet out of a bar of soft iron one foot long, does it matter whether it is round, or square, or what shape it is? Does it make any difference how large the bar is, whether the size of No. 16 wire, or an inch in diameter, or any other size? A. We believe Russian iron is the best for this purpose. The bar may be round or square. The size of the bar has a strong influence on the power of the magnet. The magnetism of cylinders of iron of equal length, magnetized by currents of the same force, and having the same number of windings surrounding the core closely, is proportionate to the square roots of the diameters of the cylinder.

E. A. N. asks: How can I soften chilled castings of iron? A. We know of no better plan than to place the castings, surrounded by saw dust, in an iron box, close it up with clay to exclude the air, and subject it to a red heat for several hours. The castings must be cold before they are withdrawn.

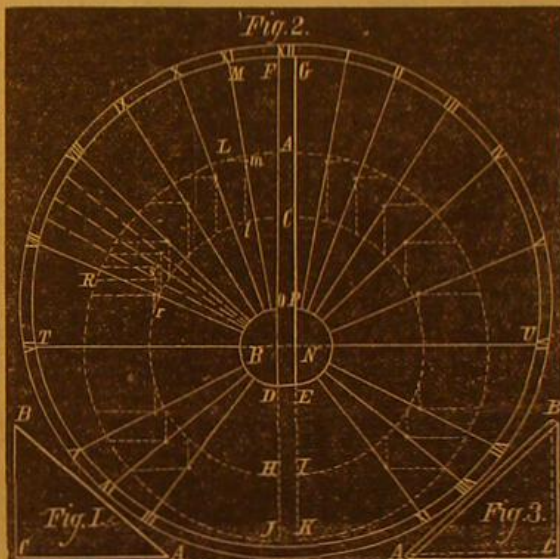
C. H. M. asks: 1. Where was the Great Eastern built? 2. What is metalline? A. 1. The Great Eastern was built at the works of John Scott Russell & Co., Millwall, London. 2. We believe the composition of metalline is kept secret by the manufacturers. It is a pressed compound of which plumbago is the base.

E. E. P. says: I run a boiler which carries 55 lbs. steam; I have been using water heated to 125° Fah. What would be the saving in fuel should I use water heated to 210° or 212° Fah? A. In case all the other conditions were the same, the saving would be as follows: With water heated to 200°—about 7 per cent., to 212°—about 8 per cent.

W. R. says: 1. I have a pistol which I load with powder and ball. I notice that, after firing, the barrel looks as though it had been painted inside with red paint. After a short time, the red color disappears. The powder is the same as I use in a gun without any such appearance. Where does the red come from? 2. How can I remove the bark from a stick to use for a cane without injuring the wood? 3. Would it be likely to crack in seasoning? A. 1. It may be that the red oxide, which is readily decomposed by heat, is formed. 2. The bark can be removed when the stick is green, or afterwards, by steaming or heating it. 3. It should be seasoned slowly to avoid liability to crack.

W. F. H. asks: How can I get the numbers of concave spectacles in the most practical manner? I can get the convex ones correctly by measuring. A. We believe that double concave glasses are numbered in accordance with their radii of curvature. For instance, No. 6 glasses have a radius of curvature of 6 inches.

A. P. asks: Can you tell me how to draw the lines of a horizontal sun dial? A. Draw a triangle A B C, Fig. 1, having the angle B A C, equal to the latitude of the place in which the dial is to be used. This angle may be laid off by the aid of a protractor, by a table of chords, or by the calculation of the sine and cosine. In our example, we have the angle B A C, Fig. 1, 40° 45' 54", which is the latitude of New York city. From a table of sines and cosines, we find that sine of 40° 45' 54" = .663497. Cosine of 40° 45' 54" = .747791. Hence, in Fig. 1, make B C = .663497, and A C = .747791, on any convenient scale, and join the points A and B by a straight line. B A C will then be the required angle. Next, to construct the hour lines on the dial, draw two parallel lines J F, K G, Fig. 2, at a distance apart equal to the thickness of the style, Fig. 3. Draw a line, T U, perpendicular to these parallels, and mark the points of intersection, B and N. This will be the six o'clock line. From B as a center, draw two semicircles, with radii equal to A B and B C, Fig. 1. Divide each of these semicircles into twelve equal parts. Then from each point of division in the outer semicircle, draw a line parallel to T U, and from each point of the inner semicircle draw a line parallel to J F. The intersections of lines drawn from corresponding points of outer and inner semicircles give points of the hour lines. The hour lines can then be drawn through these points and the center B. To illustrate the construction, from the point L, of the outer semicircle, draw L m, parallel to T U. From l, the corresponding point of the inner semicircle, draw l m, parallel to J F. Then m, the point of intersection of the two lines, is a point of the eleven o'clock hour line, and this line may be drawn through B and m. To find the quarter hour lines, divide the outer and inner semicircles into four equal parts, between consecutive hour lines. Then draw construction lines, as before from points on the two semicircles, and their intersections will give points of the quarter hour lines, which are to be drawn through the center, B. The construction of these quarter hour lines is shown between the hour lines of VII and VIII. In this way, all the morning hour lines can be constructed. The afternoon hour lines are found in a similar manner, except that they radiate from the center, N, and the semicircles, used in construction, are drawn from the same point as a center. It is not necessary to lay off all the hour lines, but only enough to contain all the hours of the day between



earliest sunrise and latest sunset, in the latitude for which the dial is constructed. The style, Fig. 3, should be made so as to have the angle B A C, equal to the latitude of the place. The base of the style should cover the space B N F G. The dial should be carefully levelled and placed so that B N points to the south, and F G to the north. To lay off a north and south line, draw several circles on a board, and place a light rod at the center, perpendicular to the plane of the board. Place the board in a level position, so that a shadow will be cast by the sun from the board. During the morning, mark the points where the shadow just reaches each of the circles, and mark the same points in the afternoon. Then bisect each of the arcs between the points marked in morning and afternoon, and the average direction of a line joining the centers of the circles and the points of bisection will be north and south. This construction, while not strictly accurate, is sufficiently correct, if carefully made. The time given by the dial must be corrected by the equation of time, which may be found in nearly any almanac. It will be observed that the hour lines around noon are closer together than those further removed on either side. For this reason, it is usual to place the center of the dial at a little distance from the center of the hour lines, so as to give greater divergence of the hour lines around noon.

L. P. asks: 1. Is the link a cut-off, or does it wire-draw the steam by shortening the stroke of the valve? It closes the valve sooner or later just equal to what the lead varies, but does it do any more? 2. I am running a propeller 37x30 inches stroke, pressure 40 lbs., vacuum 15 inches, making 50 revolutions, cutting off at about one half stroke. The boilers have 2,500 feet heating surface, the surface condenser, about 600 feet cooling surface. The valve takes steam in the center and exhausts on the outside. It has 1 1/2 inches lap on the steam side, one thirty-second inch lap on exhaust side. The valve is set where the engine does its work, with seven sixteenths inch lead, mid-stroke lead one half inch, exhaust lead two and five thirty-seconds inches. The eccentrics are cast solid, and are therefore unalterable. The link is what, I presume, is called an open one, the eccentric rods being outside of the block, connecting to the valve directly, without any rock shaft. The eccentrics have 9 inches throw; but as I use it, only 5 inches throw. I get a better vacuum when well linked up, with the throttle wide open than any other way. Exhaust opens on the up stroke 7 1/2 inches from end of stroke, and five inches from end on the down stroke. I think this is wrong, and the remedy I propose is to bore out the eccentrics on one side and put in a bushing, or piece out the valve, or close up the ports. Piecing out would make the exhaust close sooner. By crossing the eccentric rods, I should get one half inch lap instead of seven sixteenths inch lead, taking steam just as the crank pin passes the center line, cutting off and exhausting later. What would be the effect on the engine's running smoothly, and would it take more sweep of the link to handle her? What would be the effect on the vacuum, and what would a diagram of each way look like? 3. What range of stroke and pressure has a good indicator? 4. The condenser has upright composition tubes 40 inches long x 1/2 inch diameter, and weighing 15

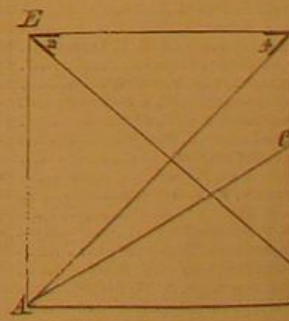
ounces, taking water at the bottom and delivering on top, but to one side. The temperature of injection is 90°, and of discharge 100°, of hot well 160°. The circulating pump is 8 x 5 inches stroke, air pump 10 x 5 inches stroke, double acting, both making 120 revolutions. How can I increase the vacuum? How do you get the amount of water for a surface condenser? For a jet, Bourne gives about 29 times the amount contained in the steam. The timing on the tubes seems to be cut away and small pin holes come. Is it the exhaust or the oil used? 5. How can I make the cut edge of belting (rubber) like the new edge? 6. How would hard wood, set in brass, do for foot and delivery valves, to work at a temperature of 160°? 7. What is the best method in the care of boilers with composition tubes? Is it not as well to feed a little salt water and blow off occasionally as to feed lime? What amount of lime is used per cubic foot of water evaporated? 8. What is the specific gravity of carbonic acid compared with fresh water? 9. Can a person prevent another from using a patent article, if he has used the same thing a number of years before the article was patented? A. 1. You have the right idea of the action of the link. 2. Probably you can secure a better action by adding lap to the exhaust side of the valve. Engines ordinarily require some cushion, whether high or low pressure. We scarcely think an alteration of the valve would affect much change in the vacuum. 3. Indicators are adapted to all strokes and steam pressures that occur in practice. 4. The trouble with your condenser seems to be that it is too small. The tubes are probably injured by some impurity in the oil. They are timed by immersion in a tin bath. Theoretically, the amount of water required for a surface condenser can readily be calculated, and then it is customary to allow from one half to twice as much. For example, we will suppose that your engine cuts off at half stroke. Then in every revolution it uses a cylinder full of steam at 40 lbs. pressure. The capacity of the cylinder, adding 10 per cent for clearance, is about 29.5 cubic feet, so that in every revolution 29.5 x 0.1344 = 3.95 pounds of steam are used. Steam at this pressure has a total heat of 1201.5° Fah. The steam, when condensed, has a temperature of 160°, so that it has lost 1201.5° - 160° = 1041.5°, which it has imparted to the condensing water, raising the temperature of the latter 100° - 50° = 50°. Hence, in this case, if all the injection water is equally effective in condensing the steam, we shall require 1041.5 ÷ 50 = 20.83 times as much injection water as the amount contained in the steam, or 3.95 x 20.83 = 82.11 lbs. of injection water for each revolution of the engine. The circulating pump ought to be capable of delivering at least half as much more. 5. We do not think you can do it. Perhaps applying a hot iron to the edge might have a good effect. 6. The arrangement might answer. If the wood were placed endwise of the grain. 7. We know nothing of the action of lime, but do not think that, in ordinary cases, it will make any scale. Probably the best plan will be to make a slight scale in the boiler by the use of salt water. 8. About 0.00157. 9. We think you can use your arrangement, but cannot apply the improvements made by another party without first obtaining his consent.

E. L. E. says: I have a 12 inch cog wheel, gearing into a 3 inch. A crank is placed (1) on the 12 inch wheel, so as to give 5 inches leverage, or (2) so as to get 13 inches leverage, or (3) on center of 3 inch wheel. What proportions have these three powers? A. Disregarding friction, the resistance that could be overcome at the circumference of the small wheel, would be as follows: 1. 3 1/2 times; 2. 8 1/2 times, and 3. 6 times the power applied to the crank.

J. H. asks: 1. What would be the loss of steam by having a throttle valve 25 feet from engine, with a pipe of 1 1/2 inches inside diameter, well covered? The engine is of 10 horse power, working at 100 lbs. pressure to the square inch. 2. Were the guns on the first monitor set opposite each other, or were they set so as to fire in the same direction, having separate ports? 3. Are the guns arranged on all monitors as on the first one built? A. 1. Probably there would be no appreciable loss, under the circumstances mentioned. 2 and 3. The guns on all the monitors were arranged so that both pointed in the same direction.

P. says: I have a small printing press, which is run by a treadle. I want to know if it could be run by a weight, which could have a drop of forty or fifty feet. How heavy should such weight be? A. If it requires the power of a man to drive your press, then you will need a weight equal to one fifth of 33,000 lbs., or 6,600 lbs., raised 50 feet. This ought to drive your press 50 minutes nearly, if attached by rope and drum to your shaft.

A. M. B. says, in reply to E. R. G.'s question as to how to get the miter at the intersection of a raking with a level molding: Of course he is aware that the raking molding is of a different size and shape from the level. Draw a square of any size, and the line A B at the pitch of the cornice. Take A for a center, and C for a radius, and cut at D. Join E D, and in the angle 2



is the cut across the box; the angle 3 is for the side of box, the angle 4 is of course the miter for the level molding.

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

J. W. T.—Your specimen is iron pyrites, a combination of sulphur and iron. It is used for the manufacture of oil of vitriol, and also for coppers or sulphate of iron. For the latter purpose, the ore is piled in heaps and, after roasting, is kept moistened with water. By this treatment, and the action of the oxygen of the air, the sulphur becomes oxidized to sulphuric acid, which combines with the oxide of iron, also produced, forming coppers, which is leached out with water, concentrated, and crystallized. Your grindstone material might prove of value, if its transportation to market be not too expensive.

COMMUNICATIONS RECEIVED.

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

- On a Square Acre. By J. H. M.
- On Patent Cases in the Courts. By J.
- On Cheap Telescopes. By S. M. B.
- On Pisciculture. By J. A. M.
- On Friction Pulleys. By B. N. C.
- On Trisecting an Angle. By J. S. A.
- On the Parabolic Mirror. By J. L.
- On Reduction of Copper Ores. By F. C.
- On Transfusion of Blood. By W. A. G.
- On Rheumatism. By J. P.

Also enquiries from the following:

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

[OFFICIAL.]

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WERE GRANTED IN THE WEEK ENDING

November 25, 1873,

AND EACH BEARING THAT DATE.

(Those marked (r) are renewed patents.)

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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:

- 27,297.—RAILROAD CAR COUCH.—E. C. Knight. Feb. 11.
- 27,293.—FASTENING SAW HANDLES.—J. Neimyer. Feb. 11.

EXTENSIONS GRANTED.

- 26,281.—WATER CLOSET BAKEN.—W. Boeh, Sr.
- 26,282.—JOURNAL BOX.—W. M. Ferry, Jr.
- 26,278.—INDIA RUBBER HOSE.—T. J. Mayall.
- 26,281.—METAL CASTING MOLD.—J. P. Broadmeadow.
- 26,277.—NURSING BOTTLE.—F. J. La Ferme.
- 26,279.—BOOT TIP.—N. Silverthorn.

DESIGNS PATENTED.

- 7,002.—KNIFE HANDLE.—J. D. Fray, New Britain, Conn.
- 7,003.—INKSTAND.—G. W. McGill, New York city.
- 7,004.—ORNAMENTAL MAT.—L. Moslein, New York city.

TRADE MARKS REGISTERED.

- 1,537.—EMERY.—Abbott & Howard, Boston, Mass.
- 1,538.—GUANO.—GROSHANS GUANO CO., Petersburg, Va.
- 1,539.—FLOW.—Hunter & Co., Fredericksburg, Va.
- 1,540.—PERFUMERY, ETC.—Felix Prot & Co., Paris, France.
- 1,541.—CHARRS.—T. B. Slingerland, Rome, N. Y.
- 1,542.—CHARRS, ETC.—Consolidated Tobacco Co., Glroy, Cal.
- 1,543.—TEAS, ETC.—Great Eastern Tea Co., Terre Haute, Ind.
- 1,544.—ORGANS.—G. Woods & Co., Cambridgeport, Mass.

SCHEDULE OF PATENT FEES.

On each Caveat.....	\$10
On each Trade Mark.....	\$25
On filing each application for a Patent (37 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 (34 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA FROM NOVEMBER 25 TO DECEMBER 5, 1873.

- 2,884.—T. W. Perry, Ringwood village, York county, Ontario. Composition of matter for a table sauce, called "Perry's Indian Chutney Sauce." Nov. 25, 1873.
- 2,885.—I. K. Proctor, Salem, Essex county, Mass., U. S., assignee of J. K. Proctor, Malden, Middlesex county, Mass., U. S. Improvement for sewing machine tables or stands, etc., called "Proctor's Caster Attachment for Sewing Machine Table, etc." Nov. 25, 1873.
- 2,886.—D. Saul, New Edinburgh, Carleton county, Ontario. Improvement in hoisting machine, called "Saul's Improved Hoisting Machine." Nov. 25, 1873.
- 2,887.—W. M. Rice and A. D. Cable, Montreal, P. Q. Improvement in laying the permanent way of railways, called "Rice's Cushioned Rail." Nov. 25, 1873.
- 2,888.—T. Paxton, Wm. Tate and C. Paxton, Fort Perry, Ontario county, Ontario, assignees of Wm. Dunn, same place. Machine for attaching to or connecting with gang plows, called "Dunn's Improvement on Gang Plows." Nov. 25, 1873.
- 2,889.—J. C. Schoonmaker, Kansas City, Jackson county, Mo., U. S. Improvement on lightning rods, called "Schoonmaker's Insurance Lightning Rod." Nov. 25, 1873.
- 2,890.—W. W. Weaver, New Haven, Oswego county, N. Y., U. S. Improvement on turbine wheels, called "Weaver's Volute Chute Turbine." Nov. 25, 1873.
- 2,891.—J. G. Loggins and T. P. Wilkins, Williston, Chitenden county, Vt., U. S. Improvement on machine for cutting the notch in wooden hoops for barrels, etc., called "The Hoop Locker." Nov. 25, 1873.
- 2,892.—C. Campbell, Montreal, P. Q., and J. A. Laemie, Staten Island, U. S. Improvement on printer's furniture, called "Campbell's Improved Printer's Furniture." Nov. 25, 1873.
- 2,893.—Honorable H. Aylmer, Melbourne, District of St. Francis, P. Q. Improvement on machine for cutting clappboards, called "Aylmer's Clappboard Machine." Nov. 25, 1873.
- 2,894.—G. Boucher de Boucherville, P. Q. *Nouvelles manieres de se servir des lames pour propulser le navire, "Lame Moteur."* Nov. 25, 1873. Improvement in "new paddles for propelling vessels."
- 2,895.—J. C. Livermore, Boston, U. S. Improvement on skirt protectors, called "The Oracoline or Dayton Skirt Protector." Nov. 25, 1873.
- 2,896.—H. Parker, Gananoque, Leeds county, Ontario. Improvement in the art or process of molding cores and mold employed for casting the cores by such improved process, called "Parker's Improved Process and Mold for Casting Cores." Nov. 25, 1873.
- 2,897.—J. P. Bass, Bangor, Penobscot, Me., U. S., assignee of H. C. Bucknam, Bangor, Hancock county, Me., U. S. Improvement on the process or method of cleaning surface condensers, called "Bucknam's Process for Cleaning Surface Condensers." Nov. 25, 1873.
- 2,898.—F. H. Perry, Drummondville, Welland county, Ontario. Machine for washing textile fabrics, called "Perry's Hydraulic Washer." Nov. 25, 1873.
- 2,899.—Wm. C. Sillar, No. 1 St. Swithin's Lane, London, Eng., R. G. Sillar, Lee, Kent county, Eng., and C. Rawson, No. 1 St. Swithin's Lane, London, Eng. Improvement on geodolizing, purifying and utilizing sewage, night soil, excreta and excrementitious and refuse matters, called "The Native Guano Company's Improvement on Geodolizing, Purifying and Utilizing Sewage, Urine, Night Soil, Excreta and Excrementitious and Refuse Matters." Dec. 5, 1873.
- 2,900.—S. Standish, Eureka, Lander county, Nevada, U. S. Improvement on brooms, called "Standish's Broom." Dec. 5, 1873.
- 2,901.—C. Stoner, Montreal, P. Q., assignee of I. Fisher, Boston, Mass., U. S. Improvement on mechanism for lighting gas burners, called "Fisher's Automatic Gas Lighter." Dec. 5, 1873.
- 2,902.—E. Moncau, San Francisco, Cal., U. S. Improvement on sewing machine, chiefly designed for embroidering and stitching button holes, called "The Eureka Button Hole Sewing Machine." Dec. 5, 1873.
- 2,903.—T. Baty, Westminster township, Middlesex county, Ontario. Useful fence, called "Baty's Farm Fence." Dec. 5, 1873.
- 2,904.—I. Fréchet, St. Hyacinthe, P. Q. *Améliorations aux râteaux de moissonneuse, called "Râteaux de Moissonneuses Améliorées."* Dec. 5, 1873. Improvement on rakes for mowing machines.
- 2,905.—D. Heaton, Providence, R. I., U. S. Improvement in combination tools, called "The Imp." Dec. 5, 1873.
- 2,906.—F. Rogers, Lynn, Essex county, Mass., U. S. Improvement on the manufacture of shoes, called "Rogers' Improved Shoe." Dec. 5, 1873.
- 2,907.—J. L. and D. H. Coles, New York city, U. S. Im-

- provements on sewing machines, called "Cole's Universal Feed Sewing Machine." Dec. 5, 1873.
- 2,908.—J. Miller, Perth, Lanark county, Ontario. Improvement on sewing machines, called "The Miller Sewing Machine." Dec. 5, 1873.
- 2,909.—J. H. Copping, Toronto, Ontario. Improvement on a machine for the rolling, printing and cutting of lozenges, called "Copping's Improvements on Lozenge machine." Dec. 5, 1873.
- 2,910.—H. J. Davies, Brooklyn, Kings county, N. Y., U. S. Improvements on machines for printing and embossing skirts and other articles, called "Davies' Machine for Printing and Embossing Skirts." Dec. 5, 1873.
- 2,911.—H. F. Knapp, New York, U. S. Improvements on means for raising and floating wrecks and sunken vessels, called "Knapp's Improved Means for Raising and Floating Wrecks." Dec. 5, 1873.
- 2,912.—J. Varney, Montreal. Improvement on washing machine, called "Varney's Washing Machine." Dec. 5, 1873.
- 2,913.—D. S. McKinnon, Carleton Place, Lanark county Ont. Improvement in sewing machine stands and covers, called "Mack's Sewing Machine Stand." Dec. 5, 1873.
- 2,914.—P. D. Cummings, M. Smith and J. C. Jordan, all of Portland, Maine, U. S. Improvement in match slitting machine, called "Cummings, Smith and Jordan's Match Slitting Machine." Dec. 5, 1873.
- 2,915.—T. A. Heintzmann, Toronto, Ont. Improvement on pianofortes, called "Heintzmann's Improved Bridge." Dec. 5, 1873.
- 2,916.—W. M. Fuller, New York, U. S. Improvement on heating apparatus, called "Fuller's Improved Heating Apparatus." Dec. 5, 1873.
- 2,917.—M. Thibault, Hull, Ottawa county, P. Q., and S. Benoit, of Ottawa, Carleton county, Ont. Improvement on machine for cutting nails, called "Thibault's Improved Nail Cutter." Dec. 5, 1873.
- 2,918.—D. M. Lamb, Strathroy, Middlesex county, Ont. Improvement on filters for oil and other liquids, called "Lamb's Combined Oil Filter." Dec. 5, 1873.
- 2,919.—D. M. Lamb, Strathroy, Middlesex county, Ont. Manufacturing and treating vulcanizable gum and hydrocarbon oils, called "Lamb's Gum and Oil Process." Dec. 5, 1873.
- 2,920.—D. M. Lamb, Strathroy, Middlesex county, Ont. Compound vulcanizable gum, called "Lamb's Vulcanizable Waterproof Gum

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PATENTS

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