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SCIENTIFIC AMERICAN

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IMPROVED HORIZONTAL TESTING MACHINE.

We illustrated in a former number one application of Riehle's method to testing the strength of metals, rope, etc. Our present engraving refers to a novel device on the same principle, which, however, in addition to other advantages, allows of experiments being made not only upon small fragments of material, but on pieces of considerable length.

The machine represented is of 75 tons capacity. At one end, enclosed in an iron frame, is a heavy intermediate lever, the upper fulcrum of which bears against a plain steel surface composing a part of the iron frame, accurately and firmly inserted. The lower fulcrum presses against the clevis that connects directly with the tools that hold one end of the test specimens. This intermediate lever is suspended

multiplication of leverages, causing so much to depend upon mere calculation, is dispensed with. Instead of a number of fulcrums, two main fulcrums bear the whole strain, and these being made in certain lengths, according to a regular rule, obviate any danger of the crumbling of fine bearing points.

For further particulars address Riehle Brothers, No. 93 Liberty street, New York city, or Ninth street, below Coates, Philadelphia, Pa.

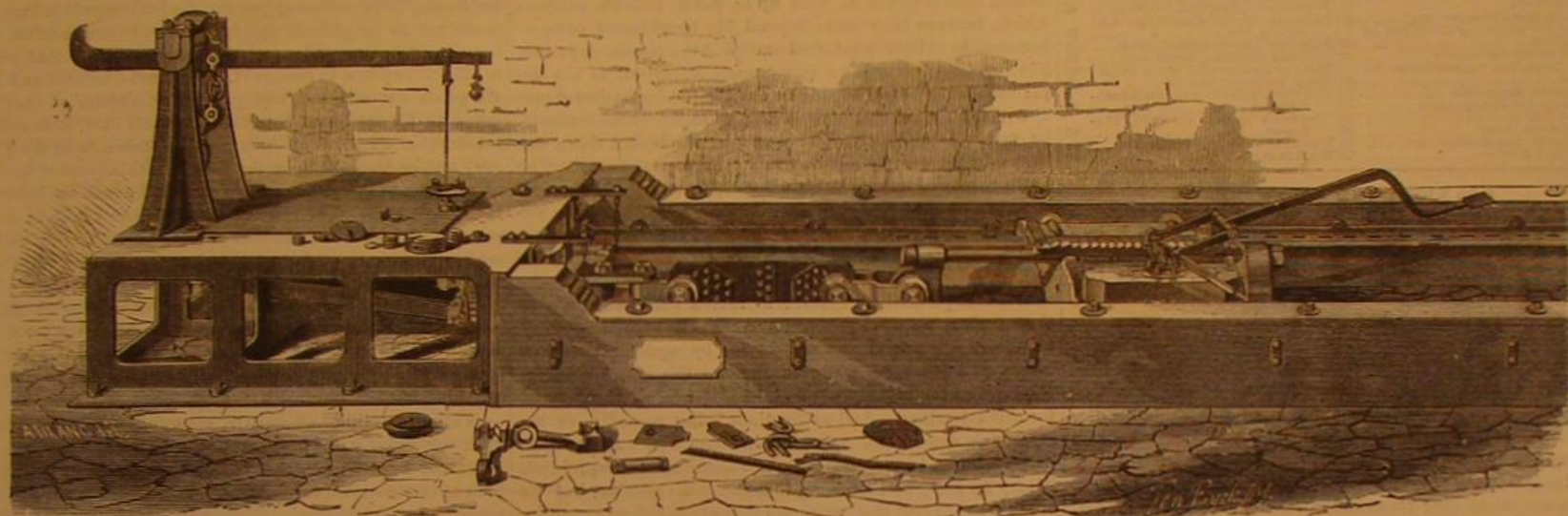
A New Language for Japan.

M. Mori, the Japanese *chargé d'affaires*, has written a remarkable letter to Professor Whitney, the distinguished orientalist at Yale College, in which he states that the pres-

ented with transverse grooves, which form a bearing surface, the circular object held therein having its center in line with them. C is a plate pivoted to the jaw, A, and its opposite end rests on an offset on the stationary jaw. The circular bolt held in the vise will therefore be supported as indicated by the dotted lines at three points, the grooves and the upper edge of the plate, C. These parts maintain the same relative position to whatever extent the jaws are separated, the free end of the plate, C, dropping as the jaws recede, and *vice versa*, thus lowering or raising its upper edge in proportion to the separation of the jaws.

Deacon's Chlorine Process.

It is well known that, by Deacon's process (described on



RIEHLE'S HORIZONTAL TESTING MACHINE.

at the larger end by clevises that swing from the iron frame, and at the smaller end from a compound parallel crane beam, that rests upon pedestals. Upon this parallel beam is an ordinary weight dish upon which U. S. standard weights are placed to weigh the strain that the test piece is being subjected to; one pound on the weight dish indicates a strain of one thousand pounds on the test specimen. At the other end of the machine is a hydraulic jack and pump, which are placed upon low, strong wheels and run along a railway; they are stopped at any desired point, by means of keys dropped into slots about 10 inches apart in the railway; this is in order to accommodate the length of the test piece, which might be but a few inches, and can be a hundred feet long or more. The power is applied merely to take up the slack, but the strain is weighed and even broken by the weights being placed upon the weight dish on the crane beam, which must be kept parallel by the use of the power and weights together. The equipoise of the beam is indicated by means of a finger point that must vibrate freely when the proper weight is applied. This is clearly shown in the engraving, between the pedestals. When the test piece is in position, the lever and beam must be balanced by means of the balance cup hanging from the extreme end of the parallel beam. All the bearings and fulcrums are steel, made very strong and true, and as each part swings perfectly plumb, there is no friction, so that a strain upon a specimen can be weighed to within a few pounds. The operation of the jack and pump is as follows: The handle of the pump being operated, the plunger of the jack is forced out horizontally, and is connected with the tools that are fastened to a cross head by means of two bolts. In order to get the plunger back again, a lever is raised which catches in a ratchet, and which, when pressed down, forces the latter back again; this operation also sends the fluid back from the jack into the pump reservoir. The iron frame and the timbers that support the iron guides are all firmly secured to a foundation of masonry.

The machine represented in the illustration, which is straining a piece of double riveted boiler plate, was built for the purpose of testing chain, wire, and hemp ropes, also bridge bolts and boiler plate, and is ninety feet long when put up for use. The construction of the device embodies certain principles, that can be modified indefinitely and adjusted to apply any desired strain, to any material, in any shape or form—including the crushing resistance of iron or stone columns, transverse strain of girders, and torsional strain.

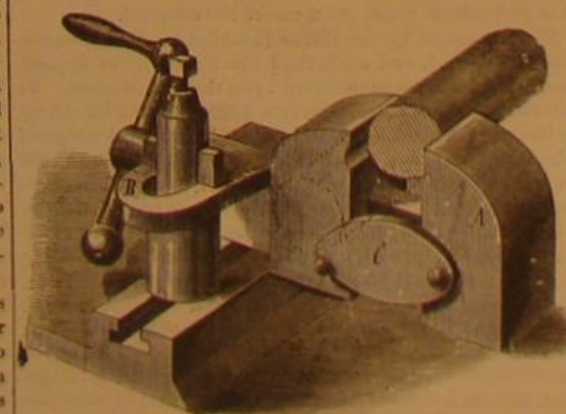
The principal merit of this apparatus, in addition to its evident compactness and strength, is its simplicity. It will be noticed that, by using the parallel crane beam and a single counting or multiplying lever, any elaborate construction or

ent language of Japan is inadequate; and that it is the opinion of the best educated men and most profound thinkers of that country that, in order for their nation to keep pace with the age, some copious, expensible European language must be adopted, which must be taught in the schools and gradually made the common vernacular. The present Japanese dialect is merely a spoken one, having little or no relation to the written language, which is a corruption of the Chinese.

The English language, the writer states, would be adopted in preference to another tongue, were it not for its many irregularities and the absence of law, rule, or order in its orthography. Mr. Mori's idea is to invent a new language or, rather, a modification of an old one. In other words, he proposes to compile spelling books, dictionaries, grammars, and other text books teaching what may be termed "simplified English." The forms "spoked, bited, thinned, buyed, comed, beared," will be substituted for the commonly received preterites and participles, and all plurals will be made regular. Spelling will be reduced to a purely phonetic basis, and in fact the entire language will be recast.

LATHE VISE.

Mr. J. B. Low, of Ravenna, Ohio, has patented the accompanying convenient form of lathe vise, which may be used



in connection with the lathe tool carriage, either as a rest for bolts while cutting threads upon them, or as a holder for drills and other lathe tools in ordinary use. It also provides a rest for the bolts while they are held by the instrument, which will adjust itself to the varying diameters.

The vise is of ordinary construction, A being the movable jaw. The slotted lug, B, on the stationary jaw holds the tool post, as shown. The inner sides of the jaws are

page 73 of our volume XXVII.), chlorine is made directly from muriatic acid, without the intervention of manganese dioxide. It is justly regarded as one of the most important technical improvements of modern times. At a recent meeting of the Leipsic Polytechnic Club, the subject came up for discussion, and some interesting facts were elicited. Dr. Gruneberg remarked that much depended upon keeping the temperature of the furnace constantly at 700° Fah., and this point was carefully observed by the inventor. It was also found necessary to dry the chlorine to insure a high grade of bleaching powders. This was accomplished in some factories by using chloride of calcium, and in others by substituting sulphuric acid. Deacon's process was highly prized in England for economical and sanitary reasons—the escape of muriatic and chlorine vapors into the air was avoided, and the costly black oxide of manganese was dispensed with. The great cost attending an entire change in the construction of the manufactories of bleaching powders has stood in the way of a general introduction of the process into Germany. All of the old chlorine retorts are useless, and the floors for the lime must have ten times as much surface, owing to the dilute condition of the chlorine. In England, however, many establishments have adopted the new method, and it appears likely to supersede all others. Dr. Hurter was mentioned as the chemist who had studied the chemical reactions of the process, and he had been of great assistance to Deacon. It was stated by Dr. Glaser that there was a larger consumption of fuel in Deacon's process; but, as the costly manganese falls out, this objection was considered as overruled.

Detection of Small Quantities of Titanium.

For the detection of small quantities of titanium, Mr. Apjohn recommends to fuse 12 grammes of the finely pulverized mineral with six times its weight of acid sulphite of potash, until all of the free sulphuric acid is expelled. Pulverize the cold mass, exhaust with water and boil the highly diluted aqueous solution in sulphite of soda. As soon as the precipitation is complete, allow the liquor to cool and pass a little sulphurous acid through it to dissolve any small traces of iron or aluminum that may have been thrown down by the previous operations. The precipitate of titanic acid thus obtained can serve for the preparation of any of the salts of titanium. It is an interesting fact that titanic acid readily absorbs nitrogen, and upon this property Du Motay has founded a method of making ammonia directly from the air.

The Territory of Oklahoma.

A bill is now before Congress for the organization of a new territory, under the above name, out of lands now pertaining to the Indian territory.

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GAS LIGHT AND STEAM HEAT.

The question of heating our buildings by steam is now about in the same condition as was the question of lighting our dwellings by gas fifty years ago. It is true that gas is the safest kind of light, much safer than any kind of lamp, whether kerosene or oil, and even more safe than candles, which, when left burning in a corner and forgotten, have often been the cause of fire. Notwithstanding this, there were, at the time mentioned, scores of people raising their voices against the introduction of gas in our cities and houses; they declared that we should not be safe against fires for a single moment, that such combustible material as gas in the pipes under our floors, connected with large reservoirs containing thousands of cubic feet of the inflammable stuff, was worse than a gunpowder magazine; that a city possessing gas works was subject to the risk of blowing up at any moment, that a house using gas was especially unsafe, and that insurance companies would not or could not insure such a building; and a few single instances of accidents caused by the careless or ignorant use of gas were pointed out as proofs of the soundness of the fears of the alarmists.

We have now exactly the same kind of alarmists among us, who, notwithstanding that heating buildings by steam is the most safe of all methods, far surpassing the hot air furnaces and infinitely safer than having a separate fire in each room, raise their voices against steam heat, and attribute every fire, taking place in a locality where steam is used, not to the fire in the furnace, or any other cause, but to the steam, making the pipes red hot and so igniting the wood work in the neighborhood of these pipes. In order to sustain this theory, they have taken refuge in the fact that when steam has been very highly superheated, that is, passed through an extensive superheating apparatus (which essentially consists of a series of pipes, laying in an actively burning furnace) and thus raised in temperature to a bright red or white heat, it may, under certain circumstances, heat the tubes through which it afterward passes to such a temperature that the pipes become dangerous to woodwork. They overlook the fact that, in none of the boilers used to heat buildings, do the conditions necessary to superheat the steam exist to such a degree as to become dangerous; while in the great majority of boilers the steam is not superheated at all.

In expressing our opinion, as we have repeatedly done, in regard to the impossibility of igniting wood by steam, we of course had only in view the practical side of the question, the existing boilers in actual use for heating buildings, and not steam proceeding from extensive red hot coils passing through furnaces, and, for instance, used for distilling or heating substances to temperatures far above that of the steam found under all other circumstances. If those who appear so convinced of the ease with which steam will heat iron pipes, to such a degree as would become dangerous for wood work, would take the trouble to try what they can themselves accomplish in this line, they would (in case they have no other object in view than to know the truth in this matter) soon become convinced that it is not so easy to get the temperature up to the required degree, that alleged results are highly exaggerated, and that the formation of superheated steam with the fires banked or withdrawn is a gross illusion without any foundation in fact. Banked fires are themselves a source of danger, as by shutting off the draft and access of air, there may be a greater amount of combustible gases generated than the accessible air can consume; this imperfect combustion gives rise to a mixture of two gases, some unburnt hydrocarbons, and imperfectly burned carbonic oxide, in place of carbonic acid, to which the gas burns under free access of sufficient air. When such gas, by reason of hav-

ing the draft shut off, passes out of the furnace doors into the boiler room or engine room, it will be ignited by the fire itself, or by being hot enough to burn when coming in contact with air, in the same way as we often see by night the flames flaring out of the tops of the smoke stacks of our river steamers, and as is often observed in our furnaces and cooking stoves when suddenly opening the doors; some of the latter have been improved in this respect by holes admitting air over the fire, and are thus called gas-consuming stoves.

We hold that it is much more probable that Barnum's museum took fire from such a cause than that, according to the Fire Marshal's theory, the banked up fires made the pipes in the upper part of the furnace hotter than the fire did when the full draft caused an active combustion.

ENTOMOLOGY IN CONGRESS.

Our legislators in the House of Representatives have placed on record a very amusing debate over the question of increasing the appropriation for the Department of Agriculture for the coming year. The argument took place during the discussion of the Legislative Appropriation Bill, and the opportunity was seized by several members to explain at length what they did, or, more correctly, what they did not know on the subject of scientific agriculture. For Mr. S. S. Cox, of New York, was reserved the distinction of delivering an effusion which deserves a prominent place in the comic literature of the country. With a narrow mindedness which we would fain believe did not arise from ignorance, the gentleman took occasion to hold up to public ridicule subjects which, because they were beyond his faculties of comprehension, he evidently inferred exceeded the reasoning powers of every one else. After humorously adverting to the department in general, he singles out the entomological report as a target for his wit. "God help us to a faithful lexicon," he rather irreverently observes, and then brings down the House by facetiously alluding to a "bureau of bugs." The Latin names of insects he quotes *ad libitum*, and, because he is unaware that, by such appellations, the possessors are best known, described and distinguished through the world, free license is given to the exuberant scintillations of his humor.

Without proceeding further to review the absurdities of the member, we would inform him that the reports at which he sneers are prized and sought for by agriculturists and lovers of science generally throughout the entire country. They are of the highest use and importance, as the demand for them testifies. And as for their being recondite or abstruse, we cannot find anything in them that any one ordinarily educated in natural science would fail to comprehend. It may be witty and amusing to make such speeches, but we venture to suggest that, although they are excellent examples for stump oratory, they are beneath the dignity of the House, while they are far from calculated to foster public interest in a young and valuable department which needs and richly deserves the utmost popular support.

The discussion of the question of treating so indispensable an office as that of microscopist, involving a salary of \$1,800, and that of raising the pay of the Commissioner of Agriculture a couple of thousand dollars a year, fills nearly an entire page of the *Globe*. The expediency of devoting this trivial sum to purposes of direct national advantage occupied the attention of the House for hours, and the increase of salary to the commissioner was in the end refused. It is a suggestive fact that the same body, with half the discussion, devoted fifty times the pittance asked to satisfy the demands of a few useless officials and to advertise a number of private individuals at the Vienna show. It is a strange policy that refuses hundreds for the national good and devotes thousands for purposes of private gain.

THE VIENNA SHOW IN THE SENATE.

The Senate has at length taken action upon the Vienna Appropriation bill. The amount to which the sum devoted has been raised, together with the further expense involved by the amendments which have been added to the original act, of which but the form has been retained, authorize, we confess, a rather more wholesale raid upon the Treasury than we anticipated; but it is probable that some reliance may be placed upon the Lower House to curtail the extravagant proportions which the measure has assumed.

The bill passed by the House provided for the appropriation of \$100,000, and authorized the President to appoint twelve skilled artisans to report upon the Vienna show. As returned by the Senate, it devotes \$300,000, calls for the selection of seven scientific men and eight skilled artisans, whose expenses, not to exceed \$2,000 each, are to be paid from the above fund, and who shall report, etc., and it authorizes the designation of one hundred assistant commissioners, who, strange to say, are to receive no compensation. Senator Schurz, of Missouri, opened the discussion by presenting the favorable report of the Committee on Foreign Relations, and was supported by Senators Cameron, Hamlin, Morton, and Sprague. In opposition, Senators Chandler, Saulsbury, Casserly, and Trumbull conducted the debate. As usual, the exhibition certificate was again declared to act as a full patent, and the misconceived interpretation placed upon its provisions by the Commissioner was once more brought forward. This we have repeatedly disproved; further asseveration is useless. The facts that we are to have an Exposition of our own before long, and that nations are like individuals—if we do not go to their festivities, they will retort by refusing to come to ours—were frequently reiterated, and special stress was laid upon "the great many objects for which the money is to be expended." Happily, the latter are for the first time in the history of the controversy enumerated, and

the following list is, as stated by Senator Schurz, derived from "gentlemen connected with the commission." "First, office expenses of our commission in New York; freight from Trieste to Vienna, and back; unpacking and installation of goods; guards, interpreters, local commissioners, and general office expenses at Vienna; exhibition tax for place occupied in building; the building of foundations for our machinery; advertising, catalogues, circulars, insurance, free packing, and returning goods to exhibitors; cost of scientific commission to visit and report on the exhibition; printing and circulating reports of scientific commission; salaries of Commissioners; separate structures in park for agriculture, schools," etc.

After perusing this list, we have only to express our wonderment that so modest a sum as \$300,000 has been considered sufficient to meet so varied a category of expenses. More astonishing still is it, however, to contemplate the present proportions of the plan in connection with the original act which was passed in Congress in June last. We commenced with a simple bill of a few lines authorizing the President to appoint one or more agents (nothing is said about "Commissioners-General") to represent the United States at Vienna, with a distinct proviso "that such appointments shall not impose upon this Government any liability for the expenses which they (the agents) may occasion." Here was no outlay; it was affirmed that the act was intended merely to confer a little dignity on gentlemen who wished patriotically to benefit the country. Now we are to pay for free transportation of exhibited articles; pay not only the Commissioner, but his assistants, large salaries; pay for the buildings in which our goods are to be placed; pay for a scientific commission, and even pay to insure and set up the very machinery that we go to all this expense to transport. Why not continue, and buy the goods out and out, and pay the exhibitors at once for going to Vienna? As Senator Trumbull said, it is safe to predict that a million of dollars will be taken from the Treasury and be assessed upon the people of this country by way of taxation to pay the expenses of this Exposition before it is through with. The farce of the Paris show is to be re-enacted, with additions. In that case as in this, after we had appropriated money for commissioners, we devoted a still further amount to build houses to contain our articles. We gained nothing beyond half a dozen volumes of scientific reports now difficult to obtain, a grand advertisement for a few wealthy and well known manufacturing firms; and, after all, made a display which was so badly managed as to make it anything but creditable. The unpleasant fact remains that over a half a million of dollars, according to Senator Trumbull, was directly disbursed from the National Treasury.

Senator Schurz urges that our ideas strike down the whole plan of international exhibitions. We cannot trace the reasoning by which he attains this conclusion. If this Exposition were to take place in a country which had a code of laws not clearly oppressive and unjust; if inventors could acquire its benefits without more than compensating for them by the loss of their rights; if, in short, it even produced upon the people of this nation the effect which such enterprises are designed to have, and that is, to awaken the industrial classes to new efforts, to stimulate them to rely on their own excellences and not to turn supinely to a fatherly government for help, we should be the last to call up any opposition. But when, as is manifestly now the case, it is proposed to tax a nation already overburdened for the benefit of a few: when, under cover of a disinterested patriotism, every possible effort is made to deplete the Government Treasury; when, to gratify a feeling of false national pride, we are asked to be contented with such reasons as "we ought to be liberal," when we are without the means to pay our just debts: "encourage immigration" when foreigners from almost the vicinity of Vienna are pouring in by every steamer in such numbers that our local charities can barely keep them from starving in the streets: "advertise our products" when the same are already thoroughly known throughout Europe: or "conciliate Austria" when that country has fairly insulted us by ignoring our request for even a modification of her unjust code: then we, as a journal striving for the public welfare, together with our legislators in Congress who have the true interests of the country at heart, do but advocate the right in opposing a measure which, if not prejudicial, is plainly of no benefit to the nation at large.

THE OCEAN TIDES AS A PRIME MOTOR.

The power of the ocean tides is the only power on earth due directly to gravitation. All other powers are obtained by the intervention of solar heat, which causes the watery vapors to ascend. These, returning as rain, are the cause of the rivulets, rivers and all water power. Solar heat also causes the unequal expansion of the air and so gives rise to air currents, or winds, which drive our sailing vessels and windmills. Again, the solar heat causes vegetation to flourish and so produce combustible material, which is used either fresh, as wood, or from the inexhaustible deposits, stored up in geological periods and transformed by age and circumstances into coal, petroleum, asphaltum, etc. The heat of this fuel is, in appropriate engines, changed into motion, or certain products of vegetation are consumed by animal bodies which, in return, may be utilized as moving forces; or, lastly, the solar heat may be directly employed to move machinery, a problem to which it appears that Captain Ericsson the well known inventor of the caloric engine, the monitors, etc., appears now to have devoted the rest of his life.

Indeed, whichever way we turn, we see that all life and all motion on the surface of our earth, with the sole exception of the ocean tides, may be traced back to the heat of the sun as primary cause; and the power we may obtain from the tides is due to the combined attraction of the sun and moon. In-

vestigations in this regard have shown that the original tide wave is generated in the Pacific Ocean, and that this wave moves westward with the apparent motion of sun and moon, one wave following the sun and another the moon, but as the apparent motion of the latter body is slower, the lunar wave is continually overtaken by the solar wave; if the whole equatorial belt of our earth were water, the solar wave would make the revolution around the earth in 24 hours, while the lunar wave would accomplish this in a little over 25 hours. As it is, however, the continents of Africa and America prevent this regular flow of tides, and the Pacific tide waves have to go around the Cape of Good Hope, and thence spread northward through the Atlantic Ocean. Any gulf having a funnel shaped mouth, placed in the right direction, will increase the height of the tide entering it; this is the case with the Bay of Fundy and the Red Sea; and all gulfs having a narrow entrance not placed in the right direction will have a tide wave of much less height than that in the free ocean; such is the case with Chesapeake Bay and the Baltic Sea. Different forms of the coast and its direction will exert a similar influence; while the greatest divergence will be reached where the tide wave reaches any place from two sides, as is often the case behind large islands. The effect will be then, of course, to increase the height, if the high or the low tides coincide, while the height will be diminished and even the whole tide neutralized if the high tide wave, coming from one side, coincides with the low tide from the other side.

It is thus not at all surprising that the tides are so different in different localities. In the Bay of Fundy the difference between the ordinary high and low tide is 70 feet; at the mouth of the Severn, England, and at St. Malo, France, it is 46 feet; at Guernsey and Jersey 36 feet; at the mouth of the Scheldt 20 feet, along the coast of Holland 10 to 16 feet; along the coast of the United States the tides vary from 4 feet to 10 and 20; while in the Mediterranean they are scarcely perceptible.

To estimate the power of the tides, we have only to consider that the attraction of sun and moon elevates the surface of the ocean to a mean height of about two feet; this happens twice in 24 hours, and we may then set down the extent of surface thus raised at half the surface of the earth, of which the ocean occupies three quarters. We have then 100,000,000 square miles of water 2 feet thick; every square mile of water of this thickness contains nearly 60,000,000 cubic feet, or 3,840,000,000 pounds of water, and this multiplied by 100,000,000 (the number of square miles affected by the tide) gives the enormous number of 384,000,000,000,000,000 of foot pounds exerted every 12½ hours, or 750 minutes, which is 500,000,000,000,000 foot pounds per minute; dividing this by 33,000 to reduce it to horse power, we obtain more than 15,000,000,000 horse power for the mechanical value of the tide wave over the whole surface of the earth; of which, however, only a comparatively small portion can be utilized, namely, that within reach of sea coasts along continents and islands.

Such an enormous power, due to the combined action of the solar and lunar attraction and the terrestrial rotation, must have its influence on this rotation, and this is the theoretical problem for the future astronomer; while the method of utilizing this enormous power is the practical problem for the future engineer and mechanic.

BALANCING MACHINERY.

In a recent article we stated the principles involved in the balancing of machinery, whether a standing or a running balance, or both combined, was desired. We have now a few remarks to make relative to the application of those principles.

It is evident that, in introducing a counterbalance into a machine, to secure the best result such an arrangement should be effected that the new forces introduced should be not only equal in intensity to the forces to be counterbalanced, but that the two forces should act, at all times, in opposite directions along the same line. A piece rotating about an axis should be counterbalanced by another piece directly opposite, moving in the same path. A reciprocating piece, like a piston, should be counterbalanced by another heavy piece moving with equal and opposite *vis viva* in the same line. This is sometimes impracticable, however. A pulley or fly wheel can usually be either rendered symmetrical by carefully turning up, or it can be counterbalanced by added weight, on the light side and precisely opposite the point at which the center of effort of the excess is found. A crank can generally be counterbalanced by adding a piece of proper weight and shape, cast or otherwise secured to its hub, directly opposite the eye of the crank. It seldom happens, however, that the effort of the counterbalance required to neutralize the strains and jars due to the reciprocation of the piston of a high speed engine can be made to act in the center line of the cylinder; and it not unfrequently happens that cases occur in which the counterbalancing of rotating parts must be effected by adding the new weight at a point on the opposite side of the shaft, but not in the same plane of rotation. In such cases, although the tendency of the shaft or of the machine to shake bodily, backward and forward or upward and downward, is destroyed, and although the result is, in very many cases, found satisfactory, a new action is introduced which requires examination; for, after passing a limit of speed which must be determined for each individual case, it also may give rise to inconvenience or even danger. The case of the balance wheel set with its plane at an angle with its shaft will serve as an excellent illustration of the general case. Here, while the shaft is rotating, every particle in the wheel is balanced by a particle,

of exactly equal weight and of equal *vis viva*, on the opposite side of the shaft.

Every particle whose centrifugal force acts upward has a companion particle diametrically opposite in the wheel, whose centrifugal force acts downward; and every particle tending to draw the mass to the right is similarly counteracted by a particle tending to the left. In only one set of particles, however, in that set lying in the one line which can be drawn as a diameter of the wheel at right angles to the line of the shaft, are these actions in opposite directions along the same line. All other pairs of particles pull in opposite directions but not in the same line, and they all tend to pull the fly wheel around until its shaft becomes vertical to the plane of the wheel.

This disposition of one set of forces, by which they tend to produce a rotation about some center while having no tendency to produce a motion bodily in any direction, is called, in the science of mechanics, a "couple."

In our illustrative case, therefore, and also in all similar cases of counterbalancing, as we stated in our reply to a correspondent, if the system "is accurately balanced and is perfectly symmetrical," there will always be a tendency "to turn until its plane shall take a position at right angles with the shaft. This effort will be a constant one, tending to bend the shaft, and does not necessarily produce unsteadiness in the shaft." Yet, although this arrangement is in principle often met with and may generally be found satisfactory, there will always be a limit of speed, beyond which unsteadiness will exhibit itself in the twisting effect which we have noticed.

The shaft and its supports, although not carried bodily in any direction, will have a tendency to oscillate about some point as a center. This action should, of course, be carefully avoided where great speed of revolution is contemplated.

Our final conclusion is, therefore, that in any piece of machinery, perfect steadiness may be secured, whether at rest or at high speed, by so designing it that every particle may be balanced by another of equal and opposite moment, of equal and opposite *vis viva*, and so placed that the opposing forces may not produce a couple.

THE DUPLEX TELEGRAPH INSTRUMENT IN ENGLAND.

An alleged important discovery in Telegraphy is just announced in England, consisting in a device said to be original with Mr. Preece, the Postal Telegraph Engineer. It consists in an arrangement of instruments for sending messages in both directions at once by the use of one wire.

This is an American improvement, invented here some years ago, by J. B. Stearns, and by him patented. It has been in use on the lines of the Western Union Telegraph Company in this country for a considerable time, with much success. It doubles the transmitting capacity of every telegraph wire, and is regarded here as one of the most important inventions that have been made since the introduction of the electric telegraph system.

We are glad that our British cousins have at last waked up to an appreciation of its value, even if they credit the discovery to the wrong individual. It might be well for the British telegraph authorities to send over here for a few hundreds of the Stearns machines and put them into use at once; thus immediately doubling the capacity of their wires, and saving them from further experimentation upon the subject.

WHAT IS THE USE?

The first question usually asked by the average member of society on hearing of an important discovery is: "What is the use?" If this is not answered in a satisfactory manner, the subject is at once dismissed as unworthy of consideration. We were led to reflect upon this propensity, to underrate scientific discovery unless an immediate use could be found for it, the other evening when listening to Professor Tyndall's exposition of the laws of light. Newton's analysis of light by passing a beam through a prism was a discovery of no apparent value at the time it was made. The spectrum was very beautiful to look upon, but few persons could understand or appreciate it. No one could have anticipated that this was the germ of a method which would gradually lead to the discovery of new metals on our earth, to a study of the atmosphere of the sun and planets, that minute quantities of substances would be detected by it in mineral waters and rocks, that steel would be manufactured by watching the light produced by burning gases, that an instrument called the spectroscope would become one of our most important adjuncts in the study of astronomy, in technical researches, in the detection of new bodies; and thus the ray of light passed through a hole in the shutter becomes, in the contemplation of future men of science, the starting point in a great array of discoveries.

Professor Tyndall told us that the French physicist Malus, while one day walking through the garden of the Luxembourg Paris, observed a peculiar reflection of light from one of the windows of the palace; a closer study and examination of the phenomenon led him to his discoveries respecting the polarization of light, which consisted in showing that light may acquire properties identical with either of two rays yielded, by refraction through Iceland spar, by the process of simple reflection at a particular angle from any transparent body. Thousands of people had seen the light reflected from a pane of glass in an identical manner, but no one had made any deductions from it. What good has grown out of these researches of polarized light? "What is the use?" In this case, as in the preceding, the principle has been applied to many practical purposes. The value of glass for optical instruments, the extent to which glass has been annealed, the testing of stone-jewels and the detection of paste dia-

monds, are accomplished by the use of a polarizing apparatus; but the most important application of the power of rotation possessed by different substances is seen in the apparatus employed to determine the quantity of sugar contained in any solution. The crude sugar of commerce is bought and sold on a polarized test, and millions of dollars are involved in the accurate use of discoveries which at first had no apparent value. The spectroscope and polariscope could not readily be dispensed with at the present moment.

While we are on this topic, it may be well to present a few more illustrations of the fact that nearly all great things are founded on what at one time appeared to be useless discoveries. Hans Christian Oersted observed the deflection of the needle produced by an electromagnet, and the needle telegraph was the natural growth of the observation; and afterwards, by further research, we arrived at the telegraph in its present form. A little deposit of copper on one of the poles of a battery when seen by De la Rive and Jacobi soon developed into electroplating and galvanoplastic operations. Gold, silver, copper, nickel and other metals, thrown down from solutions by battery currents, offer an occupation to a large number of persons, and enable publishers of illustrated papers to furnish their readers with prints for electrotypes plates in a manner far superior to what was formerly accomplished in this line.

Professor Tyndall's observations on haze and dust have for their practical result improvements in ventilation and the discovery of the precautions to be observed to ensure good health.

Pasteur's researches on the germs of fermentation have revolutionized our former notions on this subject, and we recently published an account of the application of his theories to the brewing of beer and the conservation of wines. The same theory carried further in its consequences points out the probable origin of epidemic diseases, and thus indicates the best remedies to be applied.

Scarcely any body could have anticipated, in the study of minute germs, that out of it would grow methods for brewing beer or remedies to prevent contagion.

Faraday discovered, in the cylinders in which illuminating gas was formerly transported, a dirty, oily liquid, to which, subsequently, was given the name of benzole. Here was an instance where the utilitarian inquiry might have been made with great propriety: "What is the use?" Few discoveries have been more fruitful in their consequences than that of the detection of benzole among oil residues. Out of this body has sprung a long line of important industries. We have the most magnificent colors; we prepare sweet perfumes; we concentrate the light of illuminating gas; we dissolve resins and make varnish; and the investigations into the properties of this substance have conducted to the discovery of analogous compounds reaching far into the domain of organic chemistry.

Margraf found that an unsightly weed, growing wild on the shores of the Mediterranean, contained a small quantity of sugar and a large proportion of soda. By transplanting and careful culture, a large part of the soda was eliminated and potash substituted in its place, and the quantity of sugar considerably increased. The weed was transformed into the sugar beet, and an industry established which has proved to be of great value to the countries where beet root sugar is made. In the tubers of another weed, the fruit of which, in the form of bolls, is highly poisonous, was found large quantities of starch. It also was subjected to culture, and at the present time few articles of food are of more consequence than the potato. The detection of sugar and starch in vegetables was not regarded as of much account at the time it was made, and it was many years before any practical results grew out of it.

We can recollect when a peculiar gum called gutta percha was brought to the United States for the first time. It had been found by an intelligent traveler, and specimens of it were shown to scientific men everywhere, to see if they could make any practical use of it. It was a considerable while before its value was appreciated and the traveler was rewarded for his enterprise in bringing it into notice. We now know its immense value, for without it the submarine cable would be impossible, and the insulation of wires would be surrounded with great difficulties.

When Scheele discovered glycerin and Chevreul described its properties, there was no apparent use for it. It has now become one of the most important and useful products of chemical technology. A few years ago it was thrown away; now it is made in great quantities and the demand for it is largely on the increase. Nitro-glycerin, dynamite, lithofracture, are among the secondary products of this interesting substance. The uses of glycerin in medicine, for the extraction of perfumes, in confectionery, to keep substances moist, as an antiseptic, are a few among the many uses for glycerin that could be stated.

These are some of the discoveries that passed through our minds while listening to the lectures of Professor Tyndall. The practical application of the subject is that no discovery is made in vain. As there is a conservation of forces, so is there also a conservation of discoveries. No force is lost any more than matter, and no discovery is lost in making up the chain that may lead to important results. Men who are engaged in what appear to be purely scientific pursuits, without the least practical bearing, are the ones who ought to receive more sympathy than they generally obtain. Their pursuits appear to be so useless to the common mind that they fail to receive due appreciation. It is safe to take for granted that every scientific discovery at the present time has its value. We may not appreciate it at the moment, but, as in the case of Newton's prismatic colors and Faraday's benzole, the time is sure to come when the world will profit by the discovery.

EARLY METALLURGY.

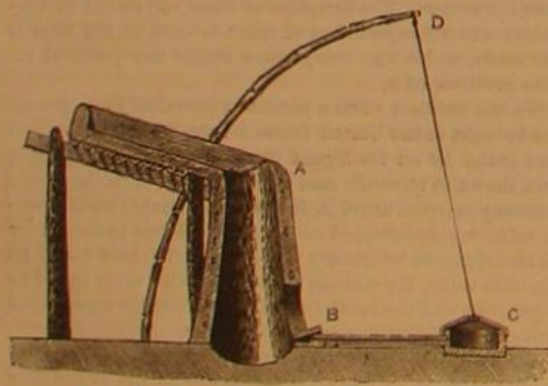
Iron was not in common use till long after the introduction of copper. It is far more difficult to procure, because it is not met with in the native state, and the fusing point is very high. The metallurgy of iron is more complex than that of copper, and when obtained, it is a more difficult metal to work. According to Xenophon, the melting of iron ore was first practiced by the Chalubes, a nation dwelling near the Black Sea, hence the name *chalybe*, used for steel, and hence our word *chalybeate*, applied to a mineral water containing iron. Steel was known to the ancients, but we do not know by what means it was prepared; it was tempered by heating to redness, and plunging in cold water. According to some, *kuanos*, mentioned by Homer, was steel; but Mr. Gladstone prefers to conclude that it was bronze. Iron was known at least 1537 B. C. It was coined into money by the Lacedaemonians, and in the time of Lukourgos was in common use. It was used in the time of Homer for certain cutting instruments, such as woodmen's axes, and for plowshares. Its value is shown by the fact that Achilles proposed a ball of



Egyptian Bellows. Fifteenth Century B. C.

iron as a prize for the games in honor of Patroklos. Neither iron money nor iron implements of great antiquity have been found, because, unlike the other metals of which we have spoken above, iron rusts rapidly, and comparatively soon disappears. No remains of it have been found in Egypt, yet Herodotus tells us that iron instruments were used in building the pyramids; moreover, steel must have been employed to engrave the granite and other hard rocks, massive pillars of which are often found engraved most delicately from top to bottom with hieroglyphics. Again, the beautifully engraved Babylonian cylinders and Egyptian gems, frequently of cornelian and onyx, must have required steel tools of the finest temper. We have no record of the furnaces in which iron ore was smelted, but we know that bellows were in use in the fifteenth century B. C., in Egypt, and some crucibles of the same period are preserved in the Berlin Museum. They closely resemble the crucibles in use in the present day. The accompanying engraving represents a double pair of bellows, a furnace, fuel, and perhaps a crucible.

The native Indians prepare iron from hematite at the present time by equally primitive bellows, which indeed resemble the above very closely, and which, without doubt, have been unaltered for centuries. A small furnace, A (see accompanying section), is rapidly constructed of clay, and into the bottom of this, two nozzles, B, are introduced; these are connected with the bellows by bamboo tubes. The bellows, C, consist of cup shaped bowls of wood covered with goat



Smelting Furnace and Bellows used by native Indians in the present day. skin above, and connected with the bamboo below. In the center of the goat skin cover a round hole is cut; the blower places his heel upon this, which is thus closed, while, at the same time, the skin is depressed, and a blast is driven from the tube; then he steps upon the second skin, and thus a continual blast is kept up. The bent bamboo and string, D, is for the purpose of raising the goatskin cover of the bellows after depression, which, it will be noticed, is accomplished by the Egyptian bellows by a string raised by the hand. A piece of hematite is introduced with some charcoal, and after the lapse of some time, it is reduced by the carbonic oxide to a spongy mass of iron. Undoubtedly a crude furnace and appliance of this nature was used by the first melters of iron.

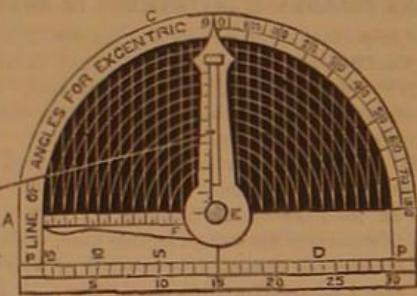
A New Way of Copying Drawings and Designs.

Some years ago it was proposed to copy black and white drawings by the employment of starch paper and the fumes of iodine. The process answered very well at the time, but has since been superseded by photography. We now hear of a new suggestion on the part of M. Renault, who employs the reducing properties of hydrogen and phosphorus vapors. The drawing paper is first made transparent by washing it with a two per cent solution of paraffin in petroleum naphtha, and is then dipped in a solution of nitrate of silver. The

design is written or printed with bromide or chloride of ammonium, and is then exposed to the action of hydrogen gas, or to nitrogen or carbonic acid which has previously passed through a tube containing fragments of phosphorus. The paper turns black excepting in such places as have been touched by the tracing ink. The design appears white on a dark background. If now a second sheet, similarly prepared with a silver solution, be placed beneath this and submitted to the hydrogen, the gas penetrates the white parts of the upper sheet and produces the design reversed upon the lower sheet. The author states that copper salts can be reduced in the same way. As these salts are much cheaper than silver, it will be preferable to use them. It is possible that, for copying labels to be attached to acid bottles, the method will prove available, particularly as the paraffin renders the paper unalterable by acids. For ordinary designs, it is a question whether tracings could not be more rapidly made through the translucent paraffined paper by hand than in the circuitous manner described above. It will be well for somebody to try the experiment and report the result.

GUIDE FOR SETTING SLIDE VALVES.

A B is a line of any length made to a scale to suit the convenience of the engineer. In this, one sixteenth of an inch means 1 inch. C is a line of angles; F is the crank graduated to suit diagram; E the eccentric, marked in inches as on the common rule. In the center of pointer runs a slot; in this must be placed a pin with a collar near its end, so that it can be screwed into a split nut; the hands are of brass, put together with an ordinary belt screw, a hole passing through its center to admit the pin. P P is a continuation of drop lines, the upper side being numbered from right to left, the under side from left to right, giving the full length of stroke of engine. To use it, first obtain correct duplicates of the valve, steam and exhaust ports, which lay off on a pair of thin laths; make the bottom of one fast and in line with A B, place the one representing the slide centrally over ports, arrange the hands as shown, at right angles; now move the pin in eccentric to the half required throw—in drawing 3½ inches;—screw the pin tight, slip on M the connecting rod,



and all is ready. Now move the eccentric hand so that the slide just peeps past the crank hand back to dead center; this now gives angularity of eccentric. So says a correspondent of the *English Mechanic*. By moving round the pointers, the laths will show the condition of the engine under examination.

The Constellation of the Great Bear.

Miss Maria Mitchell, Professor of Astronomy at Vassar College, recently delivered in this city an entertaining and instructive lecture on the above topic, recounting the results of researches in the firmament, and sketching the progress of astronomy from the earliest knowledge to the latest discoveries.

After picturing the general view of the heavens, the lecturer stated that the Arabians were the first to study the science. The seven stars of the Great Bear have been spoken of from very ancient times. They are the seven sages of the Hindus, and are also called Charles' Wain and commonly the Dipper. They were named about 1,600 years ago after certain letters of the Greek alphabet. No two are alike in color, a fact that can be detected better by the unaided eye than with the telescope. A double star consists of two stars close together, usually of different tints and complementary in color. Miss Mitchell stated that she had often tried to match their hues with worsted, but had never succeeded; nothing resembles them except rubies and diamonds. A description was then given of her visit to the observatory in Rome into which she was at first refused entrance on account of her sex. Reverting to her theme, the lecturer alluded to Father Secchi as one of the earliest astronomical discoverers with the spectroscopic. According to him, our sun belongs to the group of stars which give yellow light, such as *Arcturus* and others. She then spoke of the time required for the passage of light; a ray from the polar star reaches us 30 years after its emission. Some stars are variable, differing in splendor at various times, one in the Great Bear having its period of variation once in every 301 days. Our sun itself is a variable star. The solar spots have been noticed in great numbers during the past few years, but we do not perceive any difference in the quantity of light received from the sun's disk when it is thus obscured. Of late years, it has been noticed that the sun's spots have some connection with certain conditions of the planets.

WOMAN'S WORK IN ASTRONOMY.

In speaking of Sir William Herschel's labors in this field, Miss Mitchell said that he was assisted by his sister, Miss Caroline Herschel, who, night after night, patiently worked at recording what her brother saw. To do this work, she required a combination of qualities not often possessed by a woman.

But how was she appreciated? We are brought up to think

not too highly of George III: let us, however, not judge him too harshly. When he heard of Caroline Herschel's labors, he gave her a position in the Royal Observatory, but when he found she was doing a man's labor, he gave her a woman's half pay.

Mary Somerville became celebrated through her great translation of *La Place's Mécanique Céleste*, a book which earned the highest praises from Sir John Herschel. The study of astronomy calls into play those perceptive faculties which women use in every day life in making their embroidery.

Miss Mitchell then alluded to the study of astronomy at Vassar College, where, she said, the sun was photographed every day and record of its changes thus kept. Movements of other heavenly bodies are carefully noted. The spectroscopic shows that six of the stars of the Great Bear are moving towards the earth, while the seventh is receding.

Rays of light from some stars may take 100 or 1,000 years to reach us. They may have changed from white to pink or from yellow to red, while the record that the ray brings us is that of years ago.

GEARS FOR CHANGING DIRECTION OF MOTION.

Our engraving shows a form of gears for changing the



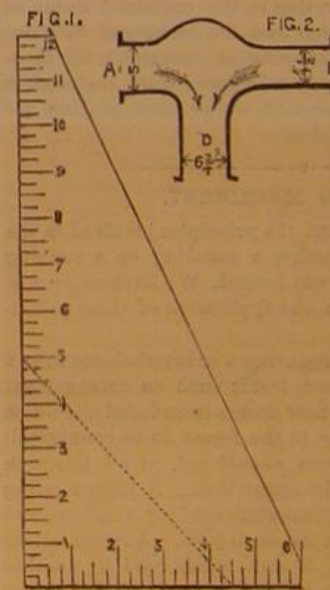
direction of motion, somewhat rare in use, but effective for many purposes.

THE PROPORTIONS OF PIPES.

We subjoin a sketch of a handy little contrivance, designed by Mr. George Cockburn, pattern maker, Glasgow, for ascertaining the diameter of a pipe, etc., having a sectional area equal to that of two other pipes, or *vice versa*. The instrument consists simply of a piece of wood on cardboard, shaped like a set square, as shown in Fig. 1, or a diagram of the same form drawn on paper, and divided out along the two edges, which are at right angles to each other, the divisions being taken to represent inches, feet, or yards, etc., according to the kind of work for which the instrument is used. When employed for determining the equivalent diameters of pipes or bars, inch subdivisions will generally be found most convenient.

The mode of using the instrument will be readily understood from an example. Suppose, for instance, that two pipes, A and B, Fig. 2, respectively 5 inches and 4½ inches in diameter, deliver into a third pipe, D, and it be required to find the proper diameter for the latter pipe. Then from 5 on the scale of one of the divided edges to 4½ on the other,

draw a line, as shown dotted in Fig. 1, and the length of this line, measured with the same scale as that to which the edges are divided, will be the diameter of pipe required, in this case, 6½ inches. On the other hand, if a pipe, D, 6½ inches in diameter, be delivered into a pipe, A, 5 inches in diameter, and it was required to know what other size of pipe, B, could also be supplied, all that would be necessary would be to take the division point, 5, on one edge as a center, and, with 6½ inches as a radius, describe an arc cutting the other divided edge. The point at



which the latter edge was cut by this arc would show the diameter of pipe required.

Besides being useful for determining the diameters of pipes or circles of equivalent areas, the instrument is also available for determining the sides of equivalent squares, while, by a little contrivance, it can be made available for determining the diameter (or length on the side, if square) of a pipe or bar having a sectional area equal to the aggregate sectional areas of any number of other pipes or bars of which the diameters (or lengths on side, if square) are known. To use it for this purpose it is only necessary, first, to determine by its aid the diameter of pipe or bar equivalent to any two of the whole number, and next to ascertain the equivalent of the diameter thus ascertained, and that of a third pipe or bar, and so on. The arrangement of the instrument is, of course, founded on the fact that the areas of squares and circles increase as the squares of their sides and diameters respectively, and that the square of the hypotenuse of a right angled triangle is equal to the sum of the squares of its two other sides.—*Engineering*.

THRIFT.—Labor is the greatest promoter of happiness to individuals, of civilization and prosperity to nations. Steady work, with regular earnings, will do more for the elevation and comfort of the laboring man than any other effort that can be made in this direction.

PROFESSOR TYNDALL'S FIFTH LECTURE IN NEW YORK—THE INVISIBLE RAYS.

Is the eye capable of receiving visual impressions from all the rays emitted by the sun? The answer, said Professor Tyndall, is "No." On both sides of the spectrum there is a copious overflow of rays which are incompetent to excite vision, but which, however, are able to agitate the molecules of certain substances so as to shake them asunder and produce chemical decomposition. There are special substances upon which these ultra violet rays exert a special power. They darken the white salts of silver; and by permitting a spectrum to fall on paper properly saturated with a solution of such salts, the chemical action reveals the existence and the extent of the ultra violet spectrum.

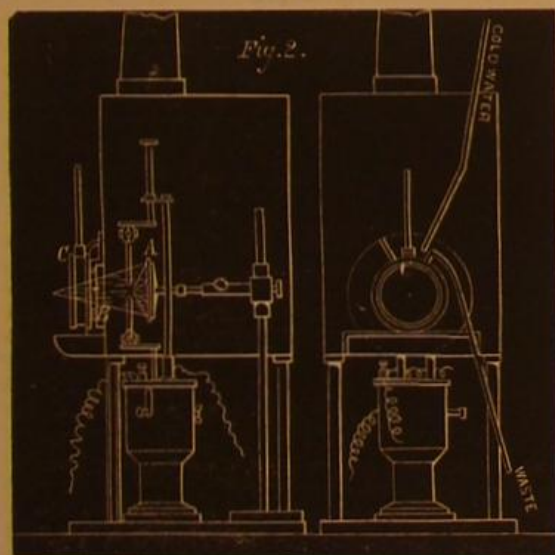
RENDERING ACTINIC RAYS VISIBLE.

As a general rule, bodies either transmit light or they absorb it. There is a third case, however, in which light is neither absorbed nor reduced to darkness, but changed into light of another kind. Professor Stokes, in the University of Cambridge, has demonstrated this change of one kind of light with another, and has pushed his experiments so far as to render the invisible rays visible. A piece of paper, moistened with a solution of sulphate of quinine, was then introduced by the lecturer into the spectrum beyond the violet. Immediately a bluish tint appeared where previously none had been. The light from the electric lamp was then passed through a sheet of violet glass, and the experiment was repeated with the spectrum thus obtained. A sheet of paper properly prepared, on which a rose with leaves appeared in outline, was placed in this light, and immediately the rose assumed a delicate blue, and the leaves showed a tint of emerald green. These facts, continued Professor Tyndall, are due to the quality possessed by the sulphate of quinine, and other bodies, of changing the rapid vibrations of the rays beyond the violet into slower vibrations, and thus rendering the non-luminous rays luminous, and also changing one kind of light into another. Fluorescence is the name given to these effects. The human eye is a beautiful formation, as there is no doubt some substance in its crystalline lens analogous in its action to the sulphate of quinine.

RENDERING HEAT RAYS VISIBLE.



The next question, said the lecturer, is: Is radiation capable of diffusing heat? Throwing the image of the carbon points on the screen, as in Fig. 1, he showed that ordinary

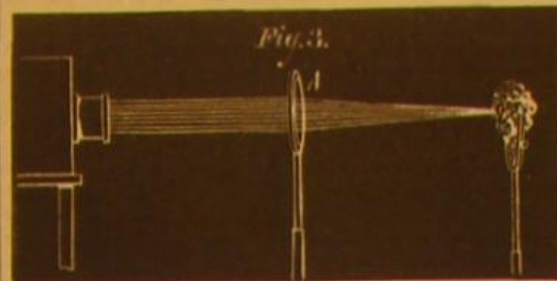


paper, saturated with gunpowder, could be readily ignited in the focus of the image. The rays were then caused to converge to a focus by the aid of a concave mirror in the apparatus shown in Fig. 2. A is the mirror from which the reflected cone of rays passes, first through a rock salt window, B, and afterwards through a solution of iodine in bisulphide of carbon, in C. Cold water is permitted to enter to keep down the temperature of the apparatus and prevent the vaporization of the bisulphide. So intense was the heat thus obtained that zinc and magnesium readily fused in the focus of the reflected rays.

HEAT CONCENTRATED BY A LENS OF ICE.

Professor Tyndall next went on to explain how the same effects may be produced by the concentration of the purely radiant heat of the carbon points by means of convex lenses. Even a lens of ice will answer the purpose. Arranging a piece of ice, ground in lenticular form, at A, Fig. 3, the lecturer ignited gun cotton placed in its focus. This mode of concentrating heat by an ice lens has never before been attempted with artificial light. The lens may be cold as the ice is, and yet transmit sufficient heat to ignite various sub-

stances. The fact is easily explained when we reflect that it is only those rays that are absorbed that produce the impression of heat. Professor Tyndall then ignited a diamond



suspended in a jar of oxygen by the heat radiated from the carbon points.

SEPARATING HEAT, LIGHT AND ACTINIC RAYS.

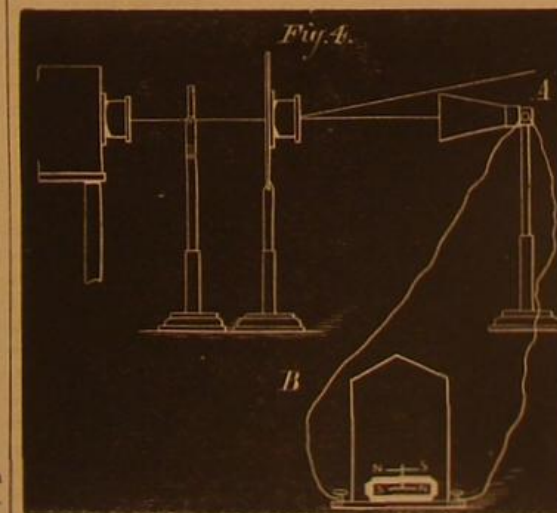
What constituent of the radiation produces these effects? By introducing a cell of alum so as to interfere with the light passing from the mirror to the focus, it was shown that the ignition of gunpowder in the latter position is prevented. If we bring the light to a focus by means of the mirror within the camera, and then cut off all light, certain effects which follow will give us a clue. Chemical combination exerts an enormous influence on luminiferous ether. The reason why we cannot see these rays is that the vibrations are too slow to awaken sensation on the retina. The atmosphere, which is a mechanical mixture of oxygen and nitrogen, is a practical vacuum to the passage of heat rays. When the atmosphere is dry, there is an enormous reduction of temperature, because of the amount of heat radiated by the earth into space. The elementary bodies, such as oxygen, hydrogen, chlorine, etc., are remarkably transparent to the rays of heat. Placing the iodine filter, C, (Fig. 2) so that the spectrum from the carbon points should pass through it, as the solution of iodine was weak, Professor Tyndall pointed out that only the green of the spectrum grew dim and disappeared. As iodine was added to the solution, the spectrum was more and more invaded, and was finally cut off altogether, thus

INTERCEPTING THE LUMINOUS RAYS

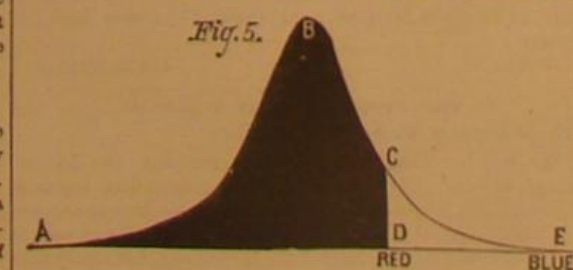
and leaving the calorific rays alone for examination. A piece of paper held in the point which was the focus of the light rays, although no traces of light were visible, instantly ignited. Professor Tyndall then inserted a plate of platinum coated with platinum black in the same position. Platinum, he explained, with its surface thus prepared acts in regard to the invisible heat rays just as the sulphate of quinine paper does to the invisible light rays. The temperature of the air surrounding the glowing platinum has nothing to do with this circumstance of heating. The air at the focus may be of a frosty temperature, as no heat is communicated to it from the mirror. The heat raises the platinum to a white heat without affecting the air. This is due to the fact that while the air cannot absorb the heat rays, the platinum can and does.

DELICATE DETERMINATION OF HEAT.

In 1821, Seebeck, of Berlin, discovered that heat applied to the junction of two metals of unequal heat-conducting power, soldered together at one end, the other extremities of the bars being connected with a galvanometer, would give rise to electric currents. This is the thermo-electric pile, which, arranged with a galvanometer, will indicate the most delicate differences of heat. In Fig. 4, A is the pile and B the galva-



nometer. With this instrument, we may discover the seat and intensity of the rays of heat in the spectrum. This is done by carrying the thermo-electric pile through the spectrum many successive times and noting its indications. The lecturer here referred to the diagram, Fig. 5, representing the



invisible rays beyond the red end of the spectrum along with the visible rays in the curve of comparison. In it, the

space A B C D represents the invisible, and C D E the visible radiation. By this and other modes of experiment it has been shown that the heat radiated from the non-luminous portion is seven or eight times as great as from the luminous or visible. We can now understand

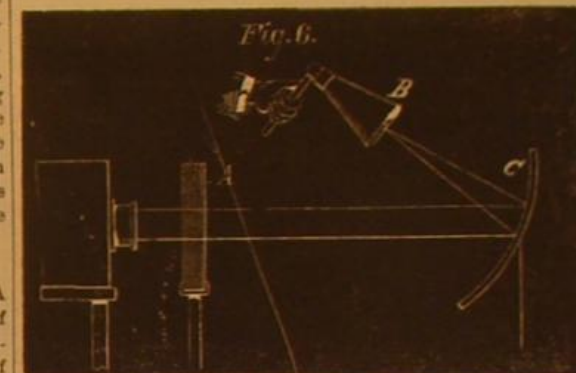
WHY RED HEAT PRECEDES WHITE HEAT.

Dr. Draper has shown that the light emitted by glowing wire is first red, then orange, and so on through the other colors of the spectrum until, where the wire is white hot, all the hues are displayed.

At the beginning and even before the current acted on the wire, it emitted invisible rays. The vibrations or waves causing these were too slow to excite vision. They are not destroyed, but their intensities are augmented as the shorter waves are introduced. It is the wave amplitude and not the wave length which determines the intensity of heat as well as of light and sound. The rule is that the square of the maximum velocity of the wave determines its intensity. All these waves existed simultaneously. Without such, there could be no sun.

PART OF HEAT AND LIGHT RAYS IN NATURE.

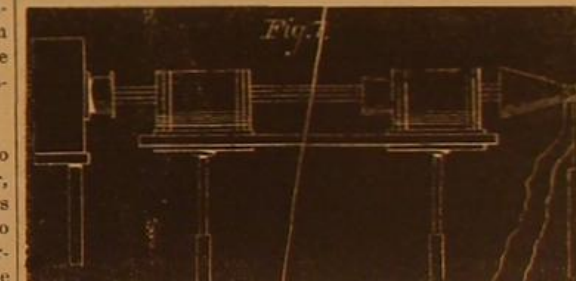
The action of the sun on the tropical ocean results in warming the waters and vaporizing a portion for the production of rain and snow. It is the dark rays which accomplish these results. The light rays go deeper down. The non-luminous rays go but a short distance beneath the surface. Rivers are liberated by the same invisible ray. In order to show clearly that it is the dark and not the light rays that produce these effects, Professor Tyndall placed the thermopile, B, in the focus of a mirror, C, as shown in Fig. 6. An



alum cell, A, cuts off the light, but the needle is found deflected though no light appears at the focus.

POLARIZATION OF HEAT.

By means of Nicol prisms and the thermopile, arranged as in Fig. 7, we may show that heat may be polarized as well as light. When the prisms are rotated to the proper angle



with each other, polarization ensues. As in the experiments with light, a pair of quartz plates with right and left polarizing power was then introduced, and in the deflection of the galvanometer needle there was shown the circular polarization of heat. Professor Tyndall stated, in conclusion, that it was by these means that the parallelism of light and radiant heat had been established.

John Ericsson.

A recent number of the *British Workman* contains an interesting biographical sketch, by Mary Howitt, of John Ericsson, of this city, of monitor fame. He was the son of a poor quarryman, and was born in 1803, at Wernland, Sweden. At a very early age he exhibited an unmistakable talent for mechanical construction. At the age of twenty-three, he had planned a hot air engine. In 1829, he was in England, and was one of the competitors in that remarkable trial of locomotive steam engines from which our present wonderful railway system has sprung. Ericsson's locomotive distanced all competitors, and for seven days he remained the undisputed victor, but on the eighth day the boiler burst and his iron nag, like any other broken down steed, lost the race. After this he planned a steam fire engine, and then a screw propeller, which, placed in a small vessel on the Thames, astonished all observers by its ability to tow great ships of many times its size. His efforts to induce the Admiralty and British merchants to adopt his screw failed, and in 1839 he settled in New York, where wealth and honors have attended him. Here he planned the first screw steamer for the American navy, the Princeton; and was engaged in many important mechanical works.

The fame of his latter days rests upon his successful planning of that form of ironclad known as the monitor vessel, in which the great broadside is done away with, and nearly every part of the ship placed below water save the small iron turrets which protect the guns. This form of vessel is now considered in England to be the strongest and best, and the heaviest ships of the British navy are at present built on that plan. In 1867, the people of his native village, in Sweden, erected a granite block in front of the humble cottage where he once lived, and upon it, in letters of gold, is this inscription.

HERE JOHN ERICSSON WAS BORN, 1803.

Correspondence.

Sure Test of Death.

To the Editor of the Scientific American:

Dr. Mary J. Safford writes, under the above head, a note to the Boston Transcript, in which it is asserted, on the authority of Dr. Magnus of Germany, that "the surest test of death is to tie a string snugly around a finger or toe; if the subject be not dead, the member thus tied becomes red, and grows constantly deeper and darker colored, till it is tinged a blue red from the end to the point where it is ligated. Comparative experiments on the living body and on the cadaver have in every instance proved this satisfactorily."

Looking into the cause of this phenomena, it is evident that the red color is produced by the mechanical obstruction to the return of the venous blood; this explanation is acknowledged in the correspondence I have referred to, but it ought therefore to be also acknowledged that this is only a test for finding out if the circulation of the blood is still going on. It is true that, in every case where this circulation has not ceased, the red color described will be produced; but how about such cases of apparent death, in which the circulation has ceased, and the supposed corpse had grown cold? The red color would not be produced, and the poor victim would be pronounced dead and be buried.

The test in question is founded on the erroneous theory that in every case of apparent death the circulation of the blood has not ceased; therefore the comparative experiments on the living body and on the cadaver, which are undoubtedly correct, go for nothing. The cessation of respiration has, for an immediate consequence, the cessation of the heart's action; and if this condition continues long enough, all circulation will finally cease, and may be afterward followed by real death, from which the patient might be saved by proper means (such as artificial respiration, electricity, etc.). How long after the apparent death this real death, from which no return is possible, may take place is of course impossible to tell; it will vary according to circumstances; but I ardently wish that I had the means to inculcate into every person the principle of not having any one buried before the only sure sign of death has set in, namely, the commencement of putrefaction. This may be very soon observed in the region of the stomach, by a greenish discoloration; this is caused by the fact that putrefaction always commences in the abdomen; it may be seen at a comparatively early period, say 24 or 48 hours after the supposed death. I should be inclined to say then only that sure death has commenced; and when I think how many victims are hurried prematurely to their graves, without showing any such symptom and without any sufficient reason for the haste, I shudder.

It is more than 40 years ago that one of my nearest relations died unexpectedly; at that time I had not yet studied medicine; I believed implicitly in the declarations of the attending physicians, and had full confidence in the actual death. The burial of course took place as usual, but when afterward I recalled the symptoms of the disease and death, the appearance of the supposed corpse, etc., details which are still very vividly before my mind, and tested these with the medical knowledge later obtained by long study and practice, I have become more and more convinced that this was a decided case of apparent death, from which, with proper treatment, restoration would have been sure. I need not say that this thought has sometimes embittered moments of my life, and I write this with the sole purpose of saving others from similar experience.

P. H. VANDER WEYDE, M. D.,
Late Professor of Chemistry, New York Medical College.

Working and Doctoring Steel.

To the Editor of the Scientific American:

Some time ago, I wrote you concerning steel forgings and the hardening and tempering them by the use of salts, hydrates, etc., with especial reference to Mr. Siegfried's process. The article (in your volume XXVII., on page 277) was copied into the Newark Courier of October 26, 1872, and since then several persons have written and spoken to me, giving proofs of the truth of the assertions I made, namely, that poor steel could not be made into good steel by external working and doctoring. Let us see what constitutes poor and good steel. It is a question of the processes of production; and, to get at this properly, we must go back to the ore and its formation. But at present we will speak of forging. What shall we forge? First, let us see what our Government needs in the dock yards, arsenals, armories, navy and army. Poor steel is not wanted for any purpose, but, as a means of retrenchment and a low priced article, it is used, and, by Mr. So-and-so's process, it is said to be converted, while being forged from the bars, to a double refined quality, hard and durable. Let us look at this matter a little. If we will buy cheap steel, we must take puddled steel, or steel made from cheap and impure iron, bars rolled direct from the squeezers, or scrap iron melted in crucibles, carbon being added at the same time. This, no doubt, will be steel, poor and cheap. If cast into ingots, it may draw; if not too impure or too highly carbonized, it may be washed; if it stands heating and drawing externally, the imperfections are remedied. Internally, no doubt, an ingot made of impure iron is of the same character; as old Tom Firth used to say, if you put the devil in the pot, he is there when the metal comes out. Most iron contains more or less zinc, phosphorus, sulphur, etc., which cannot be got rid of by melting. Mr. Bessemer in his process partially disposes of them, yet I find his steel very seamy. The longitudinal seams on the outside of the bars, which, in the molds, were globules, can be welded up with borax; but an application put on and

cooled off will not do it; nor can carbon be subtracted from or added to the inner part of the ingot, except by remelting or baking, as is done with blistered steel. This latter is useless unless welded and closed together. If it were possible, and I wish it were, we could then convert all the old worn out railroad rails, of iron as well as steel, into new ones, made hard and durable; and machinery, light and strong, combining all necessary qualities for turning, boring, drilling, striking, engraving, etc., could all be made with tools forged from rag ends and broken railroad spikes. If Mr. Siegfried's, or any one else's, wash or bath can do this, or nearly so, it no doubt is valuable; if his wash or bath does not penetrate the inner part, but is confined to the outer surface, then old shoes, boots, and bones, with fire and water, have the control for the present. The other metals could not be obtained if it were not for steel, and iron, its base. It is strange that men, well informed in other respects, talk and write so much nonsense on this subject.

P. McCORMICK.

Newark, N. J.

The Moon and the Tides.

To the Editor of the Scientific American:

For several years I have been of the opinion that tides are not in the least degree formed by attraction of the moon. Among the reasons for holding this opinion the following are enumerated: First, it is well substantiated that, at the Society Islands and many other parts of the Pacific ocean, tides rise to their greatest height at twelve o'clock throughout the year. And as it is evident that those tides are formed without the moon's influence, it is but reasonable to conclude that other tides may be thus formed. Second, one of the daily flood tides, in the vicinity of New York, New London, etc., is at its greatest height when the moon is on the opposite side of the earth; which circumstance shows that the said tides are not, in the very nature of things, caused by the moon. And it is argued that if one of the daily flood tides can be formed without the moon's influence, the other can be. Can not some of your correspondents "aerate" this subject, as an immense amount of time has been spent at the schools in learning a theory which I believe is founded in error?

S. S. G.

REMARKS BY THE EDITOR.—It is rather late in the day to call in question the influence of the moon on tides. If we see a locomotive drawing a train, we conclude that the moving power is in the steam engine. Astronomers and physicists have seen the waters of the earth drawn by some invisible attraction, and, after close watching and comparison of observations, have discovered that the force comes from the sun and moon. The periods of the tides are exactly those of the bodies which raise them. The semi-diurnal period of twelve hours and twenty-five minutes is comprised between the passage of the moon over the two opposite meridians of the earth. The diurnal period during which the ocean swells and subsides twice, corresponds exactly to the duration of one apparent rotation of the satellite around our planet. There is the same coincidence for the semi-monthly, fortnightly, semi-annual, and annual periods; in fact, every change in the relative position of the sun and moon towards our earth manifests itself by a corresponding change in the level of the seas. This coincidence is not accidental but stands in the relation of cause and effect. Knowing the route which the earth pursues through space, astronomers can anticipate the future oscillations of waves and map them for centuries to come, subject to local variations, due to heavy storms and changes in coast lines. The objection of our correspondent that the tides are highest opposite the moon proves the correctness of the above theory, for when we squeeze an orange it swells out at the ends and takes the form of an ellipse, and so does the earth; when the waters are drawn out at one end, the other sides swell in proportion. Read what La Place and Whewell have to say on this subject.

A Fire Escape.

To the Editor of the Scientific American:

In view of the great loss of life in recent conflagrations, I would suggest, as a means where there is no other chance of escape, that the person in danger should take a sheet, a piece of carpet, or its equivalent (something of the kind being always within reach) tie a knot in each corner, tie two corners round the waist from behind, and bring the other corners up over the head, grasping a knot in each hand; then extend the arms well forward as stiffly as possible and jump outward as far as he can from the building, where some person should hold an extended canvas, or its equivalent, to break the fall. If there should not be such persons, the jumper should extend the toes well down, and prepare to fold the legs under, as the shock would not be so great as if the legs were kept stiff. I think also that the person should spring from the house backward as the air would escape from the sheet in a way to take him or her further from the building.

This could be tried by some good swimmer without danger, as he could jump off some elevated position into the water.

Potosi, Mo.

JAMES CURTIS.

The Proposed Great Telescope.

To the Editor of the Scientific American:

As you have suggested the construction, by the Government, of a telescope of much greater capacity than any now in existence, would it not be a commendable idea to suggest the circulation of petitions to Congress praying for an appropriation sufficient to construct the largest one that money and labor can procure? A work like this would do more for the cause of education and science than all the money that Gov-

ernment is now appropriating for scientific purposes. The law can be so guarded as to prevent any expense or outlay until the difficult portions of the instrument are completed.

A great nation ought to be able to undertake a great work. But in case my suggestion fails, then, in the columns of your valuable publication, open a subscription for the purpose of procuring the necessary amount. A few scientific gentlemen can arrange the details, and there can be no doubt but that the requisite sum will soon be secured.

Prominent scientific men, who are deeply interested in the matter, can deliver lectures upon astronomical subjects, and in this way procure the advancement of large amounts and at the same time create an interest in this most beautiful and comprehensive science. It is a subject well worthy of national consideration, and it is to be hoped that your journal will urge such action as will secure success.

THE TELESCOPE IN THE CAMBRIDGE UNIVERSITY.

About twelve months ago, the German Astronomical Society divided the northern heavens into zones of five degrees each, within which all stars up to the ninth magnitude are to be carefully observed twice and their exact positions recorded. Portions of this work were given to the observatories in Cambridge and Chicago, that of Cambridge being the zone included between 50° and 55°, containing about 7,500 stars. At the observatory of Cambridge, this work was begun on November 10, 1871, and it will require three years longer before it can be completed, only 700 stars having thus far been observed.

The telescope used for the purpose is a marvel of mechanical delicacy and ingenuity. It is nine feet in length, its object glass is eight inches in diameter, and it is constructed throughout of carefully beaten brass. At each side of the instrument is a system of prisms and reflectors, together with graduated circles divided into spaces of five degrees. The figures on the latter are believed to be the finest in the world, four delicate microscopes being used in reading them. The prisms and reflectors are placed in glass cases, and serve to carry the light from a single flame to every point of the telescope where illumination is necessary. By this means, the small wires in the eye piece used for calculating the position of a star, and also the graduated circles from which the degrees are read by the microscopes, are brilliantly lit up; while another series of reflectors throws a flood of light over the recording table.

The best qualities of the telescope are its marvelous rapidity of movement and admirable steadiness and rigidity. By the aid of a finding arc, divided into spaces of five degrees, the instrument may be set eleven times in the brief space of one minute, at an equal number of degrees ranging from extreme north to extreme south. In zone work, where the graduated arc is necessarily much shorter, the telescope can be set even twenty-two times in a minute. The average work of the telescope is from thirty to thirty-five stars per hour. Fifty-two stars have been observed in this time, which, the Boston Globe, from which we obtain the above description, says is the most rapid work ever accomplished at the observatory. The shortest time in which the observation of a star can be made is thirty-five seconds. Between April 1871 and May 1872, four thousand observations were taken, and a catalogue of seven hundred stars made.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the months of October and November, 1872:

During these months, there were 2,217 visits of inspection made, and 4,162 boilers examined—3,922 externally, and 1,311 internally—while 373 were tested by hydraulic pressure. The number of defects in all discovered were 1,981 of which 493 were regarded as particularly dangerous. These defects were as follows:

Furnaces out of shape, 102—23 dangerous; fractures, 302—89 dangerous; burned plates, 138—52 dangerous; blistered plates, 267—35 dangerous; sediment and deposit, 420—25 dangerous; incrustation and scale, 383—45 dangerous; external corrosion, 145—21 dangerous; internal corrosion, 55—7 dangerous; internal grooving, 22—3 dangerous; water gages defective, 123—19 dangerous; blow-out apparatus defective, 32—8 dangerous; safety valves overloaded, 59—29 dangerous; pressure gages defective, 235—33 dangerous. These varied from 10 to 420. Boilers without gages, 145—25 dangerous; cases of deficiency of water, 19—12 dangerous; broken braces and stays, 49—34 dangerous; boilers worn out and beyond repair, and condemned, 31. Many of the defects enumerated above come from neglect on the part of the boiler attendants. The boilers are blown down under heavy pressure, or, having been blown down, are filled up immediately with cold water, and bad fractures are caused. Some boilers have been found set with the minimum water line below the fire line. Theoretically, there is but one water line, and practically it should be the same; but we not unfrequently find water carried at different heights in the same boiler. The water gages or try cocks should be so arranged that water discharging from the lower one indicates a sufficient height above the fire line to thoroughly protect the sheets from overheating. Boilers should be cleaned often. The accumulation of mud and various kinds of deposit renders the boiler liable to be badly burnt. There are many "little points" that must be observed, if safety and economy are to be attained. "Little things" neglected often lead to great disasters.

PROFESSOR TYNDALL sails for England on the 5th of February.

GLEANINGS IN SCIENCE AND ART.

In Pursuit of Scientific Information.

Some years past, among a variety of presents to the Imam of Yeman, from an English gentleman, was a medicine chest. His Royal Highness availed himself of an opportune visit of a European to his domains, to ascertain the exact virtue of each article, writing out in full with his own hand the dose, to prevent mistakes. How he succeeded in the administration of drugs to cure diseases of which he knew less than he did of the remedies has not been chronicled.

Before the dethronement of His Majesty the last king of Oude, in a collection of presents from the British Government was a box of soda powders. He demanded of the chamberlain of the palace what they were for? It was explained to him to be a right royal beverage, such as was habitually taken by the sovereign of Great Britain. "Well then," said the great potentate of India, "let me try them." One dozen papers of the soda were dissolved in a tumbler of water and gulped down at one long swallow. Smacking his lips, the monarch denounced it as a barbarous drink as ever was invented, expressing unqualified surprise that Christian royalty could revel on such horrid stuff.

Fortunately it was discovered that there were twelve papers of tartaric acid to go with the first. "Ah ha!" exclaimed the king, still scowling with the shocking taste of soda, "let us have them instantly." A moment after, the whole court was thrown into frightful alarm by the extraordinary contortions, writhings and groanings of His Majesty, rolling over the floor, oppressed with gas. He felt himself blown up like an air balloon, expecting momentarily to explode. When relieved, he expressed surprise that the civilization of Europe considered soda water a luxury for none but crowned heads!

Power of Intellect.

Thomas Telford, who died in London on September 2, 1834, was one of the most remarkable engineers of our times, when the circumstances of his origin are taken into consideration, as family influence is so potent in Great Britain. He was the son of a poor shepherd in Scotland. His father died when he was a small boy, leaving him alone to contend with poverty for position. Unaided he became a splendid French, Italian, and Latin scholar, and an engineer of such transcendent ability as to be an eminent authority. Bridge building was his forte. He built the suspension bridge at the Straits of Menai, quite as marvelous as the tubular bridge a mile above it. St. Katherine's docks in London are splendid evidences of Mr. Telford's extraordinary engineering attainments. His death was deplored as a national loss.

Androides.

Wandering one day through the streets of Vienna, notice of an exhibition of various mechanical figures was sufficiently attractive to induce us to enter. It was a rare collection of apparently self-moving men and women, who had everything but souls to make them independent citizens. Vaucrin was one of the extraordinary mechanical geniuses in the early part of the last century. His artificial duck, that paddled about the margin of a pond, picked up corn and significantly quacked at suitable intervals, was a wonderful triumph of skill, but the spinet player put into the shade every androidal invention before or since. There sat a really handsome young lady before the instrument (the forerunner of the present piano) with a music book before her. When wound up, the performer first looked either way upon the audience, bowed gracefully and then began to finger the keys. She swept her fingers to and fro the whole length of the instrument in the usual manner—the fingers acting separately—vibrating over the ivory so naturally as to deceive any one not informed that she was a mere machine made up of an aggregation of wheels, cams, levers and catgut cordage. As many different airs were executed as were satisfactory to an inquisitive stranger: of course old French music, in vogue when the artist finished the interior. After the springs were exhausted, the operator unbuttoned the musician's dress between her shoulders, unlaced her stays, and next with a key unlocked the chest. Swinging open a brass door, there was an exposition of contrivances, especially of cams as thin as paper sliding side by side, amazing to view. There was a multitudinous congregation of powers. Catgut cords extended from barrels down the arms to the extremity of each finger, which they controlled precisely like digital muscles. It would be a prolix story to dwell on all the minutiae of that masterpiece. Suffice it to say that the man having the show, himself a mechanic of rare ingenuity, said that from boyhood he had read about the spinet player. When he had completed his apprenticeship, he went to Paris to find it. After a tedious persevering search, it was found packed away in a lumber room of one of the state departments, where it had been forgotten, having been there since the outbreak of the French revolution. He had permission to take it away on a promise to return it, he holding out an expectation of being able to put the lady once more in motion, which no modern artisan would undertake to do. He soon mastered the intricacies of the mechanism, and we saw it redolent, good as new. Another androidal movement, quite as astonishing, in the same exhibition was a miniature old man, smoking while drawing a hand cart laden with trunks and boxes. Of course both man and cart were on a small scale, but so extraordinary was the resemblance to a live man bracing his feet in order to drag the load, a spectator could hardly restrain an expression of enthusiasm as the cart rolled along the floor. It was the production of a watchmaker somewhere in Switzerland, who was paid five hundred dollars for the curiosity, which he made in the course of long winter evenings. Since Menzel exhibited the mechanical chess player (which, by

the way, was not conducted by machinery), although the rope dancer, a skilfully managed wonder, more nearly approached a first class androidal device, no very striking things have been invented of that kind, at home or abroad. The trumpeter was a marvel at first, but the same bellows would have supplied the instrument with wind if it had been in a barrel or a packing box. When that fact was realized by visitors, the excitement gradually subsided. Some inventors among us are capable of making such ingenious contrivances, but few can afford the time.

Primitive and Modern Light Houses.

Commercial enterprise must have the fostering care of government. Safety for life and property at sea is better secured remote from land than on the coast. Early, therefore, in the maritime industry of England, poor people residing near inlets, the estuaries of rivers, or dangerous rocks, were accustomed to build fires at night to apprise seamen approaching shore of their relation to channels, shoals, or ports, as the case might be, for which they received presents for their useful service. In time, such lights became indispensable. Finally, Government erected towers, supporting lanterns at the top. That took, from those who had kept watch fires, some of their living. Some were able to erect light houses themselves, and a law was enacted allowing them to collect, from passing vessels, a fee for the light. In the first case, ground rent was paid as a compensation for loss of their former pittance. Such was the beginning of light houses on the coast of England. At length a board of superintendents was created, to see that lights were attended to, which is the origin of the Trinity House. Even now, very many light houses are private property, yielding bountifully, and some of the old light house ground rents are extremely valuable, the foundation of the wealth of some families. They go to the custom houses to get their income, which the collector of a port exacts from coming and going vessels. American vessels for a long while were assessed for light money on entering English ports, while here, all light houses belong to Government, which never has exacted anything from navigators. This condition of things, making us pay and paying nothing when English vessels came into United States ports, led to modifications of British light money regulations, so that no light house tax is now imposed on American vessels on arriving in British waters, as formerly. Instead of large blazing fires, as in the olden time, or till within a few years, consuming enormous quantities of sperm oil for light houses, it being the only kind that could be relied upon in extremely cold weather, the whole system has been improved immensely. The consumption of oil is far less, while many excellent arrangements of reflectors characterize modern constructed lanterns. No new improvements have recently been suggested. France has taken the lead of other nations in light houses. A detailed description of the manner of utilizing light and throwing it to the greatest distance, as accomplished in France, would make an essay. Those who are particularly interested in that department of science would be profited by recent publications on the subject from the French press. According to an official report of the Light House Board to the present session of Congress, there are 179 sea and coast lights, 394 harbor and river lights, 22 light ships, 354 day (unlighted) beacons, and 2,762 buoys, in position at the expense of the United States. Besides, there are 33 air and steam engines, with signal trumpets loud enough to be heard above the roar of the surf, together with shrill whistles, the siren and other curious devices to give mariners seasonable notice in fog, storm or darkness. No nation on the globe is doing more for the interests of commerce and safe navigation than ours.

Diving Bell Deafness.

Considerable attention has been directed to well marked cases of deafness resulting from going down in a diving bell. One of these aquatic exploring machines is suspended from a crane in the Polytechnic Institution of London, and is usually let down in a deep tank every evening. Those desirous of ascertaining how it feels to be under water are permitted to descend. Resulting from such excursions, it is alleged, the sense of hearing is impaired. More than eight years since a young lady felt a pain in her ears while under the bell. On coming to the surface, one ear was nearly deaf and the hearing in the other defective. The advice of an aurist proved of no avail. Diving bells are in constant requisition in harbor improvements. Large numbers of operatives are employed, who are experienced in under-water work, but no serious injury to their ears has come to our knowledge. Possibly in a small diving bell, closely packed with visitors, the speedily vitiated air might derange the tension of the drum, which would drag out of place the little internal auditory bones; while in a very large one, no such contingencies are to be apprehended.

Raising Giants.

King Frederick William, of Prussia, father of Frederick the Great, determined to raise to order soldiers whose stature should meet his views of what grenadiers, to serve royalty should be. The army was his hobby, and tall men his special admiration. He had a regiment at Potsdam that was the talk of the world, on account of their heads and shoulders being far above ordinary humanity. There were three battalions of 800 each, 2,400 in all, perfect Anaks, the shortest of the men being seven feet and the tallest nine. Such lofty beings were procured from all countries in Europe without regard to cost. James Kirkman, an Irish recruit, could not be had till six thousand dollars were paid. Tall men were decoyed and put into service at all hazards. Next he compelled them to marry unusually tall women, whether they consented or not. Prussia is rich in very tall subjects,

the descendants of those gigantic grenadiers; these are far taller than the full blooded Kentuckians. In spite of his eccentric majesty's efforts, however, Nature would have her own way, and the children of such parentage were not all tall at maturity. Then again, another law came into operation to thwart the monarch's ambition to develop a race of monster men. Short men very generally prefer tall wives, and tall women, dapper little husbands. Of course there is no very philosophical way of accounting for taste, but such is the fact. There is a growth limitation to plants and animals. On reaching the predestined dimensions, those active artisans that built up the body, as far as the law of limitation requires, cease laboring and a permanent type of size is thus established. It is impossible to go counter to those laws and raise giants of any kind. A few individuals, transcending their kindred in altitude, are apparently accidental or at least are beyond explanation; but anomalies in that respect, like monstrosities, cannot be perpetuated through generations.

How Far we See.

Herschel was of the opinion that, with the telescope he used in those researches in the heavens which immortalized his name in the annals of Science, he could penetrate 497 times farther than Sirius, assumed to be at least so far distant that the sun is near at hand in comparison. While exploring with that instrument, 116,000 stars flitted by the object glass in one quarter of an hour, and that subtended an angle of only 15°. So all the worlds are moving rapidly in space. Reckoning from the limited zone thus inspected, the whole celestial region could be examined by giving time enough to the enterprise; and judging from a few sections only within the scope of assisted vision, more than five billions of fixed stars might be reasonably supposed to be recognizable, and could be seen with modern improved instruments. But more are beyond, vastly beyond, and we are hoping and expecting that, when Mr. Clark, the self-made astronomer of Cambridge, Mass., and the most progressive telescope manufacturer now known to scientists, has completed his great work, far more amazing discoveries will be made in the firmament. Surely, the mechanism of the heavens demonstrates the existence of an Intelligent First Cause, since such magnificent displays of unnumbered worlds, regulated by laws which secure order in the universe, could not have originated themselves. God surely reigns and directs.

London Polytechnic Institution.

Instruction with amusement is the great feature here. All the lectures are of a popular cast, beautifully illustrated by men who have a faculty for making difficult things familiar to a child. It is a rare accomplishment. Most of the learned lecturers who come before the public shoot over the heads of the audience. It is a positive mistake to set in motion an artillery of unpronounceable terms, which only a Greek professor could comprehend. Lectures in that institution draw immensely, even in the middle of the day, so eager are those in pursuit of useful knowledge to hear and see. Chemistry has been a leading topic, though every branch of science has its representative in the course of the season. The fee is small, therefore the theater is full, and is crowded when a good lecturer is to appear. If precisely the same system were inaugurated in New York, and it could be kept from being the instrument of two or three professors whose reputation essentially depends on keeping all other talent out, the success of the enterprise cannot be doubted. One of the encouraging circumstances of the London Polytechnic is its perfectly democratic character. No one ambitious aspirant for fame is allowed to monopolize a chair to the exclusion of others. Thus variety in manner and matter is insured, and the public like it. An audience tires of the same lecturer forever and for aye—an arrangement sometimes called the American system. The stomach loathes to have only one kind of food at every meal. Variety is as necessary for the brain as a change of diet for the stomach.

Fat and Lean.

Meat eaters and vegetarians show in their persons the effects of the diet. The first has the most brain force and nervous energy. A mixed food of animal and vegetable rations develops the highest intellectual powers. A strictly vegetable living ordinarily gives a fair complexion, and amiability and extreme pugnacity when the vegetarian's views in regard to that engrossing thought of his life are discussed. They are annual-meeting reformers, without ever setting a river on fire. Arabs are a sober, frugal race, rather slender, not tall, conscientious and contentious on religious subjects. They largely subsist on rice, pulse, milk and kelmec, something similar to whipped cream, through a vast region of an arid country where they are indigenous. They are not destitute of mutton, goats, camels and game; but they manifest no disposition to feed upon meats, as is necessary in temperate zones or in high northern latitudes. An intellectual man, one of their kindred, who rises to distinction by the grandeur of his mental status, is extremely rare. The beer and ale drinkers expand and grow fat, but they are not much given to profound researches in Science.

Death of Professor Rankine.

We regret to hear of the death of W. J. M. Rankine, Regius Professor of Civil Engineering and Mechanics in the University of Glasgow, Scotland. The deceased professor had a long and widely extended reputation, and was a member of many scientific societies in the different countries of Europe and America. His "Manual of Machinery and Mill-work" is a standard authority on the geometry, dynamics, and construction of machinery. He died at Glasgow on December 24, in the 53rd year of his age.

IMPROVED SEED PLANTER.

The invention herewith illustrated is a seed planter in which the amount of seed required for a hill is elevated within the seed hopper, and discharged through a hole in the upper part of the hopper into a drop tube. The seed is thus deposited at proper intervals and without injury.

Fig. 1 affords a perspective general view of the device, and Fig. 2 a sectional plan from which the working details will best be understood. A is the seed hopper mounted on a frame supported upon wheels. The axle revolves with the wheels, and upon it are cams, B B, which impinge upon the lower end of a slide, C. The latter is thereby caused to reciprocate, being first raised by the cams and then returned to its original position by the reaction of the spring, D, attached to its upper extremity. The slide, C, moving close to the back of the hopper, carries a cup, E, shaped as shown. In the back of the hopper is also the opening, F. When the slide, C, is raised by the cams the cup is brought opposite this aperture, through which its contents pass into the discharge tube, G. The orifice, F, is kept closed while the slide is down, by means of a spring cover, H, which is raised clear of the hole by the ascending cup. The partition, I, in the hopper is notched or perforated at the bottom to regulate the height to which the seed fills the back compartment. When it is desired to transport the planter from one locality to another, the slide, C, is held elevated clear of the cams by means of the bolt or catch, J, on top of the hopper. The furrow for receiving the seed is opened and closed by suitable devices attached to the frame of the apparatus.

Patented through the Scientific American Patent Agency, October 29, 1872. For further information relative to sale of rights, etc., address the inventor, Mr. John H. Dancy, Dancyville, Haywood Co., Tenn.

COOLING OUR HOUSES.

To the Editor of the Scientific American:

In your paper of September 4 was published an article of mine on heating and cooling our dwellings, to which replies were made in the issues of October 5 and 14, on which I desire to say a few words.

In the article of October 5, R. H. A. expresses the idea that my method might prove injurious, as there is danger in a sudden and extreme lowering of the temperature from 90° to 75°, the dew point. Of course there would be danger if it were carried to an excess, as there is in all excesses; but of this there is no probability whatever. During the past three or four years, the experiment has been thoroughly tried in the Capitol building, in this city, and instead of making it dangerously cool, the only difficulty has been to get it cool enough. As is generally known, the building is ventilated by means of fans worked by steam engines located in the basement, which force a large volume of air, through passages, into the rooms above, the air being heated during cold weather by means of steam pipes laid in these passages. During the summer session the halls were uncomfortably hot; and, to remedy this, large quantities of ice—a ton or more at a time—was placed in the passages, and the air passed over and through it, but with little effect. It was found impossible to lower the temperature in the House or Senate more than from 2° to 4°. Finally, the present engineer of the Senate, Mr. H. F. Hayden, hit upon the plan of water spray in the air chamber: a fine spray or mist, as though made by a gigantic atomizer, and the result was most beneficial, the temperature being reduced from 10° to 14°. This has now been used for two seasons or more, without any injury.

I give you herewith a diagram of the building, showing the apparatus in operation. So I think R. H. A. may dismiss his fears on that point. It is not so easy to lower the temperature of our rooms in hot weather as to create any danger from an excess in that direction, as those who try it will find.

With reference to the plan suggested by Egberd, in the issue of October 14, I would say that it is not practicable, especially in cities. As a general rule, there is no room for building the tall chimneys and digging the connecting tunnels suggested by him. Besides, such an ar-

rangement would cost more than an ordinary dwelling, and is, therefore, out of the question in private residences. And unless the air in the building was at a higher temperature than that outside, the current would be from the house out through his chimney, the heated outer air, of course, rushing into the rooms through the windows and other openings, and thus creating the same temperature in doors as out. Even if an inward current could be assured, the air would not be perceptibly cooled by passing through his tunnel, un-

improvement that the apparatus should be located in the attic instead of the basement, for the reason that the cold air, being heavier, would naturally sink, and thus require less power. That is true; but unless the air in the attic is first cooled it would not be heavier; and it is impracticable to locate and operate the cooling and forcing apparatus in the top of the house. Power must be used, and to render it convenient, it must be down stairs. As yet, I have seen nothing to convince me of the impracticability or danger of my plan, previously described, and I intend to give it a thorough trial the coming summer.

In conclusion I may state that, during the heated term of the past summer, I had located over my desk a fan, operated by a small water engine of seven eighths inch piston, and I found it such a luxury that I intend never to be without it hereafter during hot weather, in this latitude at least.

W. C. DODGE.

Washington, D. C.

Exhalation of Carbonic Acid by Man.

Some interesting researches on the quantity of carbonic acid exhaled in a given time from the skin of a man have been conducted by Herr H. Aubert and his assistant, Herr Lange, and have appeared in the last number of Pflüger's *Archiv für Physiologie*. The experiments have been carefully made in an air-tight chamber, in which the subject for experiment was seated, and

through which a current of air, freed from carbonic acid, was steadily passing, while the proportion of carbonic acid in the air on leaving the chamber was estimated by transmission through bulbed tubes containing a solution of a salt of barium. The results of these investigations lead to the general conclusion that sixty-two grains of carbonic acid are exhaled from the body of a full-grown man, through the skin, in the course of twenty-four hours.

The "Scientific American" in Philadelphia.

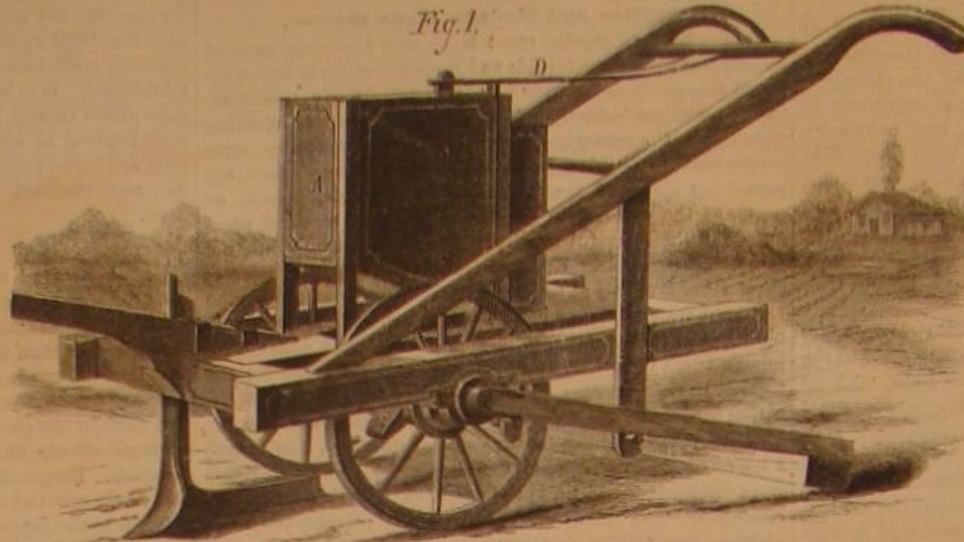
Messrs. Richards, London and Kelley, of Philadelphia, Pa., write as follows: "We have presented, to each of some 8 or 10 apprentices, a subscription to the SCIENTIFIC AMERICAN, believing that they will be much the better for reading it. They are pleased with the idea and are stimulated to increased interest in their trade. Many of our workmen have been subscribers for a long time, so that fully 50 per cent of them are taking your paper, as well as other mechanical works—a reading community. We will add to the list of subscribers as we have occasion. Permit me to add that the SCIENCE RECORD is very finely edited and is very interesting. It will receive a position in our library."

Gentle Words for Horses.

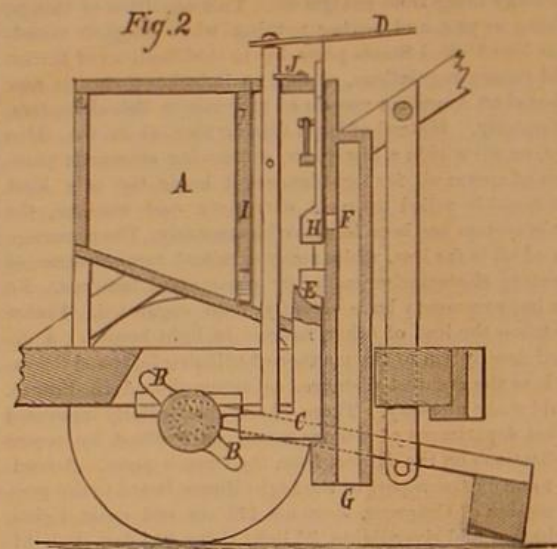
If horses were next thing to deaf, there would be an excuse for the shoutings and yellings so generally indulged in, but they are not, and therefore need not be spoken to so loudly and harshly. The ear of a horse is very sensitive, and, save in exceptional cases, it is possible to control his motions by a command given in a moderate tone of voice.

A horse is a teachable animal, and is always affected by kind treatment. The fact of the matter is that, if kind words and gentle treatment throughout were given to these noble animals instead of oaths, curses, and blows, we should find their docility greatly increased. Just imagine, if you will, a gee! or whoa! uttered in a tone sufficiently loud to be heard half a mile distant, and this command given to an animal within five or ten feet of the party giving it. Wherein consists the necessity for it? Why not resort to more rational and certainly more pleasing means? Why not speak in a moderate tone? This is all that is required. The horse, if not deaf, can hear it, and will as readily obey as if given in thundering tones.

One of the best managed teams ever seen was controlled by the driver without the indulgence of this unmusical yelling. The driver rarely ever spoke above his ordinary tone of voice, and yet his horses laid into their work with as much willingness and apparently greater earnestness than if they had been driven to it by fearful shoutings and blows. The horse is an intelligent animal. None of the brute creation more readily appreciate kind words and kind treatment. Such facts should be considered always by those who have the care of these animals.

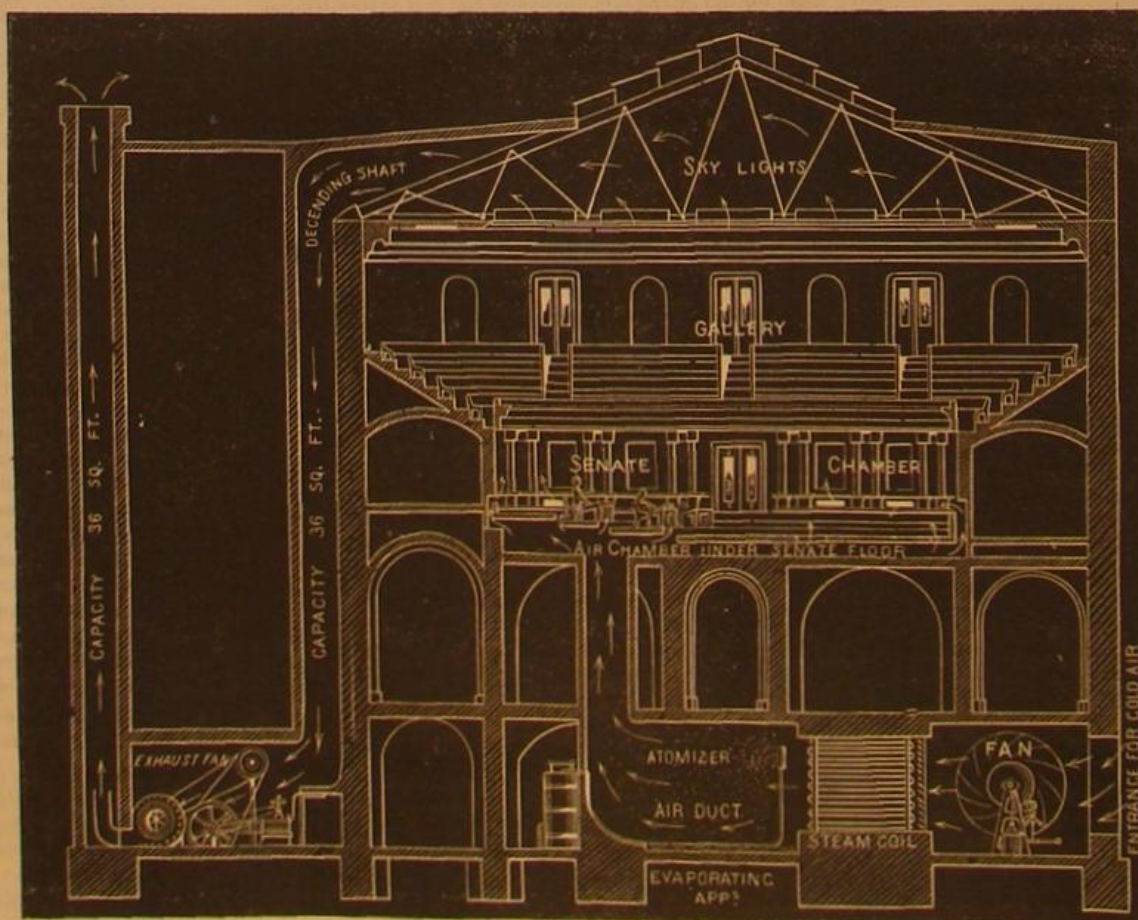


DANCY'S SEED PLANTER.



over the Potomac river from this city, and is found to work well; but it is both long and large, there being plenty of room, and the ground is well adapted for such a purpose.

Some other correspondent, I forget who, suggested as an



ELEVATION SHOWING THE DEVICES NOW IN USE FOR WARMING AND VENTILATING THE SENATE CHAMBER WASHINGTON, D. C.

NEW BRIDGE OVER THE NILE.

The accompanying engraving, prepared from a sketch made on the spot for *The Engineer*, shows a handsome new bridge across the Nile, which has just been completed for the Egyptian Government by Messrs. Shaw and Thomson, of Leadenhall street, and their colleague, Mr. John Dixon, engineer and contractor, of Laurence Pountney Hill, London.

In furtherance of the vast improvements which the enlightened policy of the present ruler of Egypt, his Highness Ismail Pacha, has inaugurated, it had become absolutely necessary to connect the city of Cairo with the fertile and populous district on the opposite banks of the Nile, a district lying between the river and the Pyramids, embracing the town of Ghizeh itself, innumerable villages, large and small, the palaces of the Viceroy at Ghizeh and Ghizereh, and those of some of his principal nobles.

Some two hundred years ago the erratic and invading Nile flowed past Cairo in one grand unbroken stream. The accidental sinking of a native felucca or barge, laden with stones, caused the formation of a sand bank. This sand bank, sitting up, gradually increased in size, and in time became dignified by the name of the Island of Ghizereh, which is now some four or five miles long and more than a mile broad. Down each side of this island flowed an arm of the noble river. On the shore opposite the suburban palace of Kasir-el-Nil stands that of Ghizereh, best known to European visitors by the gorgeous festivities celebrated there on the occasion of the marriage of the eldest daughter of the Khedive, or what in England they would style the Crown Princess of Egypt. Close to this spot a bridge of boats was, for some years, in existence to accommodate the teeming traffic, which floating structure gave place, early in the present year, to the permanent bridge of Kasir-el-Nil, constructed by a French company and French engineers during three years of labor.

Meantime the western arm of the river had been rendered passable by the thoroughly Egyptian expedient of throwing dams across it, on the tops of which the roads were formed. But old Nilus would not tolerate such re-

straint, and, threatening to burst his bonds and widen his bed, by washing down the palaces and quay walls that bordered his sole remaining channel, it became imperatively necessary to bridge over as rapidly as possible and reopen the old waterway.

Time being an object, the work was confided to English hands, and with a result that seems fully to have justified the confidence thus reposed. The plans, designs, and arrangements were, we believe, matured by Mr. Dixon, the en-

gineer, and submitted to the approval of Mr. Fowler, as chief consulting engineer to his Highness the Viceroy. An active commencement with the works was made in the beginning of January of the present year. By June, sixteen cast iron cylinders, 88 feet long and 8 feet 6 inches in diameter, had been sunk in the bed of the river, and six smaller cylinders had been fixed. By September, 1,700 tons of iron work had

which Ismail Pacha will be best remembered. The bridge is of iron double trellis girders, and constructed with a swinging draw having a one hundred foot opening. The length of the bridge is 1,350 feet; width, between centers of girders, 40 feet. Total weight of the iron work, 1,700 tons.

How Dangerous Ice Gorges may be Avoided.

A correspondent of the St. Louis *Railway Register* furnishes some timely hints relative to the removal of the ice gorges which, forming every winter in our rivers, often cause great damage to vessels and other structures. These gorges are sometimes isolated, but sometimes a succession of them, separated by intervals of but a few miles or less, is formed: they are occasionally of such magnitude and depth as to completely dam up the river, especially if resting upon a hard bottom, producing inundation of the low lands. There is generally sufficient head in the confined water to cause the ice to move with considerable velocity upon the sudden rupture of the gorge.

Ice can be blasted as well as any other material, and ice blasting has been frequently practiced in Europe. For this purpose any of the explosives can be used; blasting powder is employed where slow burning is required, and for quick burning any of the explosive compounds, as dynamite or dynamite, will serve. In breaking up a gorge, one would commence in general at the lower end, taking off strips all the way across, allowing them to float down with the current, and working up thus towards the head until the end was accomplished. Care would be required not to produce enough disturbance to start the whole mass at once, as, in that case, the operator would produce just what he was aiming to avoid, and perhaps bring down a mass of ice on himself from some point above. Where it is necessary to remove an intermediate gorge, and there is not current enough in the reach of water below it to float off the pieces, a moderate cur-



BRIDGE OVER THE NILE AT GHIZEH.

been manufactured and sent out from England, transhipped up the Nile, and placed in position; the masonry and concrete were completed, the swing space was turned round on its axis by the aid of one man, and in November the finished structure was finally handed over to the intelligent young Prince who presides as chief of the Public Works Department in Egypt.

The bridge belongs to the class of works which benefit a country. The work belongs to the industrial monuments by

rent could be induced, in some cases, by opening a narrow cut in the gorge below, although this might be an operation of some difficulty. Where a line of telegraph runs in close proximity to the river, several parties can operate simultaneously and in concert, by means of the rapid and easy communication thus afforded. Of course it is not assumed that circumstances will always favor blasting, but that it is sometimes of great benefit, experience in other countries has plainly shown.

LEARN TO DRAW.

To the artisan, there is no acquirement outside his trade which is of more direct benefit than a fair knowledge of drawing. The mechanic that can make a graphic sketch of a machine or a good working draft of the same possesses an advantage over his fellows that will materially promote his advancement and, besides, greatly facilitate his education in his chosen calling.

Drawing, like instrumental music, requires the cultivation of both eye and hand; the former to appreciate things as they really are, in form, color and position; the latter to act as the servant which reproduces the similitude of the objects recognized by the perceptive faculties. It is, therefore, necessary to bring both mental and physical powers to a given degree of education in order to attain a certain amount of skill.

A few practical hints on this subject, designed to serve as an answer to the question "How shall I learn to draw," will perhaps be found of advantage. At the beginning of the study, exercise the eye in appreciating the shapes of simple objects and the memory in retaining the notion of form. We must learn, and no principle must be more strictly followed, to see a thing as it appears, not as reason tells us that it is. For a common example, we well know that a certain piece of furniture, a table, is of such and such a shape; that is, its legs are of equal length, that they rest on the floor, its top is flat, etc. Now, if we wished to depict our table in a sketch from a given point of view, if we allowed our knowledge to govern our eyesight, we should undoubtedly fail to produce a correct representation; and this simply because, relying upon fact previously acquired, we should draw what we do not see. We should, to exemplify, make all four legs of equal dimensions, whereas those furthest from us appear the shortest; we should represent the flat surface as rectangular instead of oblique and acute angled, and, to carry out the idea still further, did we color our drawing, we should paint it a single shade of oak or mahogany, so that in the end we should have a distorted image of a uniform hue. We should thus annihilate distance, light and shade; and to illustrate once more our mistaken method, we would represent two similar objects, one beside us and the other half a mile away, as of precisely the same dimensions. Without pursuing this branch of our subject further, let the reader either try the effect for himself, or, if he desires a more graphic representation, let him look among Hogarth's engravings, to be found in book form in any public library, for a landscape which he will find thus depicted. The absurdity of the drawing is obvious.

Necessarily, the rules of perspective will aid us to avoid the above difficulty; but, except for mathematical drafting, we should advise the student not to hamper his mind in the beginning with geometrical demonstrations, but to educate his eye to unassisted effort. Nature is the best teacher, and constant practice in representing her in her ever varying forms will lay a better groundwork for future accurate drawing than all the treatises ever compiled. Let us counsel the beginner at the outset to beware of published systems or "drawing without a master" handbooks; we never knew them to produce any other result than an inextricable confusion of ideas. The student should commence with pencil and paper to depict the simplest object—for instance, a box—and represent it in all positions. It may at first be difficult to perceive the exact form, owing to the relief caused by light and shade; but if the eyes be partially closed and the object regarded through the eyelashes, it will appear to be an irregularly shaped mass and its outline will be readily followed. No matter how rough first attempts may be, persevere. Skill can only be acquired by practice; and as the perception is educated, the hand will grow in cunning. Avoid artificial aids of every kind; they only retard true progress. Erase as little as possible; aim at correctness at once; do not make a line until it has been considered. Work slowly—rapidity of execution and brilliancy of effect will come in proper season. Study to express an idea in as few lines as possible. A glance at the works of skillful artists will show how simply and yet how surely every stroke of the pencil has a definite purpose. Follow Ruskin's advice, and never give away a drawing; to present a friend with a poor one is no compliment; to donate a good one is to deprive oneself of the best result of all previous labors. Keep all failures and successes; they are milestones in our onward path. Systematically avoid the lithographed pictures sold to serve as copies; we never saw any that were not, at best, of doubtful excellence, calculated to rather mislead than advance the pupil. There is no merit in servile copying; if such is to be done, better use tracing paper at once. Draw boldly—timid and weak strokes never produce broad effect or a vigorous picture. Better see too little than too much—a few curves accurately drawn represent a tree in a sketch infinitely truer to nature than the labored and necessarily imperfect delineation of every leaf or spray. Facility in outlining acquired, shades and shadows may be studied. Here the counsel of one skilled in art may be sought. We mean skilled in art in the fullest sense of the term; a poor or mediocre teacher is worse than none; the best talent attainable may be more costly, but it proves the cheapest in the end. It is an abominable practice in many schools to have the students' drawings "corrected" by the master. It is needless to add that every spark of individuality is extracted from them, in order that the pupil may "show progress," or, by producing pretty pictures, gain a fraudulent credit for the instructor. This, of course, should not be permitted, for the teacher should be but a guide to call the attention of the learner to what would otherwise escape his notice; to point out that certain effects that apparently are the result of accident, are subject to

known laws, and finally to instruct in the mechanical labor of the manipulation of materials.

It is excellent practice, after a fair degree of skill is acquired, to strive to produce representations of images formed in the "mind's eye." Houdin, the French conjurer, says in his memoirs that his marvelous dexterity in deceiving the senses of others was largely due to the high cultivation of his perceptive powers. He mentions that he began by rapidly walking past a shop window and afterwards trying to call to mind as many of the objects therein, together with their peculiarities of form and color, as possible, afterwards verifying his memory. This plan on a simpler scale may be practiced in learning to originate. Commencing as before with some simple article, regard it carefully, and, after placing it out of sight, endeavor to draw it from the image left in the mind. From this, advance by degrees until it is found that a short glance at an object is sufficient to ensure a fair representation of its general appearance. Then seek to imagine forms and to draw them correctly, always remembering to select such articles as subjects as that the sketch may be verified with the original after completion. Do not aim at too high a standard; it is well to recollect that art is a jealous mistress and requires long years of servitude before she becomes the servant of her pursuer. Seek rather to obtain a fair proficiency, when further progress will be optional and dependent solely upon the ability and desire of the student to devote the necessary time and labor.

In conclusion, let us add a word as to how working men may learn to draw. It is better for some one man to seek to interest his comrades and so get a number together in pursuit of the same object. The enthusiasm of a single individual is apt to fall when unsupported; competition between several is an excellent incentive to labor and success. We were recently informed of an admirable plan adopted by the mechanics in the shop of the New York Steam Engine Company, in Passaic, New Jersey. These men have clubbed together, purchased for a small sum the necessary instruments, and are now pursuing, during their spare time, a course of mechanical drafting under the guidance of the draftsman of the establishment. This example deserves to be widely followed, and we believe that these mechanics will have no cause to regret so wise an expenditure of unoccupied hours. The same system may be adopted by a sketching or reading club, and thus every opportunity gained for mutual and self improvement.

The inventor that can represent his idea upon paper, and thus give it tangible form, is at once possessed of an object capable of elaboration. His mind is unburdened, as it were, and free to range to other thoughts. The artisan that can fill a volume with suggestions of improved devices as they occur to him in the routine of his every day life, or is able, sketch book in hand, to jot down the good ideas of others, secures an unfailing fund of information, which, if not some time directly productive of lucrative returns, will be of inestimable benefit to him throughout his whole career.

DR. DRAPER'S RESEARCHES IN ACTINO-CHEMISTRY.

The well worn figure, which likens the investigator of the secret laws of the universe to the explorer of unknown lands, is truer than we sometimes think it; and the history of the outposts which he thrusts far into the dim region of the unknown is very apt to be like that of the advance stations of the pioneer in geographical discovery. The fortunate researcher may strike a point, a Mexico or a Peru, whose visible wealth will bring him immediate glory and compel the tide of conquest to set at once in that direction; or it may be a California, which must wait till the slow advance of generations shall make the time ripe for the full development and appreciation of its riches. The history of science is full of these contrasts, as every student knows. Of the latter sort of advances, a fine illustration may be drawn from some of Dr. John W. Draper's researches in actino-chemistry. In papers published thirty years ago, Dr. Draper maintained these two propositions, namely:

1st. That so far from chemical influences being restricted to the more refrangible rays, every part of the spectrum, visible and invisible, can give rise to chemical changes, or modify the molecular arrangement of bodies.

2d. That the ray effective in producing chemical or molecular changes in any special substance is determined by the absorptive property of that substance.

These points were well taken; yet the standard treatises on the solar spectrum continue to teach that only the more refrangible rays have power to produce chemical changes.

In the last issue of the *Philosophical Magazine*, Dr. Draper restates these propositions with an abundance of evidence to prove the current teaching incorrect. Even the so-called curve of chemical intensity, derived from the action of sunlight on the sensitive salts of silver, does not truly represent the range of chemical action in the case. By a careful determination of the habitudes of silver iodide, Dr. Draper finds that every ray in the spectrum acts on that substance, the more refrangible rays apparently promoting, the less refrangible apparently arresting, the action of daylight on it, these contrary effects taking place not only simultaneously but successively, and that when considerable intervals of time intervene.

Again with bitumen and resin—the substances first used by Niepce for photographic purposes—every ray in the spectrum acts, the "proof" being continuous except where the Fraunhofer lines fall.

The rays which act chemically on the carbonic acid of plants—the most important of all actino-chemical operations—are the less refrangible rays, not the more refrangible "chemical" rays, as they are commonly called. Two methods may be employed for proving this fact—by observing

the place of maximum evolution of oxygen gas in the spectrum, and by finding the place in which young etiolated plants turn green. The point of maximum action in both cases is in the yellow, the range of action embracing the orange on one side and a portion of the green on the other.

The action of light on the colors of flowers is well known. Years ago these phenomena were observed far enough to determine that nearly every radiation affected some particular color. Thus paper stained yellow by *corchorus japonica* is whitened by green, blue, indigo, and violet rays. The rose red of the ten weeks stock is changed by the yellow, orange, and red; and soon, the general law of such action—discovered by Grothuss and verified by Herschel—being that the rays which are effective in the destruction of any given vegetable color are those which by their union produce a tint complementary to the color destroyed.

In this connection Dr. Draper calls attention to a matter worth examining, namely, that the physiological explanation of sight may hinge on the fact that, like vegetable colors, the retina is a carbon compound, and carbon is affected mainly by rays whose wave lengths are between those of the extreme red and the extreme violet, the maximum being in the yellow. In other words, the chemical curve of carbon in the spectrum is the same as the curve of luminosity, as represented by Herschel. This being the case, the possible development of human vision up to the capacity to measure vibrations now invisible, as suggested by Professor Tyndall in his recent lectures, would depend not on education but on a change in the chemical composition of the retina, which is hardly to be expected. But this is apart from Dr. Draper's memoir.

The action of light on the growth of plant stems and roots proves with equal conclusiveness that it is wrong to restrict the chemical force of the spectrum to any special region. As observed by Dr. Gardner, seeds germinating in darkness develop vertical stems. On exposing such stems to the spectrum a bending movement begins toward the indigo, the stems in the indigo bending toward the approaching ray. Removed into darkness, the stems recover their upright position. Repeating and extending these observations, M. Dubrochet found that plant roots bend from the light, this action being produced by all the colored rays of the spectrum.

In support of his second proposition, namely, that the ray absorbed by any substance is the one which produces chemical effects in it, Dr. Draper reviews at great length the modes in which radiations act on the decomposition of silver iodide, and in the combination of chlorine and hydrogen. Briefly stated, his deductions are as follows:

When a radiation impinges on a material substance, it imparts to that substance more or less of its *vis viva*, and therefore undergoes a change. The substance is also disturbed, its physical and chemical properties determining the phenomena which result.

If the substance is black and undecomposable, the radiation establishes vibrations among the molecules it encounters, each molecule becomes a center of agitation, and heat radiation and conduction in all directions are the result.

If the substance is colored and undecomposable, it will extinguish the rays complementary to its own tint, and its temperature will rise correspondingly.

If the substance is decomposable, the absorbed radiation will be expended in breaking down the union of those particles which have arrested it with their associated particles.

In the last case the effect presents two separate and distinct phases, the physical and the chemical. The first phase, the physical, consists in a disturbance of the group of molecules about to be decomposed. Up to a certain point the dislocation may be checked, stopped, and the original condition restored; but that point once gained, decomposition ensues, and the result is permanent. These phases are happily illustrated by the following familiar example:

"If a sheet of paper be held before a fire, its surface will gradually warm; and if the exposure be not too long or too hot, on removing it the paper will gradually cool, recovering its former condition without any permanent change. One could conceive that the laws of absorption and radiation might not only be studied, but could be again illustrated by the exposure and removal of such a sheet. But a certain point of temperature or exposure gained, the paper scorches, that is, undergoes a chemical change, and then there is no restoration, no recovery of its original condition."

As in his former memoir Dr. Draper demonstrated the heating power of radiations to reside in all equally, whatever their refrangibility, so in this he proves the power to produce chemical changes to be manifested by rays of every refrangibility, different substances being acted on by different rays. In other words, the seeming three-fold nature of radiations is due solely to the character of the substances on which they impinge; those rays which are reflected affect our eyes as light; those which are absorbed set up molecular motions, which manifest themselves as heat or chemical action, according to the constitution of the absorbing substance.

It is not what we have or what we have not which adds to or subtracts from our felicity. It is the longing for more than we have, the envying of those who possess more, and the wish to appear in the world of more consequence than we really are which destroy our peace of mind, and eventually lead to ruin.

"Engineer," of Youngstown, Ohio, whose interesting letters on boiler explosions have been published in our pages, says: "I have four volumes of your valuable journal bound and I have four more ready to bind. There is not a book in my library that I would not rather part with than the volumes of the *SCIENTIFIC AMERICAN*."

Facts for the Ladies.—Mrs. Mary Sanders, Jersey City, N. J., has used her Wheeler & Wilson Lock-Stitch Machine since 1863, constantly, on all kinds of sewing, without repairs, and broken but one needle (accidentally); would not sell it for \$1,000 if she could not get another. See the new Improvements and Woods' Lock-Stitch Ripper.

Recent American and Foreign Patents.

Improved Pruning Shears.

Amos B. Moulton, Fall's Branch, Tenn.—This invention relates to an improvement in shears for pruning purposes, whereby they are rendered more effective than the ordinary kind, and it consists principally in the method of producing a drawing or sliding cut upon the branch or limb to be separated, by the employment of a horizontally or obliquely sliding cutter which is operated by means of a pair of hand levers. The second feature of the invention consists in providing the cutting blades with a series of holes which are employed for adjusting the same as it wears away, or for regulating the distance between the cutter and holding jaw.

Improved Feather Renovator.

Edgar N. McKim and John R. Gearhart, Lathrop, Mo.—The invention consists in providing the stirrers of a feather renovator with loops at one end and a hinged concave clamp at the other so that they can be easily detached.

Improved Spring Power for Sewing Machines.

James Cleveland, of Williamsburg, and Charles A. Todd, of New York city.—This invention has for its object to furnish an improved spring power for driving a sewing machine at any desired velocity, and which shall be so constructed that the tension may be readily kept upon the spring, so that the machine may be run continuously for any desired length of time.

Improved Grain Binding Harvester.

Harry H. Bridenbark, Jr., Youngstown, Pa.—This invention has for its object to improve the construction of the harvester for which letters patent No. 120,057, were issued, October 17, 1871, so as to make it a self binder; and it consists in the combination of a block, crossed or diagonal rods, and their supports or equivalents with the driving piston and sickle bar; in suitable mechanism, for the purpose of raising the gavel into contact with the binding device, for the purpose of twisting bands upon and around the grain bundles, for the purpose of forming a straw band around the gavel while being held and rotated by the endless chain; and in the combination of the lever chain and lever for raising the cutter bar with the cutter bar and with the pivoted seat and pivoted standard.

Apparatus for Preparing Roofing Felt.

George W. Pond, Brooklyn, N. Y., assignor to himself, J. W. Smith and J. W. Coolidge, of same place.—The object of the present invention is to improve the machinery employed in manufacturing what is known as roofing felt; and it consists in making the frames of the rollers upon which the felt or paper is rolled adjustable, so that the different rolls of felt or paper, when being drawn from those rollers to be joined together between the feed or compressing rollers, will meet with their edges even and be uniform with each other, thereby obviating the necessity of shearing off the edges of the felt to make them even. It also consists in a device for adjusting the uprights which support the roller to suit the width of the felt or paper.

Improved Corn Planter.

William T. F. Smith, Lexington, Ill.—This invention has for its object to furnish an improved device for planting corn, which shall be so constructed as to enable the corn to be planted in perfect check row. By suitable construction the movement of a rope continuously in the same direction operates the dropping slide alternately in opposite directions, knobs being arranged at such a distance apart as to operate the slide and drop the corn at the proper points.

Improved Adjuster for Well Drills.

Joseph Gallagher, Shamburg, Penn.—The object of this invention is to provide simple and convenient means for connecting pump rods and drilling rods to the working beam of pumping or drilling machinery; and it consists in a grooved wrist bar and a screw clamp. In attaching the device to the working beam, the part of the bar between the clamp and the wrists is inserted in a slot in the end of the beam. The whole device will then hang vertically with the wrists resting in a shallow groove on the top of the beam. It is then made fast to the beam by a slotted timber bolted fast over the wrists. When thus connected the adjuster is ready for use either for pumping or drilling, the hook being used in the former case and the straight rod in the latter, which may be drawn into the groove in the bar sufficiently tight to be held by the friction alone. This device may, therefore, be used for either pumping or drilling without removing it from the working beam.

Improved Glove.

James I. McMartin, Johnstown, N. Y.—The invention consists of a single glove pattern, by which the thumb may be cut in one piece if made entirely of leather, or of two pieces if made with leather front and cloth back.

Improved Bolt Trimmer.

William Dunlop, Fullarton, Canada.—This invention is an improvement in the class of bolt trimmers in which a cutting tool or chisel is reciprocated by a rack bar and toothed segment. The forward end of the lower lever of the implement is made wide and has a slot formed in it to receive the operating parts of the device. A block slides back and forth upon ways formed upon the lower parts of the inner surfaces of the side bars that form the slot, and which is held down to its place by stays attached to said surfaces. In a recess in the forward part of the lower side of the block is secured a chisel, the lower side of which is flush with the lower side of the lever. The edge of the chisel, when the block is pushed forward, strikes against a steel cushion secured to the inner surface of the forward end of the lever. The lower edge of the end of the lever and the lower end of the plate project a little below the lower surface of the lever to rest against the edge of the nut, while the lower side of said handle rests upon the face of said nut, and the chisel shaves off the projecting end of the bolt. Upon the upper side of the rear part of the sliding block is formed gearing connecting with the end of the upper lever. The forward end of the lever is pivoted to projections formed upon the rear parts of the upper edges of the slotted forward end of the lower lever, so that the sliding block and chisel may be drawn back by raising the free end of the lever, and forced forward to make a cut by forcing the said end downward.

Improved Cigar Perforator.

Elbertus A. Konter, Brooklyn, N. Y., assignor to himself and W. M. Hawkins, of same place.—The invention relates to the well known cigar end piercers containing a tapered guide tube with one or more knives fastened therein, and sometimes provided with an eye on the outer part of closed end, by which it may be attached to a chain and hung from a watch or from the person. The invention consists in the mode of constructing the several parts so as to render them conveniently detachable from each other, and so that thus any one can be easily replaced or the knives sharpened.

Improved Corn Planter.

Joshua McGinnis, Frazzysburg, O., assignor to himself and E. L. Lemeret, of same place.—The box to receive the grain is provided with a cover, which is kept in place by a spring catch. The bottom of the box is made thick, and has a hole formed through it near one end to allow the corn or other seed to pass through to the dropping slide. The lower part of the hole through the bottom is enlarged upon the side toward the central line of the seed box, and has a brush placed in said enlarged part to prevent any more seed passing out than enough to fill the hole in the dropping slide. The dropping slide, which moves back and forth in a square groove formed in the under side of the bottom, is held up in place by a block or plate, placed in a notch in the bottom and held up against the dropping slide by a spring. In the dropping slide is formed a hole to receive the seed from the hole in the bottom and carry it out of said box, the block or plate keeping the seeds from dropping out of the hole before they have been carried to the proper position. The amount of seed dropped out at a time depends upon the thickness of the slide. In the slide, near its end, is formed a second hole to receive any seeds that may pass through or beneath the brush to prevent the machine from becoming clogged. As the seeds drop from the slide they fall into the hopper shaped spout, by which they are conducted into the receiver.

Improved Paint Brush.

Lavine A. Lighthouse, Chicago, Ill.—This invention relates to an improvement in the class of paint and varnish brushes whose bristles are secured in a tapered or conical ring and their handles in the socket of a cap or disk adapted to screw into the same. The improvement consists in a mode of securing the bristles more efficiently than heretofore by means of cement, which is placed in the space or cavity between the screw cap and heads of the bristles, and forced into or among the same by driving the handle into its socket.

Improved Gates.

William B. Smith, Copper Creek, Ill.—The invention relates to means for opening double gates. The two gates have high posts, by which they are hinged to permanent posts for being coupled overhead by cross and parallel bars, so that one gate will be opened and closed by the other, the said gates swinging in opposite directions. Long rods, attached to one of the gates and extending each way along the road, serve for opening and closing the gates without dismounting. The said rods, being longest and heaviest at the outer sides of their pivots, hold the latch up and keep the gate fastened. They are lifted up when taken hold of to operate the gates for unlatching them. The lower hinge of the gate is movable up and down the post for shifting the gate higher or lower by the withdrawing of the staple from one of the holes and putting it in another—but the staple of the upper hinge, being connected to a long staple on the gate, allows the gate to slide up and down freely as much as required, so that the gate may be readily raised in winter above the snow and let down again when the snow is gone.

Improved Reciprocating Steam Engine.

Charles E. Lamb, Waukegan, O.—The distinguishing features of this invention are the arrangement and operation of an oscillating valve in the piston of the engine and the manner of introducing and exhausting the steam. On the end of a tubular piston rod a valve is arranged, within the center of the piston, and receives a rotary motion sufficient to change the ports and allow the cylinder to take and exhaust steam at both ends at each stroke of the engine. This rotating motion is produced by means of a pin in the crotch of the connecting rod. On the end of the hollow piston rod is a collar, with two projecting lugs, between which lugs the pin works. The collar is made adjustable. By means of this adjustment the valve is changed or set so as to cut off the steam sooner or later, as may be required. The extent of this revolving motion depends upon the distance of the pin from the center of the cross head. This distance is always supposed to be sufficient to turn the valve and change the ports as the crotch of the connecting rod is carried up and down by the engine crank. The steam is admitted through a tube, which is screwed into the end of the valve on the opposite side of the piston. This tube reciprocates in and is inclosed by an outside tube which connects with the boiler. As the piston works back and forth in the cylinder it is prevented from turning or partaking of the revolving motion of the valve by means of the straight rod which passes through the piston and is confined in the cylinder heads. The positions of the valve are reversed at every stroke of the engine, and the steam is admitted and performs its work and is exhausted with the same regularity and precision as with the ordinary slide valve, all the steam being admitted through a suitable pipe and exhausted through the hollow piston rod.

Improved Cotton Cleaner.

James L. Coker, Hartsville, S. C.—This invention has for its object to furnish an improved attachment for cotton gins for cleaning the cotton and feeding it to the gin, removing nails, sand, and other impurities from the cotton, and feeding it uniformly to the gin. The two sides and the upper part of the front end of the frame of the machine are closely inclosed. The upper part of the top in the rear of the sweeper and the rear end is inclosed with wires or slats inclining inward to allow sand, nails, etc., to drop through. The upper front part of the machine is left open at the top to serve as a hopper to receive the cotton, which rests upon the endless apron, which is formed by attaching cross slats to bands or belts which pass around the rollers. The slats of the endless apron are provided with points to take hold of the cotton and carry it forward. The sweeper is formed by attaching knives or plates in an inclined position. The sweeper may be adjusted to allow more or less cotton to pass through to the gin, as may be desired. And it is revolved in such a way as to push the cotton back from the upper end of the carrier and allow only the desired amount of cotton to be carried to the beater. The beater is formed by attaching numerous teeth to a cylinder, which receives the cotton from the carrier and knocks out the sand, nails, and other impurities, which fall through the slatted or wire back of the machine while the cotton slides down said back to the cleaning cylinders, one or more of which are used. The cylinders are covered with leather having wire or card teeth attached to it, or the card teeth may be attached directly to the said cylinder. The cylinders further clean the cotton by shaking it and rubbing it against a board secured above the said cylinders, and which is concave and corrugated. A brush cylinder takes the cotton from the last cleaning cylinder and discharges it between the guide boards or aprons to the gin.

Improved Converting Motion.

Taylor D. Lakin, Greenfield, N. H.—This invention relates to a new mechanical movement in which a right or left hand nut are arranged within a cylindrical or other case, and surrounding a threaded spindle. When the said cylindrical case is moved longitudinally—that is to say, parallel to the axis of said spindle—it will cause the latter to be revolved continuously in the same direction. This movement will be of great advantage for various purposes; for hand tools as well as for larger machinery, such as augers, drills, shafts, etc.

NEW BOOKS AND PUBLICATIONS.

A POPULAR TREATISE ON GEMS; a Guide for the Teacher of Natural Sciences, the Lapidary, Jeweller, and Amateur. With Illustrations. Fourth Edition. By Dr. L. Feuchtwanger, Chemist and Mineralogist, Member of the New York Lyceum of Natural History, etc. etc. Published by the Author, 55 Cedar Street, New York city.

This is a republication of a work of known value, which has long been a standard authority on its subject. The information in this edition has been carried down to the latest date; and the illustrative lithographs are numerous and valuable, the text being elucidated by wood cuts in great profusion.

DECISIONS OF THE COURTS.

United States Court.

BILLIARD TABLE PATENT.—LEVI DECKER vs. FREDERICK GROTE, et al.

BLANCHFORD, Judge.
This suit is brought on released letters patent, granted to the plaintiff, March 2, 1869, for an "Improvement in cushions for billiard tables," the original patent having been granted to him December 18, 1866. The specification of the released patent says: "My invention has for its object the preservation of cushions for billiard tables against the impact of the ball. The nature of my invention consists in the employment or use of a catgut or other strong cord, located in or at the upper corner or edge of the cushion, and immediately at the point against which the ball strikes when the game of billiards is played."
Decree for the plaintiff, for a perpetual injunction, and an account of profits, and an ascertainment of damages, with costs.
W. J. A. Fuller, for the plaintiff.
B. F. Lee and A. Pollak, for the defendants.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From December 21 to December 31, 1872, inclusive.

BOOTS, ETC.—T. H. Dodge, Worcester, Mass.
CARBONIZING CLAY, ETC.—G. H. Smith (of New York city), London, Eng.
FILLING MOLDS WITH CLAY, ETC.—G. H. Houghton, Marlin, Texas.
ILLUMINATING LIQUIDS.—J. Hale, Jr., Cincinnati, Ohio.
MAKING STEEL, ETC.—T. R. Scowden, Cincinnati, Ohio.
MOWER AND REAPER.—W. A. Wood, Hoosick Falls, N. Y.
PISTOL.—W. J. Morris (of New York city), London, England.
PRINTING TELEGRAPH.—G. M. Phelps, Brooklyn, N. Y.
RAG TEARING MACHINE.—A. Peple, Lowell, Mass.
SCOURING NEEDLES, ETC.—Mallett Manufacturing Co., New Haven, Conn.
TRIP HAMMER.—C. C. Bradley, Syracuse, N. Y.
WHEEL FOR VEHICLE.—O. S. Vreeland, Salamanca, N. Y.

Value of Patents, AND HOW TO OBTAIN THEM. Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office; men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office; enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN Patents.

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model Drawing, Petition, Oath, and full Specification. Various official rules and for malities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of \$5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is \$10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co. 37 Park Row, for full particulars.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee \$20) for ten years (government fee \$40) or for fifteen years (government fee \$60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

Address

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Business and Personal.

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For Sale, Cheap—First class McAllister's Oxy-hydrogen Stereoscopes. Address Rev. A. C. Hubbard, Danbury, Conn.

Patent Gearing—Great Strength, Durable, Noiseless, Cheap. J. Conly, 145 Ten Eyck St., Williamsburgh, N. Y.

Special attention paid to Hammering or Trueing of large Circular and Shingle Saws. Also, Retooling. Address J. Tattersall, 26 Carroll St., Elmira, N. Y.

Traction Engines and Plows. Address W. H. H. Heydrick, Chestnut Hill, Philadelphia.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 420 Grand Street, New York.

Selden Patent, for stuffing boxes. Circulars, &c., mailed free. 85 Oliver St., Boston, Mass.

Foot Lathe for \$22. Goodnow & Wightman, 28 Cornhill, Boston, Mass.

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For the Best Circular Saw Mills and Steam Engines, Stationary and Portable, of all Sizes, apply to the Mansfield Machine Works, Mansfield, Ohio.

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Plow Shares, Mold Boards, Cultivator Teeth, &c., cast to order, by Pittsburgh Steel Casting Co., Pittsburgh, Pa., of steel which can be worked same as wrought steel. All work warranted.

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Circular Saw Mills, with Lane's Patent Sets; more than 1200 in operation. Send for descriptive pamphlet and price list. Lane, Pitkin & Brock, Montpelier, Vermont.

Wanted Situation—Thoroughly understands building, setting up, and running Wood Working Machinery. Would prefer going South. H. Inman, Troy, N. Y.

Manufacturers who can furnish Trunk Board 36 to 40 ins. square, please address Sullivan Machine Company, Claremont, N. H.

First Class Bed and Platen Printing Presses to order on short notice by Sullivan Machine Company, Claremont, N. H.

Machinists—Price List of small Tools free; Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 28 Cornhill, Boston, Mass.

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Wanted, by T. R. Bailey & Vail, Lockport, N. Y., Planer, new or second hand, to plane 5 to 6 ft. long, 20 to 25 inches wide.

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

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American Boiler Powder, for certainty, safety, and cheapness, "The Standard anti-incrustant." Am. B. P. Co., Box 277, Pittsburgh, Pa.

Scale in Boilers. I will Remove and prevent Scale in any Steam Boiler, or make no charge. Send for circular. Geo. W. Lord, Philadelphia, Pa.

Gauges, for Locomotives, Steam, Vacuum, Air, and Testing purposes—Time and Automatic Recording Gauges—Engine Counters, Rate Gauges, and Test Pumps. All kinds fine brass work done by The Recording Steam Gauge Company, 91 Liberty Street, New York.

Dobson's Patent Scroll Saws make 1100 strokes per minute. Satisfaction guaranteed. John B. Schenck's Sons, 115 Liberty St., N. Y.

The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Boilers. L. B. Davis & Co., Hartford, Conn.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 47 Broadway, New York.

Steam Boiler and Pipe Covering—Economy, Safety, and Durability. Saves from ten to twenty per cent. Chalmers Spence Company, foot East 9th St., New York—122 N. 24 St., St. Louis, Mo.

Steel Castings "To Pattern," from ten lbs. upward, can be forged and tempered. Address Collins & Co., No. 212 Water St., N. Y.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 21 and Nov. 23, 1869. 64 Nassau St., New York.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address L. B. Davis & Co., Hartford, Conn.

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Boynton's Lightning Saws. The genuine \$500 challenge. Will cut five times as fast as an ax. A six foot cross cut and buck saw, \$6. E. M. Boynton, 90 Beekman Street, New York, Sole Proprietor.

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For Steam Fire Engines, address R. J. Gould, Newark, N. J.

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

Wanted to purchase, six good second hand Milling Machines, two extra heavy. Address P. O. Box 2269, New Haven, Conn.

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

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

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

A New Machine for boring Pulleys, Gears, Spiders, etc. etc. No limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. L. B. Davis & Co.

Always right side up—The Olmsted Oilier, enlarged and improved. Sold everywhere.

Gatling guns, that fire 400 shots per minute, with a range of over 1,000 yards, and which weigh only 125 pounds, are now being made at Colt's Armory, Hartford, Conn.

Notes & Queries

1.—D. B. asks: How is the gelatin used in plaster casting made?

2.—G. S. asks: How is the cement with which the coils are fastened to glass lamps made?

3.—J. A. P. asks: What is the best preparation for filling the holes and seams in an open French burr for grinding wheat?

4.—L. M. L. asks: If the air be suddenly exhausted from the inside of a vessel, will the temperature in the inside remain the same as the air surrounding it?

5.—J. B. C. asks: How can I make a show case for a drug store, to contain all kinds of liquors or spirits in one glass without their mixing?

6.—A. B. C. asks: I want a recipe for making a water and steam proof glue or cement that will fasten pieces of wood as firmly together as the ordinary glue.

7.—H. G. B. asks: Where can I obtain the many kinds of patterns used on stained and frosted glass?

8.—G. R. B. asks: What is a good composition to prevent rust on gun barrels? It should be of a dead black color, as a bright barrel often frightens the game.

9.—A. L. N. asks: Will some good mechanic, of the many thousands who read the SCIENTIFIC AMERICAN, give me a rule for drafting a link for a steam engine?

10.—E. asks: What are the simplest methods of softening and molding horn; also of making and molding paper mache?

11.—G. R. B. asks how the wire of Weinhold's acoustic telegraph, described by us on page 332 of volume XXVI, is to be insulated. Is it to be insulated as for electricity, or to be kept from anything that will deaden the sound? Should the mouth pieces be soldered to the wire?

12.—J. D. W. asks: How can I make a mold for casting a small cylinder 2 x 4 inches for slide valve engines? Will lead or block tin be a good metal to make it of?

13.—A. L. asks: What will destroy or neutralize the narcotic properties of tobacco while being smoked in a pipe?

14.—E. P. M. wants to know how to coat pins 1½ inches long, of ¼ inch wire with zinc.

15.—M. and L. ask: Can some one inform us of a compressed paper packing, used instead of Rabbitt metal for journals and railroad boxes?

16.—J. L. H. asks: Is there any known process by which inkstains can be removed from lawn, printed with violet flowers on a white background? The ink is a mauve writing fluid.

17.—E. E. E. asks: Can any one give a process, other than distillation, for determining when all the spirit in cider, or other fermented liquids is acidified? How many grains of crystallized carbonate of soda should an ounce (560 grains) of good marketable vinegar saturate?

18.—C. H. K., of Ind., states as a curious fact that the "epizootic" is more injurious to the jacks and jennets than to the horses. To many of the former the distemper has proved fatal in the West. Our correspondent asks why it is.

19.—C. R. M. says: I want a recipe for a cement to stick stannol to iron rolls, something that will stick tight and dry quick. I am using a cement composed of 3 parts white lead, 1 part Venice turpentine; but it requires from 7 to 10 days to dry. What can be added to it that will make it hard in a much shorter time?

20.—A correspondent says: Although much has appeared from time to time in this and other journals in regard to the employment of soluble glass, there is still room for information in regard to its practical use. Its application for covering wood is very much limited by the fact of its solubility in cold water. Soluble glass ordinarily met with in the shops, though hard and polished when dry, will absorb sufficient moisture on a damp day to destroy this surface. I have tried the expedient recommended by some, of previously washing the surface to be painted with a solution of common salt or with lime water, in order that, upon the application of the soluble glass, a silicate of soda or of lime may be formed, but I have met with only indifferent success. I have seen it stated in a recent English periodical that soluble glass—a silicate of soda or of potash, or of both, as the case may be—is now made by using a smaller proportion of the alkali than formerly, and preparing the solution, under pressure, at a temperature of over 300°. By this means, a soluble glass that is not acted upon in any degree by cold water (and not even by hot water, unless under a pressure and at a temperature equal to that at which it was originally prepared) is said to be produced. Can you give any information as to the question? In default of any information on this point, can you give any rule for the employment of the soluble glass commonly in use, so that it can be made available? Most of the so-called mineral paints consist largely of this, but they also contain benzine of villainous smell. I want an inodorous preparation that shall be unaffected by cold water.

ANSWERS TO CORRESPONDENTS

P. B. says: There are a number of boilers being altered from feeding through mud pipes to feeding at top into perforated pipes, four feet long and four inches above the fire. Is there any advantage? Answer: It is not unlikely that feeding into a perforated pipe just above the fires of a boiler, rather than into the mud drums, may allow a more ready settlement of mud and deposits in the drums, and it will have the advantage of equalizing the temperatures of the different portions of the boiler, and thus preventing injury by consequent strains. Care should be taken to feed constantly, if possible, and regularly, otherwise it will be difficult to keep the steam pressure steady.

J. M. M. asks: Do you know of any instrument that will correctly indicate the heat of molten metals? What is its name and where may it be obtained? Answer: Pyrometers are used to determine temperatures too high to be indicated by the thermometer, but we know of none that are very reliable at temperatures exceeding 1,000° or 1,300° Fahr. You may use one for lead, but cast iron melts at a temperature of 2,744° Fahr., according to some authorities; and this is beyond the reach of reliable indicators of temperature.

K. W. asks: Is there any transparent varnish suitable for varnishing paper, that is not affected by the action of muriatic acid? Answer: Paper can be effectively protected from the corroding action of hydrochloric and other acid fumes by painting it with a solution of paraffin in petroleum naphtha. Paper trays have been made for photographers' use by simply coating ordinary paste board with paraffin. Such trays will resist the action of silver salts, or other acids, quite as well as gutta percha or India rubber.

C. B. asks: What is the best ink or edge color for shoemakers? We can get plenty of ink, but it will not take in leather. Answer: One of the best blacks for coloring edges can be made from iron filings and pure cedar vinegar. Put the iron filings, shavings, or scraps in an iron kettle, cover them with good cedar vinegar and allow the mixture to stand two months, stirring frequently; then strain off the liquor and store in small bottles. It will produce a true black, that will not turn blue after exposure, like vitriol black.

D. G. asks: What are the objections to melting brass in a wrought iron ladle made in the same form as a crucible? I suppose that a certain amount will adhere to the iron on its first use, but it will not continue to accumulate. A ladle of iron as above will not break as a common crucible does, and could be heated in a shorter time. Answer: The iron ladle would soon burn out. Fire clay or graphite crucibles are prepared for the manufacture of brass, and in casting it use is made of granite molds, surrounded by a thick coating of clay and cow dung. Sand molds can also be employed.

P. H. S. asks: Have any experiments been tried to supply the place of fire brick in lining cupolas, by the use of cool water, by using a double cylinder or boiler, one say three inches smaller than the other, forming a cavity between their walls, which shall be made water tight by connecting them at bottom and top, and inserting a pipe at top of larger size than the waste pipe at bottom, so as to secure a constant supply of cool water between the walls of the outer and inner cylinder, and thus prevent the heat from destroying the inner wall of the cupola? Answer: We know of no such experiment. The idea is not new, however. See our reply to another and earlier correspondent.

J. M. McG. says: What power of engine is required to run a machine for cutting a bar of iron 3x5 inches wide diagonally, the cut being 30 inches long? It is to be cut by the pressure or stroke of one die square down over the edge of another, the die to have a two inch stroke actuated by connect ing rod and crank on driving shaft. How many strokes per minute will be practicable, and will it be more economical to heat the bar or to cut it cold? Answer: For such work, a powerful machine is needed. If much work is to be done, and the machine is to be kept continuously in operation, we should advise heating the bars, by all means. If the machine is only occasionally used, the bars may probably be beat worked cold. If the bars are heated, a much lighter machine will do the work. Probably ten strokes a minute will be as many as will be found convenient. See that the shears have a heavy fly wheel, and try an engine of five horse power. The power required will depend very greatly upon the construction of the shears, and the character of the intermediate connection, and may vary considerably under differing circumstances.

B. says: In a dispute regarding the number of feet, board measure, in a stick of timber, eight inches square at one end and four inches square at the other and twenty four feet long, some claim that it should be measured in the middle, which would make 72 feet, and others that the right way is to measure the contents of each end and average it, which would make 60 feet. I think neither right. Answer: To obtain the volume, in cubic feet, of a tapering stick of squared timber: add together the areas of the end and four times the area of the section at the middle of its length, measured in square feet, and multiply the sum by one sixth the length of the stick. The product is the cubic contents in feet. This product divided by twelve gives, as a quotient, the contents in feet, in board measure.

P. Bron., say: We have mills here, and our power is steam; we bought a steam gage a short time ago, made by the Utica Steam Gage Co., Utica, N. Y. When our safety valve is blowing off, the gage indicates 60 lbs. The dimensions of safety valve are 2½ inches diameter, lever 22½ inches long from fulcrum to weight, center of valve 2½ inches from fulcrum, and the action of lever 20 lbs. We estimate the pressure at 100 lbs., nearly. We exchanged the steam gage for another of the same kind and make, and find it the same as the first one. Are they correct, or are we right in calculating the pressure on valve? Answer: The pressure on the stem of the safety valve must be 42 multiplied by 2½ divided by 2½ equals 378 pounds, plus the pressure due to the weight of the lever, the size of which our correspondents do not give. The area of a safety valve 2½ inches in diameter is 3.976 square inches. The pressure per square inch required to raise the valve described would be 378 divided by 3.976 equals 95 lbs., and probably the additional weight of the lever would make it very nearly 100 pounds. Have not our correspondents erred in the measurement of the valve? If it has happened that the given measure is the diameter at the inner edge of the bearing surface, and that the bearing is actually at the outer circumference of the seat, the proper diameter for calculation will be the latter, which we presume may be 2¾ inches, at least. The area of a circle 2¾ inches diameter is 6.491 square inches, and 378 divided by 6.491 equals 58¼ pounds. The additional pressure due to the weight of the lever may bring it up to 60 pounds as shown by gage.

R. F. L. says: I am about to rebuild my saw mill; I own two engines and wish you to tell me which I had better use in the new mill. The engine now in use was built in Louisville, Ky., about forty years ago, but was bored out and a new piston, with cast iron rings, put in some six years ago. The cylinder is 18 inches by 4 feet 6 inches stroke, has slide valve, poppet valve, and a cut-off cutting off steam at ¼ and expanding ¾, and is run at 40 revolutions per minute with 90 pounds of steam in boiler. The steam pipe is 5 inches diameter, with butterfly valve controlled by Porter governor. There is no bed plate, but the engine is bolted to heavy cylinder timbers. This engine gives me plenty of power to drive two 8 foot muley saws, and one 5 foot circular saw, with edgers, shingle, and lathe machines, cut-off saw, etc. I have an engine built by George Page & Co., of Baltimore, Md., in 1860; it rests on an iron bed plate, and is 15 inches by 2 feet stroke; has double slide valves, one on top of the other; the cut-off is variable at pleasure, the exhaust steam jackets the cylinder, and there is a balanced valve in steam pipe controlled by a Porter governor. What I wish to know is: Will the Page engine with its modern improvements develop as much power as the old Louisville engine, carrying the same boiler pressure? Which one would you advise me to use? Answer: We should suppose that the old engine would develop considerably the most power, if its steam and exhaust passages are not too small, while the new engine should be the more economical. If there is a doubt whether the new engine will supply sufficient power, and if the difference in economy of fuel is no objection, it would be best to use the old engine, if it remains in good order. If a little more steam can be safely carried so as to bring up the power of the new engine, it would be better to try that. We cannot advise taking the slightest risk, however, to secure economy of fuel.

L. M. L. asks: How many pounds pressure to the square inch will it take to explode a tube constructed of the best boiler iron, 10 feet long, inside diameter 2 inches, outside diameter 3 inches. Answer: A tube of any length, of two inches internal diameter, three inches outside diameter, and of iron capable of bearing a tensile strain of 50,000 pounds per square inch of section would sustain an internal pressure of 19,200 pounds. A thick cylinder has less proportional strength than a thin one, and, in the case mentioned, no amount of thickness that could be given to a cylinder of such iron would enable it to bear a pressure of 50,000 pounds per square inch. The figure given is obtained by use of the usual rule for thick cylinders.

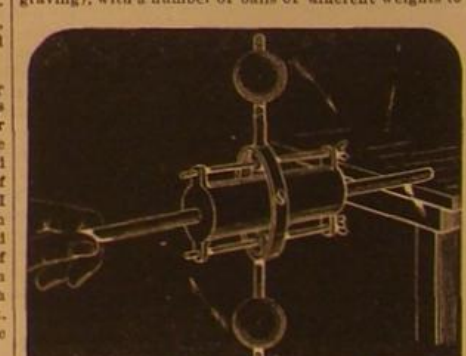
R. and W. say: R. affirms that a balance or fly wheel, if in standing balance, or each side of equal weight, need not be at right angles to the shaft, to run fast without affecting the steadiness of the shaft. Also that it may be keyed on at even 45° to the shaft without affecting it, except so far as the air may do so, as shown in the engraving.



W. asserting the contrary. The one mistaken is to pay five years subscription to your paper for the benefit of him whose premises prove correct. Answer: If a balance wheel is accurately balanced and is perfectly symmetrical in form, and if it is keyed firmly on its shaft in any position except with its plane at right angles to the line of the shaft, it will always tend to turn itself until its axis shall coincide with the center line of the shaft. This effort will be a constant one, tending to bend the shaft, but does not necessarily produce unsteadiness in the shaft, as will be readily seen if the experiment be tried. R. is right.

We republish the above from our paper of December 21, for the purpose of correcting the last sentence. It should have read as follows: W. is right.

The attention of S. W. H. and others who have written to us in reference to the matter is called to this correction. The discussion of this subject of balancing machinery has called forth a variety of interesting communications. The accompanying diagram, sent to us by J. C., gives the form for a very effective little device, by which practical experiments on the subject may be made. In respect to this instrument, J. C. says: I notice that the balancing of machinery is exercising the minds of many of your readers. I wish to suggest a little instrument that I have found to practically demonstrate that a standing balance is not necessarily a running balance, and also to refute the false teachings of some of our text books. It is made about 6 inches long, with the other dimensions in proportion (see engraving), with a number of balls of different weights to



substitute for each other. One end of the arbor is held in the hand, and the other end laid on a support; the arm is then struck with the other hand, and the instrument made to revolve. When in running balance, there will be no vibration of the arbor. The hand will detect the least vibration when not in running balance.

W. B. sends mineral specimens, and asks what they are. Answer: The specimens are galena, a valuable ore of lead. The blue and green incrustation is carbonate of copper.

A. H. B. sends samples of pebbles and granite, and asks if they are indications of diamonds? The colored pebbles are very hard; nothing but a diamond will scratch them. Answer: The pebbles are quartz, chaledony and Jasper. They can be scratched by beryl, topaz, ruby and emery. There is no reason why the diamond should not be found in their company; but the best proof of its existence is the finding of it.

T. B. G. encloses six specimens and asks what they are. Answer: All the specimens are clay, in different degrees of consolidation. Nos. 1 and 2 are clay-slate, not fire clay; fire clay is highly siliceous, and this is not. No. 3 is simply a ferruginous clay.

G. B. D. says, in answer to T., query 21, page 10, Vol. XXVIII: The difficulty in dovetailing beveled boxes, such as hoppers, etc., is not in laying out the dovetailing itself, but is rather in preparing or shaping the ends of the boards to be joined. To do this, bevel the upper edge of the boards so that, when they are set up at the angle at which you wish make the hopper, their

upper edges will be level. Then lay off the angle or bevel of the hopper on the outside of the board and square across the beveled or upper edge, as you would in making a square box. The board being cut to these lines is now ready for laying out the dovetails at right angles from the ends, same as in square work.

To J. H. R., query 16, page 10.—Gum shellac varnish (shellac dissolved in alcohol) will do to coat a canvas boat with; give three or four coats, and the canvas will be perfectly waterproof. Or put three coats of asphaltum varnish on outside and in; it will stand well. Finely ground lamp black in turpentine and Japan driers make a perfectly indestructible light paint.

J. B. S. says: A friend claims that pier A in the accompanying diagram will offer less resistance to the current of a stream flowing in the direction indicated by the arrows, than pier B will.



It is claimed that the resistance offered by pier A is less than that of pier B, because the water can flow around the curved end of pier B without being forced into a narrow channel. The laws of resistance are the same in this case as with floating bodies. Notice the behavior of a vessel with a full run and compare it with a similar craft with a fine after body.

G. W. D. says: A friend says that it will take less power to draw a given weight, or wagon load, by a long rope than by a short one; one end is to be attached like a trace to the wagon, and the power applied at the other end of the rope; I differ with him. Who is right? Answer: The power required to move the vehicle will be the same, no matter whether the rope used is long or short. In some cases, a long rope is advantageous by reason of its elasticity, as it ensures a gradual application of the power to the load.

F. H. F. asks: What are the colors commonly used by draftsmen in machine and other drawings, and of what are they composed? Answer: India ink is used by draftsmen for black lines, and, for other tints, the ordinary water colors, sold in the stores.

T. C. J. says: 1. In Peterson's "Familiar Science," I find this statement: "Captain Scoresby saw the reflection of his father's ship, Fame, which was then 17 miles below the horizon, and 30 miles distant." How is this? I did not think the earth's curvature was so great. Will some one give a simple rule for finding the earth's curvature for any given distance? 2. Would I be safe in buying the instrument described in the enclosed advertisement, and do you know the men to be reliable? Answer: The thumb rule for determining the earth's curvature is: two thirds the square of the given distance in miles equals the curvature in feet. Thus, for thirty miles, two thirds the square is 600. This result is of course an approximation, and is about seven feet too great. The problem can be readily worked out trigonometrically with accuracy. In the matter of wasting a dollar, you need no advice.

J. R. M. finds difficulty in making liquid rubber with unvulcanized rubber obtained from a dentist. Answer: Dentist's rubber is generally prepared in some way or other. Try pure native rubber.

T. R. asks for a colorless adhesive substance for paper. Answer: Try dextrin or potato starch; it will dry well and is very transparent.

H. B. asks for Dr. Bird's method of preparing urine for microscopical examination, and for the remedies for an undue quantity of lime salts. He should consult Dr. Golding Bird's work on the subject, to be found in any good medical library.

J. C. says that hot caustic potash will ruin old dry paint brushes, but that caustic soda, used in a cold solution, will do. They should not be immersed above the string.

R. H. asks how to clean a set of drawing instruments, the steel of which has become rusted. Answer: If you do not want to have them cleaned by a good mechanic, who will file and oil them, you may polish them yourself with fine emery paper, crocus and oil.

J. S. A. asks: What is the most compact battery or electrical instrument that an amateur could make, or get, to heat fine platinum wire red hot? Answer: An ordinary Grove battery will do to heat up a short length of fine wire. We are constantly publishing practical papers on electricity.

C. J. F. says: We are building a school house, and the mason told us that the mortar would freeze dry in three days. He put on the scratch coat three weeks ago, and it is frozen as hard as ever. What we want to know is: Will it freeze dry or not? If so, what is the philosophy of it? How can the ice that is in the mortar get out without thawing? Answer: In the dry fall, in freezing weather, a building is sometimes left exposed with the scratch coat of plastering not quite dry, because it is found to dry very rapidly in frosty weather, and the water is all dried out of it before it has a chance to freeze. But when plastering has been really frozen, it must thaw, and disintegrate the mortar in thawing, which will show itself in the small flakes that appear on its surface.

W. R. asks how to prevent lead pencil drawings from smearing. Answer: Try an application of new milk to the drawing, having previously stretched the latter tight on a board with drawing pins.

C. F. B. can gild picture frames with the gold size described in H. G. B.'s answer to W. H. C., in this column.

B. sends some small stones from Idaho, requests us to examine them, state what they are, and their value. Answer: The specimens are all chalcedony, an uncrystallized variety of quartz. When flesh colored, it is valued in jewelry under the name of cornelian; and when banded, it is called agate. But the gray and yellow pebbles are seldom used by the lapidary.

D. promises to send a subscription, and says: On a railroad, there is a train consisting of an engine, tender, and three platform cars. At each end of the cars there is a man; and when the train shall have reached a speed of a mile in four minutes, the men shall run in opposite directions, and each shall jump, respectively, off the end of the train opposite to that whence he started. One of them, of course, jumps with, and the other against, the motion of the train. What position

will each maintain, and which will receive the greatest concussion? Answer: The man running in the same direction with the train will have a horizontal velocity, relative to the ground, equal to the sum of his own speed and that of the train. The other will have a velocity on striking equal to the difference of the two speeds. If the men run with a velocity equal to that of the train, the first will strike the ground with a horizontal velocity of 30 miles per hour; the second will have no horizontal motion. The first will receive the greater shock, but, striking with his face toward the direction in which he moves, will be best prepared to meet it. If the second strike the ground in a perfectly vertical position there will be no tendency to destroy his equilibrium, if he has moved with the velocity stated. Send along your subscription.

H. C. S. asks for some good cement to stick rubber and wood together. Will good strong hot glue do it? Answer: Yes, especially if the wood is well painted with white lead in oil.

J. H. H. asks: Should the mud drum of a boiler or boilers be covered up or exposed to the fire? Is there any danger if the mud drum is exposed to the fire? Answer: A mud drum exposed to the heat of furnace gases is as liable to injury and explosion as a boiler would be under similar conditions. Never allow a mud drum to be exposed to the action of the gases of combustion until, by contact with the heating surfaces of the boiler, they have become reduced greatly in temperature. Set mud drums so that they shall be in the coolest part of the flue, if possible. If necessarily placed where flame might reach them, protect them by a covering.

J. S. J. asks the difference between a high and low pressure engine, and what is vacuum and how formed. What is the best rule for computing the horse power of steam boilers? Answer: In the low pressure engine the steam is condensed and the water used again in the boiler. In the high pressure engine the exhaust steam is not condensed, but is discharged into the air. The locomotive is an example of the high pressure engine; the large steamboat engine, of the low pressure.—A vacuum exists where the pressure of the air is removed. If you apply your mouth to a bottle and suck out the air, then you have a vacuum in the bottle. The nominal horse power has ceased to be any measure of the dimensions of a boiler; and the best course is to consider only the water evaporated. A cubic foot of water converted into steam in an hour was considered by James Watt as equivalent to 1 horse power; and this, he found, could be done in his day by 8 square feet of heating surface.

L. S. W. says: I have a well under my house, and the water has lately become so bad that we cannot use it for any purpose. The well is 36 feet deep, and is walled with stone, with a white oak pump. There are some willow and other trees close to the house, the roots of which penetrate through to the water. Answer: A remedy is a frequent and thorough cleaning out of your well. Tree roots are always troublesome in the vicinity of wells.

H. C. D. says: Mentioning to an engineer that I had ordered a heater and steam pump for my boiler, he informed me that a boiler inspector had told him that "the use of a heater which uses the exhaust by passing it direct through the water to be heated, would communicate so much oil to the feed water as to cause a great deal of injury to the boiler, by forming a thick oily substance in the bottom, and thereby burning the boiler." Now, if the heater and filter perform what they profess, how can sufficient dirt and oil pass through to form this sediment? But the inspector ought to know. Answer: Some kinds of deposits in steam boilers are very liable to unite with the oily matter carried into the boiler with the feed water, and to give rise to danger of explosion and burning of the iron. Careful inspection will usually determine whether, in any given case, this may occur. An effective filter would prevent such danger.

G. W. J. says: We are out of rain water in our vicinity. What can we put in other water to make it agreeable for toilet use? Answer: Couldn't tell without testing the water.

A. & Y. say: We have a yacht of 35 feet length, 8 feet beam, and 4 feet hold. We propose to put in a 4½ horse power double engine, and to work it under 90 lbs. pressure. About what sized stern wheel do we require, and of what pitch, and at what speed will the boat run? Answer: We have not sufficient data upon which to base our estimate. What is the size of your 4½ horse power engine? Is your wheel a western stern paddle wheel, or is it a screw, as we should infer from the request to give the pitch? Have you sufficient boiler power to keep up 90 lbs. steam? Has the boat full lines, or has it a fine bow and a well shaped run? To be able to predict its performance with accuracy, a consulting engineer would need the body and sheer plans of the boat, as well as the particulars above demanded, as the solution of such a problem calls for the exercise of an experienced judgment as well as of mathematical and professional skill. With the data above asked, we shall probably be able to predict pretty nearly, however, the performance of the projected yacht.

A. K. S. asks: Does the hardening of steel make a chemical change in it? If so, what is the change so made? Is the change molecular? If so, how, or in what manner is it produced? Answer: The immediate cause of the hardening of steel is still a subject of dispute among chemists. The majority side is in favor of the theory that there is a molecular change produced when iron is converted into steel.

G. W. D. says: Is there such a thing as a reliable weather table, based upon the changes of the moon in its quarters? If so, who is it by? Is there a Sir John Herschel's weather table? If there is, where can I get it? Answer: Some years since the *Farmer's Almanac* published what was called a "Weather Table, by Sir W. Herschel," wholly without authority from Sir W. Herschel, and probably without any scientific basis.

H. H. T. asks: 1. Does the center of a revolving shaft turn? Answer: Yes.—2. Is a steam gage as correct at ten feet from the boiler as at one foot? Answer: Yes, if not placed on the steam pipe or where the motion of the steam may influence it.—3. Supposing a steam gage to show 10 pounds too light, would there have to be a pressure of 10 pounds before the pointer would start? Answer: Sometimes, but not usually.

S. P. asks: What kind of a solution do silver platers use to dip their burnishers in when they burnish their work? Answer: Various mixtures are employed for this purpose. A ½ lb. prepared chalk, ½ oz. camphor, 1 oz. each aqua ammonia and alcohol, 3 oz. benzine, well mixed and allowed to dry before burnishing, is a good preparation. A solution of cyanide of silver is also used by some silver platers; also several acids. The whole subject is well explained in hand books for electro platers.

D. M. S. says: Does a hole through a bar of iron four feet long, for instance a crow bar, increase the strength? Answer: A solid bar is stronger than a hollow bar, the circumference of both being the same. But if you put the same amount of metal that the solid bar contains into the form of a hollow bar, such hollow bar will be larger in circumference and will be stronger than the solid bar.

F. A. G. says: 1. I have a hot water tank connected, by means of two pieces of lead pipe, with a hollow front in my cooking range. The lead pipes are each twenty inches long. The ends that pass through the bottom of tank are nine inches higher than the others, which are connected with the range. The trouble lies here: A very hot fire causes the water to boil in the tank so as to make a noise which is very annoying to hear. Will this noise be lessened by lengthening the pipes and setting the tank further from the stove? Answer: The annoyance might be somewhat abated by using long pipes, but it would be at the expense of efficiency in the heating apparatus. The division of the current of steam by carrying it into the tank through a number of smaller pipes would be very likely to prove more satisfactory. 2. Can I convey the steam from the tank through a small pipe, either to the fire box, the stove pipe or the chimney, directly, without its forming creosote? Answer: Yes.

J. W. D. says: 1. I had an occasion to cover a portable boiler, to protect it from the air, and for convenience I boarded it up and filled in with sawdust. The dust was mixed poplar and sweet gum, and had lain in bulk 8 or 10 days. When I raised steam in the boiler, the vapor from the sawdust smelt like that from a whiskey still. Was there any alcohol in it? Answer: The vapor very probably contained some alcohol resulting from fermentation of the sap contained in the wood.—2. Ice melted very slowly becomes porous, indicating that it was not a homogeneous body, and that one part melted at a lower temperature than another. How is this? Answer: Ice always melts at a temperature of 32° Fahrenheit. The fact noted indicates no exception to this law of nature, but simply that the disintegration of the ice crystals happened to produce greater porosity at one point than another.

S. H. says: I have a kitchen range fitted with a water back which looks very weak, and knowing the disastrous results of several explosions of such boilers lately, I thought, if a boiler made of a coil of pipe at the back of the fire was practicable, it would have the advantage of safety. My plumber shakes his head at it. I cannot see anything wrong about it myself, but not being a mechanic I am no judge. If the idea is at all practicable, any improvements you would be kind enough to suggest would be acceptable. Answer: The objection to your plan for a water back for your stove would be the difficulty of securing a good circulation of water and ready escape for the steam formed.

A. H. G. says: I notice, by my glass water gage, that in the morning, when I get up steam, the water is one inch lower in the tube than when I stopped at night. After steam is raised, it does not rise to the same point, but only rises a quarter of an inch. This puzzles me. The blow off does not leak, nor is there any leak about the boiler. Answer: It puzzles us, also. The data offered are not sufficient to justify the expression of an opinion.

J. O. says: I have a dam on a springy, sandy bottom. Can it be destroyed by throwing quicksilver into the water, and what amount would do it? Does the density of the bottom or pond side increase in the same manner as water of the ocean, and what would be the probable difference in density between the pond and tail water at a depth of 8 feet? Answer: Your mill dam is in no danger from any amount of quicksilver that you will be able to purchase in the market. The density of water increases very slowly with its depth, and the increase would be quite inappreciable in the case mentioned. A pressure of one hundred pounds per square inch only compresses water to the extent of about thirty-five one-hundred-thousandths. To compress 1,000 cubic feet of water into a volume of 999 cubic feet requires a pressure of about 300 pounds per square inch, or a superincumbent column of water about 700 feet in height.

G. L. K. asks: What size of opening would be required to give 5 horse power from a boiler under a pressure of 50 pounds per square inch, and what size of opening would be required for a 7½ horse power at 50 pounds and at 60 pounds per square inch? Answer: The size of opening required to deliver steam to an engine depends largely upon the amount of pressure that it is allowable to sacrifice. Generally good builders make their passages and pipes at least one tenth the area of the steam piston, with high speed of piston. With a long and crooked pipe, a still larger proportion is often adopted.

M. D. C. says: Your answer to F. H. N., in No. 22, Vol. XXVII. seems wrong to me. I wish to say that, if you drop a stone of a given weight into a body of water, waves will be produced a certain distance, and a second stone of the same size dropped at the same time, will not extend the undulations any farther. Is not this analogous to the question asked? I was at the first Jubilee held in Boston, and I claim that Parepa Rosa's voice could be heard farther than the singing of the entire chorus, because it was the most powerful of any and extended farther. Answer: The distance which a pure sound, a musical note as we usually term it, can be heard increases in the proportion of the square root of the intensity or loudness. We heard Parepa Rosa and the choruses on the occasion referred to, and our reply seems justified by observation. Sounds may, however, either reinforce each other or they may extinguish each other. Examples of the latter case are not frequently noticed, but we daily use sounding boards and other expedients illustrating the latter. See works on acoustics.

L. A. H. encloses a mineral specimen from Kansas, and asks what it is? Answer: An indurated plastic clay (neither loam nor marl) of very fine texture and slightly colored by oxide of iron.

J. W. M. says: I have seen at different times reports of copper tools, that were used in ancient times, being found. Said tools, it was stated, were tempered and were found to compare to those in use at the present time, that are made of steel. Can you inform me whether these copper tools were merely hardened at the ends or throughout, and where any can be found on exhibition? Answer: The copper tools of the Incas appear to have been throughout of the same hardness. One brought to this country from Cuzco by Professor Orton is now in the University of Rochester; but there is doubtless a number of them in the Smithsonian Institute.

In answer to H. & B., query 3, page 393, volume XXVII. allow me to say that there is now a pump at work at Fort Whipple, Va., which draws water from a spring at a distance from the pump, horizontally, of 900 feet; and in a vertical direction, of 65 feet. The pump is worked by horse power, and as soon as the weather moderates will supply the Fort with all the water required by 100 men and twenty animals.—C. C. W.

W. E. T. sends a sample of some mineral and would like to know what it is composed of and could be profitably used for. Answer: It is a very finely comminuted siliceous rock, with a small percentage of alumina, and evidently a result of decomposition, like kaolin. It would make an excellent polishing material.

A. M. S. sends a stone and asks what it is. Answer: It is massive iron pyrites, important, not for the iron, but as a source of sulphur and copperas.

T. McG. encloses a small piece of mineral, and asks for our opinion of it. Answer: It is iron pyrites.

G. R. E. G. encloses minerals and says: Please tell me their value and qualitative and quantitative character. No. 1: Some of the substance has been treated alone as well as with soda and with borax, before the blowpipe on charcoal. It has been tried in dilute, and also in C. P. sulphuric, nitric and muriatic acids, separately and also with their binary and tertiary combinations. It has been roasted and then subjected to the above tests, and still no result except a brownish brittle substance, slightly subject to the magnet. Some call it brown hematite; some say it is the same metal affected or impregnated with bitumen, and that its presence on the surface is indicative of coal formation in the vicinity; while others think it some compound of silice. Number 2 is granite. Answer: No. 1 is unmistakably brown hematite, or more correctly limonite. No. 2 is syenite, not granite.

B. B. R., writing from Ill., says that the temperature there has been as low as 23° below zero, and distillers' mashes go into the fermenting tubs at 106°, instead of from 96° to 92°, during the winter season.

S. F. says: I have read different ways, in the SCIENTIFIC AMERICAN, of preparing skeletons, the last one is good. It is to put the animal in a sieve and place it in a creek where the water can run through the sieve for three or four months; but I cannot place an animal two or three miles away from home for three or four months, so I tried another way, and found it good. I skinned and cleaned the animal without injuring any of the bones. (Of large animals, such as dogs, the flesh may be cut from the bones.) Then I boiled it soft in pure water and then took off as much of the flesh as I could; then I boiled it again in a mixture of two ounces of ordinary brown soap and five ounces of ordinary wash soda to one gallon of water, for about four hours; then I took the bones out of the mixture and placed them in another clean vessel and cleaned them off with boiling water.

G. H. says that J. H. R. should coat his skiff with boiled linseed oil.

A. J., page 10, current volume, asks how to load shot guns so as to throw the shot close. If he decreases the charge of powder or increases the charge of shot, the desired effect will be reached. The shot should also be rammed very little.—L. E. S.

G. H. says B. F., query 14, page 10, should repair the lead cistern with 2 parts black pitch and one part of rosin, make them into a paste, and coat the injured places. While lead with sand or ashes may also be used to stop the leaks in lead cisterns.

To C. R., page 10, Vol. XXVIII.—Don't use cloth for your fire board. It is cheaper and better to get from any store or printing office two or three sheets of the thickest wrapping paper, but empty flour sacks will do, and it matters not if they have been used and are wrinkled; glue together neatly a sufficient number of sheets to cover your fireboard and extend an inch or two beyond the edges. When the seams are dry, wet the entire sheet well with a sponge or brush, and whilst in that condition paste or glue it hurriedly to the edges or back of your fireboard. When dry, it will be as tight and smooth as a drum head; then apply the paste to the ornamental paper and lay it on evenly. A frame of four slats, three inches wide, is better than solid board, and any number of plies of paper can be put upon it.—T. M., of Pa.

To B. W. & Co., page 10, Vol. XXVIII.—Paste made by soaking gum tragacanth in water will stick on bright tin. The older the paste is, the better it will stick.—T. M., of Pa.

G. H. says: W. & Co., query 7, page 10, should coat the tin with boiling varnish and pitch, mixed with any desirable color; this mixture will adhere to bright tin.

W. H. C., query 8, page 10, can gild walnut wood as follows: Put on two or three coats of shellac or spirit varnish; and when dry, size the lines to be gilded with good gold size and, when sufficiently dry or tacky, apply your gold leaf with a camel's hair tip, and smooth off with soft silk handkerchief.—H. G. B.

G. H. says: Z., query 5, page 10, can remove the taste of kerosene by putting a few pounds of burned lime into the vessel, adding water, and closing the bung holes; shake the vessel till the lime has cooled, then cleanse the same with cold, and lastly with hot, water.

To T., query 21, page 10, current volume.—To dovetail a beveled box, first cut your board to the bevel at which you want to make your hopper; then set your bevel square to the end of the piece, and cut the bottom of your board to the same angle; then take your try square, and square across the board from the inside, letting the blade of the square lay flat on the level of the board, and it will give you the exact shoulder, inside and out, and it will fit well.—J. S. B.

To sink a well without taking out the brick: from the inside of the brick, slant out, down, two feet; when you are even with the outside, dig down as before. In laying up, when you come to the slanting part, take a trowel and remove the dirt as fast as you want to put in a brick.—E. W. B.

To A. J., query 4, page 10.—The rule for preventing shot from scattering is: Twice as much shot as powder (by measure, not weight), but you must suit your charge to the gun. Do not ram down the shot too much; only make sure the wad is down. For longer or shorter range, change the size of the shot, not the charge of the powder.—N. A. K.

J. M. sends minerals and asks what they are, and if they are of any value, or indicate the existence of metallic ores in their locality. Answer: The specimens are quartz crystal and fragments with small crystals of iron pyrites or "fool's gold." They do not necessarily indicate the presence of metallic ores.

To H. B., query 6, page 378, Volume XXVII. Forge the strip of steel into the desired shape, heat it to a cherry red, and fuse cyanide of potassium on its cutting edge. Return it to the fire, heat it to a cherry red, and immerse in lukewarm water until cool. Take care not to inhale the vapor of the cyanide of potassium. The degree of hardness can be acquired by practice in fusing the cyanide. Do not heat the steel enough to warp it. I found this plan succeed well with thin pieces of steel.—F. A. K., of Pa.

[OFFICIAL]
Index of Inventions
 FOR WHICH
Letters Patent of the United States
 WERE GRANTED FOR THE WEEK ENDING
December 31, 1872,
 AND EACH BEARING THAT DATE.
 [Those marked (2) are renewed patents.]

SCHEDULE OF PATENT FEES:

On each caveat.....	\$10
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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:

22,426.—CLOTHES WRINGER.—S. A. Bailey. Mar. 19.	
23,448.—ENGINE VALVE.—H. Clayton. Mar. 19.	
23,491.—ROPE LAYING.—G. W. Pittman & W. C. Boone. Mar. 19.	
23,520.—BURNISHING.—L. R. S. White. Mar. 19.	
23,525.—BEDSTEAD FASTENING.—L. W. Buxton. Mar. 19.	
23,533.—FAUCET.—C. W. Randall. Mar. 19.	
23,536.—NIGHT SIGNAL.—M. J. Coston. Mar. 19.	
23,600.—BOILER FURNACE.—J. Amory. April 2.	
23,726.—CORRUGATING MACHINE.—J. Wilson, C. Green & W. Wilson, Jr. April 2.	
23,750.—DOUBLE SEAMING MACHINE.—J. Wilson, C. Green & W. Wilson, Jr. April 2.	

EXTENSIONS GRANTED.

22,489.—COOKING RANGE.—G. Chilson.	
22,501.—OPERATING PUMP VALVES.—L. J. Knowles.	
22,502.—CORSET.—D. Lamoureux.	

DESIGNS PATENTED.

6,329.—CARPETS.—R. Hoskins, Brooklyn, N. Y.	
6,330 to 6,334.—CARPETS.—C. Richter, Philadelphia, Pa.	
6,335.—CARPET.—A. Webster, Jr., New York city.	

TRADE MARKS REGISTERED.

1,095.—STEEL SPRINGS, ETC.—Fort Plain Spring and Axle Works, Fort Plain, N. Y.	
1,096.—LEATHER.—J. Hannan, New York city.	
1,098.—BAKING POWDER.—Jewett, Sherman & Co., Milwaukee, Wis.	

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(NEW SERIES.)

NEW YORK, FEBRUARY 8, 1873.

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IN ADVANCE.

FOOT POWER BAND SAW.

Our engraving represents another application of the "Vertical Multiplier"—a device which has already been fully explained and described in these columns—to the band saw. As we presume that the general details of the invention are sufficiently familiar to our readers, we consider no minute explanation of principle or working parts here necessary. Actual experience has fully demonstrated and we have convinced ourselves of the fact from a careful inspection that—leaving out all mooted questions of a theoretical nature—by this ingenious combination the motive power is economized to an unexampled degree, through the all but annihilation of frictional loss. That which makes this application of more importance than any other on the same principle made by the inventor is the fact that, so far as we are informed, it is the first successful attempt to operate band saws by man power: and it is perhaps safe to consider that any effort to accomplish the same results, through the old principle of gearing, would prove unavailing.

In the machine depicted, forty steps of the treadle correspond to thirteen hundred and sixty revolutions of the saw pulley. The motion is perfectly continuous and, so far as we can judge, the saw works with a rapidity and effectiveness little short of that which it would attain if driven by steam. In trials in our presence, the blade divided three inch stuff, and even live oak timber, with great readiness, while sharp curves and scrolls were cut with no apparent difficulty. There is little doubt but that, to wood workers having no steam power conveniences, this application of the invention is destined to form an important acquisition.

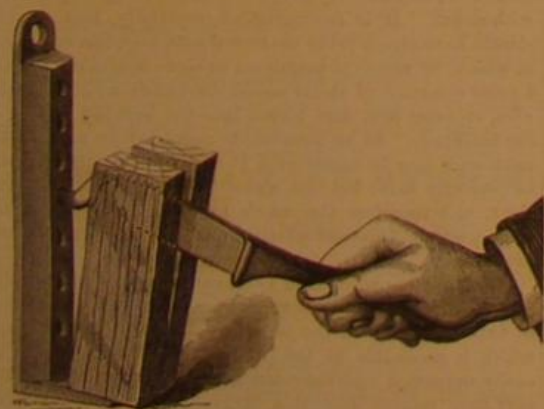
We would refer those desiring to examine more closely into the principle, which, it is clear, may be indefinitely extended, to the illustrated descriptions in Volumes XXII. and XXVI. of this journal. Detailed information may be obtained by addressing the Combined Power Company, 23 Dey street, New York city.

Improved Cask.

A Mr. Trimmer has recently invented a cask, which consists in making one or both ends partly or entirely of glass, so that the observer may see whether it is full when delivered, when it has become sufficiently empty to replace it with a fresh one, at what rate its contents are being reduced, and also, when empty, whether the cask has been properly cleaned. The inventor, in some cases, uses a cask head made entirely of glass, and in others a strip of glass let in vertically or diagonally, and properly secured from leakage.

KINDLING WOOD SPLITTER.

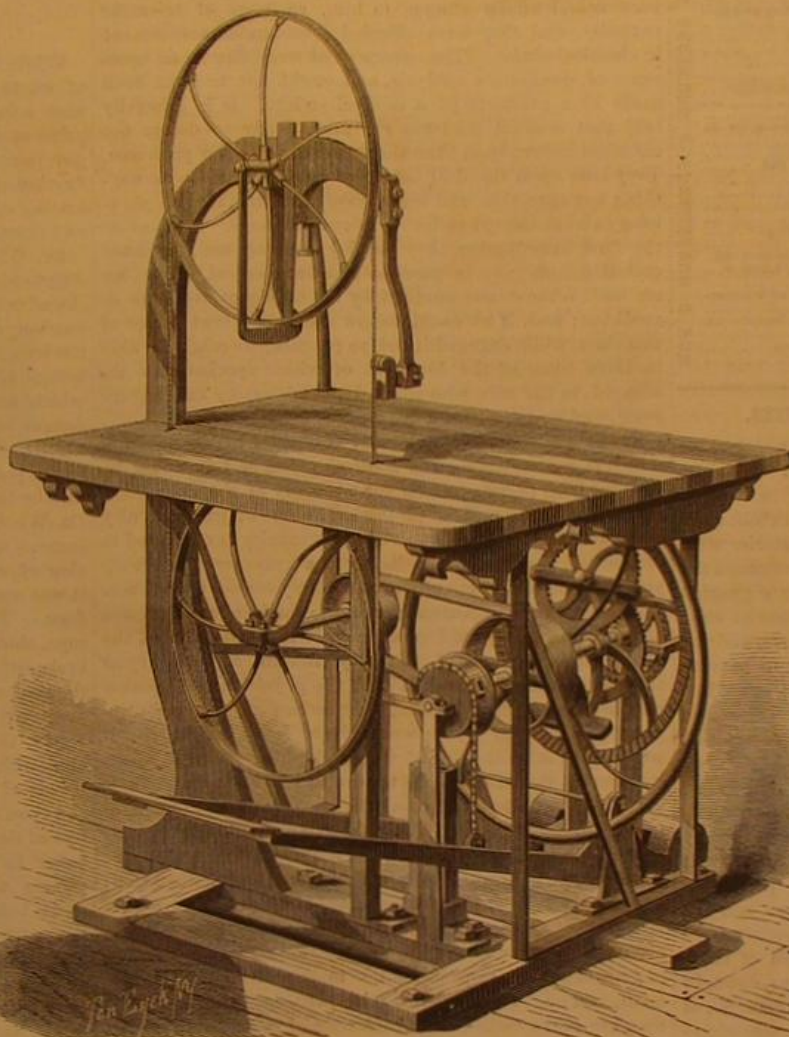
This ingenious little device will doubtless save many of self-inflicted cuts and bruises due to the awkward blows of



hatchets in inexperienced hands. It is a kindling wood splitter, and consists simply of a strong blade, at one end of which is a handle, and at the other a projection which fits into one of the holes of a perforated standard. It is only necessary to place the stick of wood under the knife, as shown in the engraving, and press down on the handle. Mr. Franz Wagner, of New York city, is the patentee.

A Novel Problem.

Four hundred and fifteen miles of track, on a road running north and south, were laid, between 1850 and 1861, says a correspondent of the *Railroad Gazette*, with the fish bar joint fastening, similar to that now in general use. The difference in the elevations of the north and south ends of the tracks does not exceed 150 feet—the southern end being the



FOOT POWER BAND SAW.

lowest—and the grades undulate; but at no point is a greater elevation attained than 200 feet above or 125 below the southern end. On about one half of the distance the track was laid with both rail joints on the same cross tie, and the balance with "broken joints." The rails were not "slotted," neither were any "stop chairs" used to prevent the track from "creeping." The track has been in use from 11 to 20 years and the creeping of both rails has been southward, and the western has crept much faster than the eastern. In places where the grade does not exceed 5 to 8 feet per mile, for 20 or 30 miles, the joints of the western are now opposite to the center of the eastern rails, while the latter have also moved southward. On the heaviest grades descending northward, there is little or no tendency to move down hill or northward.

Perhaps some one can explain why the western rails creep faster than the eastern.

Automatic Fire Alarms.

A correspondent, F. I. R. E., suggests a system of small tubes throughout a building, with small chambers full of some volatile liquid (such as alcohol, bisulphide of carbon, etc.) attached thereto at intervals. One end of each tube should be closed, and the other should terminate in a piston and cylinder arrangement, the motion of the piston being used to ring a bell. A similar result might be obtained by using an explosive compound in the chambers.

Another plan is to stretch electric wires of fusible metal through the premises, the melting of the wires serving to break the circuit and give an alarm.

The number of blood globules is greater in mammals than in birds, in the latter than in fishes. This number is almost always in an inverse ratio to the volume of the globules; the relation between number and volume is not proportional. Birds gain more by the augmentation of the volume of their blood globules than they lose by the diminution in their number.

The Public Document.

Congressman Cox, in a recent speech, said that a Philadelphia editor thus relieves his mind on a subject familiar to all newspaper offices, the inevitable Pub. Doc.: "We owe our thanks to Judge Kelley for the latest Patent Office reports. We already have sixteen hundred of these interesting volumes in our little library, but they have been read and re-read so many times that we know every page of them by heart. This new volume came opportunely and gratefully on Christmas morning, and that night we gathered our little family around the fire and read it through to them. The affecting tale entitled 'Improvement in Monkey Wrenches,' seemed to touch every heart, and when we came to the climax of the little story about 'Reversible Pieboards,' there was not a dry eye between the front door and the stable. During the reading of the piteous narrative entitled 'Gum Washers for Carriage Axles,' the whole family gave expression to boisterous emotion, and the hired girl was so much excited that she lost her presence of mind and went around to her mother's, inadvertently, with six pounds of sugar and a butter-kettle full of flour, and came home at midnight intoxicated. We can never sufficiently thank Judge Kelley for the innocent enjoyment thus furnished us. The memory of that happy evening will linger in our minds very much longer than that hired girl ever lingers when she lights on a lot of substance which she thinks will suit the constitution of her aged parent."

Acetate of Soda for Preserving Meat.

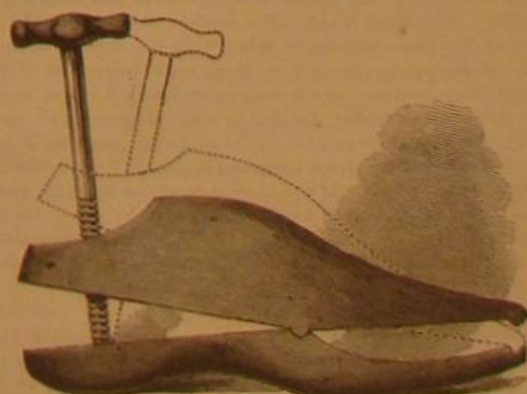
We published, in Vol. XXVII., page 149, an account of M. Sacc's researches upon the antiseptic properties of acetate of soda, and refer to it again for the purpose of recommending, to the manufacturers of vinegar in the South, the substitution of soda ash for lime in absorbing the products of the distillation of wood. The soda ash may cost considerable more than the lime, but the resulting acetate of soda can be employed to great advantage in the preservation of food, and it would be possible to send the cheap beef of the South, after preservation in the acetate, to a market where it would fetch a high price. Another advantage in the employment of soda is

that the crude acetate can be easily refined, and from it the pure glacial acetic acid can be made by treatment with sulphuric acid.

SHOE STRETCHER.

This ingenious device is the invention of Mr. T. C. Maris, of Marietta, Ohio, and is so arranged that either the instep or the toe of the shoe may be enlarged at will. It is constructed in two portions which, together, conform to the shape of the shoe.

In operation, the two plates are adjusted by the set screw, so that both the fulcrums of the upper plate rest in corresponding recesses in the sole plate, in which position the stretcher can readily be inserted in the boot. When the



handle of the adjusting screw is turned in one direction, the heel end of the upper plate is depressed and rocks on the rear fulcrum, which causes the toe end of the plates to expand and stretch the toe end of the boot in a suitable manner. When, on the other hand, the handle is turned in the opposite direction, the heel end of the upper plate is raised, as shown by the dotted lines in the engraving, and the toe end rests upon its fulcrum, so that the instep of the shoe can be stretched to any degree required.

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THE DOCTORS AND THE APOTHECARIES.

Apothecaries were originally confectioners, engaged in making preserves, candied fruit and bonbons for the tables of the rich. By degrees, they took to dealing in healing herbs; and after the invention of distillation, sublimation and the chemical processes, they fitted up laboratories with furnaces and expensive apparatus; and in consequence of the cost attending such improvements the governments granted certain monopolies and privileges, and in the course of time the art of compounding medicines became a science, and the physicians gladly handed over their prescriptions to persons more familiar with drugs than they themselves were. The modern apothecary is, or ought to be, a man of as thorough education as the physician, but it too frequently happens that the ancient and original idea of the confectioner's shop is retained, and the druggist becomes a dealer in small wares, or, in other words, a shopkeeper. In Germany it is considered entirely *infra dig.* for a pharmacist, as a scientifically educated apothecary prefers to be called, to sell candy, hair brushes and articles of the toilet. The regular profession confine themselves to the preparation of medicines and the filling up of prescriptions, and their position in society is on a par with that of the doctors. We are reminded of these things just at the present time by the accusations, brought by some medical practitioners against certain apothecaries, of falsifying prescriptions for purposes of gain. It sometimes happens that the medicine called for by the prescription is a very dear one, and, if the usual profit were to be charged, the druggist would lose the customer and the patronage of the doctor at the same time. The statement is made that, to avoid this double calamity, only half the prescribed quantity of the rare chemical is taken, or some cheap drug is substituted for the dear one. This is a pretty serious charge to make against a whole profession, and we have not seen it anywhere stated that the doctors are so sweeping in their denunciations; but there have been so many instances of complaint of gross negligence, if not of intentional fraud, that it is the duty of the pharmaceutical profession to cause a searching investigation to be made into the truth or falsity of the charges. It is bad enough to have blunders committed, and it would be intolerable to supplement the difficulty by adding intentional fraud. We confess to a feeling of sympathy for the apothecaries when they attempt to decipher the hieroglyphics handed to them under the name of prescriptions; and we cannot comprehend why it is not as easy to write out the order, for that is what it amounts to, on the druggist in a clear and comprehensible language as it is to indicate it in abbreviated Latin and ornament it with cabalistic signs and symbols. If a merchant sends an order for goods, he writes it in a clear legible hand, and he generally gets what he wants. This is an ordinary business transaction, and if a mistake were to be made it could be rectified without endangering the life of anybody. It is really, therefore, of less consequence in such matters to be so very particular; but, in the matter of drugs and poisons, one would think that every precaution ought to be taken. We recently read in a medical work that arnica was a favorite remedy in Germany for amaurosis, and the following formula is recommended:

R Ext. Arnice, ʒ ij.
Strychnie Sulph..... gr. xii.
Conf. Rosae, q. s., ft. pil. xli.

This is all very well when printed, but suppose it comes to the apothecary in a cramped and irregular hand, written with a pencil and half rubbed out. He may be able to read

what particular medicines were prescribed, but the quantities of each might baffle all attempts at interpretation, and whether we take ten grains or twenty grains of strychnin is a matter of serious importance to the patient. In such an extremity we dare say that the druggist tries to err on the right side, and halves the supposed amount, and he is now accused of forgetting to make a corresponding deduction in the price. The physician's side of the story is that the apothecaries are sometimes not properly educated, and hence make mistakes in reading prescriptions. They say that pharmacists must be familiar with Latin and with all the abbreviations usual in the profession. On the other hand, some of the pharmacists say that the doctors have neglected their own Latin and are far behind the times in chemistry. They lay at the door of the physician that he attempts to compound the most impossible mixtures, in utter contempt of the laws of affinity and of double decomposition. When prescriptions of this character come into the hands of the experienced apothecary, he sometimes secretly changes them; or, if the chemical reactions do not form poisons, he follows strictly the letter of the law and throws the responsibility upon the doctor. We have been told by a professor of chemistry in New York that certain prescriptions have been confidentially shown to him, as items of scientific curiosity, and they have afforded considerable amusement in chemical circles. The errors cited were due to an ignorance of qualitative analysis, and ought not to have been made by a graduate of a medical college. It is generally said that medical students are more ready to desert the chemical lecture room than the course of any other professor. They look upon the dull details of acids and salts as anything but agreeable, and are always ready to take up physiology and anatomy as offering more attractions. Just before the final examination, they employ a tutor and, by hard cramming, contrive to pass the necessary ordeal. This, we are told, is the course pursued by the negligent students of medicine; and, if we could follow the subsequent career of this class, while engaged in active practice, we might be able to trace some of the blunders of which apothecaries are accused to the men who shirked the laboratory and lecture room, and crammed for a degree.

There are, therefore, evidently two sides to the question which is now agitating the medical press, and it would be well for both parties to seek for a remedy of the evils complained of. The medical profession is one of great dignity and importance. The health of a community is entrusted to physicians, and the responsibility is a grave one, requiring years of careful preparation and nicely tested experience. Hardly second in importance, owing to the immense progress made in chemistry and pharmacy, is the education of the apothecary. Colleges of pharmacy are quite as necessary as colleges of medicine, and, if both the physician and apothecary are thoroughly educated, the question of Latin prescriptions or technical terms would have less significance; it would soon solve itself, and we should hear no more about it. But all the education in the world would prove of little value without absolute honesty in prescribing and equal integrity in compounding. The physician should know what he is about, and, after making his diagnosis and prognosis, should write his prescription with due care and deliberation; and this being done, the apothecary must follow it to the last grain. Any tampering with prescriptions, as one would present a false invoice at the Custom House, for the purpose of greater pecuniary profit, is not to be tolerated for a moment, and ought to be visited with penalties far more severe than are ever attached to an infraction of revenue laws. Let the physicians and apothecaries unite together in securing such legislation as will protect both themselves and the community from the impending danger.

PHOTOGRAPH PORTRAITS--AN IMPROVEMENT.

At a recent meeting of the Photographic Society of the American Institute in this city, a discussion took place upon the merits of the new method of shortening the exposure of photographic plates in taking gallery portraits. Several of our leading photographers took part in the discussion, and specimen negatives were shown. Mr. H. J. Newton exhibited a negative upon which were two pictures, both of the same subject, showing no apparent difference, although one was taken with an exposure of seventeen seconds, the other with only seven seconds. In the example of another negative, one of the pictures had an exposure of thirty-six seconds, the other eighteen seconds, both equally good. The operation is as follows: The sensitive plate is first placed in the camera and exposed to red light, which is admitted through the tube, the mouth of which is covered by a red colored glass. This exposure to red light is continued for from ten to twenty seconds. The shield slide is then pushed in and the red glass removed, after which the portrait of the sitter is taken in the usual manner, except that the time of sitting is greatly reduced.

This is a very simple improvement. Any of our photographic readers may try it, and adopt it in their galleries. Mr. Anthony, Mr. Kurtz, and other photographers regarded the process as quite useful. Mr. Kurtz said the great object of the photographer, in portraiture, was to secure a natural expression of the features; in a long exposure, it was impossible for any sitter to maintain such expression. Then, in taking portraits of children, it is of the first importance to have a short exposure of the plates. The improved process gives these advantages, without much perceptible loss in the details. The theory on which this process depends appears to be this: when the photographic action is once started on the plate, it is easily maintained. It may be compared to the inertia of a wheel or a car. When the inertia is once overcome, it is easily kept in motion.

THE EYE AND THE SUN.

Mr. Oliver Byrns, of Canada, has forwarded to us a pamphlet in which he argues that, because the pupil of the eye becomes expanded during the darkness of night, the disk of the sun on its rising is apparently larger than when that luminary reaches the zenith. He also says that when the sun is in the horizon its rays have to pass through a thicker stratum of air than when it is overhead; that the atoms of air are competent to intercept a portion of the sunlight on its passage, and the greater the distance of the air to be passed through, the more light will be cut off. Hence the gross amount of light which reaches the observer's eyes will increase from sunrise till midday, and decrease from midday to sunset, and the pupils will contract and expand in proportion. He finally thinks the time may come when the orbit of the earth will be found a circle. Comment on such theories is useless. They indicate a mental atmosphere of ignorance of astronomy, optics, and physiology so dense that the strongest light of common sense would become utterly absorbed in endeavoring to permeate its obscurity. We suppose that if this philosopher took a dose of belladonna or inserted a little atropia in his visual organs, he would expect to see the sun cover nearly the entire firmament.

STEAM AS A FIRE EXTINGUISHER.

While we are discussing the dangers of steam as a cause of conflagration, it is curious to observe that the German scientific and industrial journals are discussing the value of steam as a fire extinguisher, and some of the local governments are preparing to take measures for the introduction of special steam boilers for the sole purpose of generating steam rapidly, so as to blow it into burning buildings and smother the flames by displacing the air by steam.

Dr. Wiedenbuch, of Wiesbaden, recently published in the *Polytechnic Journal* an article on this subject, and points out the advantage that steam, while it is not a supporter of combustion and extinguishes fire by driving the air away, is not irrespirable *per se*, and does not act injuriously on living beings, like carbonic acid, sulphurous acid, and other gases which are also non-supporters of combustion. The only danger of steam is that, when escaping under great pressure, as when superheated, it will scald any one who is close to the point of escape; while, at a distance, it cools so rapidly by its own expansion that it soon becomes harmless. Dr. Wiedenbuch's last opportunity of witnessing the effectiveness of steam as a fire extinguisher was on the occasion of a fire in a factory 180 feet long and 30 feet wide; it was one story high, with an attic separated by a wooden floor. The attic was filled with a great many tuns of rags, shavings, leather scraps, etc.; and among these, a fire broke out in the night, which was only discovered when half the roof was in flames. As the location of the establishment was quite out of the way, more than an hour elapsed before the fire engines arrived from the nearest station; meanwhile the conflagration met but little resistance, by reason of the very unsatisfactory preparations against fire, and soon the whole roof was in flames; it fell in, and the fate of the lower story appeared sealed. There was a steam boiler in an outhouse with the furnace banked; the fire therein was quickly increased by means of wood, the steam being still up. A courageous carpenter, contrary to the orders of the Fire Marshal, who had decided that the walls should be thrown down, went into the burning factory, and by means of a heavy axe broke the first cast iron steam pipe he could reach; of course the steam immediately escaped under considerable pressure, filled the whole place, and extinguished one burning mass after the other; and even the rag heaps in the attic, which, after the fall of the roof, were burning in the open air, became more and more surrounded with steam, so that in half an hour after the steam was admitted all danger was considered over, and the firemen, who had in the meantime arrived with their engines, considered their labor unnecessary, it having been so effectually replaced by steam.

The German papers point out that every manufacturer who uses a steam boiler possesses the most powerful fire extinguisher, which he may make available by proper additional arrangements. For instance, wrought iron gas pipes connected with the boiler, branching off into every room, may be provided with stop cocks which, in case of fire, may be turned on, and so every portion of the building may be filled with steam. It is recommended, especially, that theaters should have steam tubes connected with a system of heating in which, by means of petroleum or some equivalent as fuel, a great quantity of steam could be raised within ten minutes, or even less, and blown into the burning portion of the building. As no pressure is necessary for such an apparatus, it may be constructed in a simple manner, and still be perfectly safe; but the quantity of steam must be sufficient, and therefore the whole problem is to generate the largest possible amount of steam at low temperature and pressure.

Finally, it is proposed in Germany to make transportable steam boilers, and connect them in case of fire with a system of tubes, with which the buildings are to be provided, and which is accessible at the front of the house, so as to be easily connected with the steam generator in the street. We may here remark that this very same plan was patented in this country, in the spring of 1870, by Dr. Orazio Lugo, a distinguished chemist at that time residing in Baltimore. The plan was at that time very favorably received by insurance companies; and it is remarkable that it has not yet received a more extensive application.

We wonder what our German friends will say when they are informed that, according to a no less authority than the Fire Marshal of the metropolis of the New World, steam is

a dangerous element in regard to fires, and is even "a highly ignitable substance."

THE BALANCE WHEEL QUESTION.

We have received a large mass of correspondence on the subject of the inclined balance wheel question, which we set right in our issue of the 25th ult., and, as there promised, we glean out for our readers some of the more interesting letters. We are much pleased with the accuracy and clearness exhibited by many of our correspondents, some of whom are evidently accustomed to reason logically and to express themselves with precision, notwithstanding their unfamiliarity with the labor of writing for the press.

G. B. D. says that, in the case of the balance wheel set at an angle on the shaft: "It is just as much out of balance as two unbalanced pulleys would be when secured to the shaft at a short distance from each other, with their heavy sides one opposite the other. . . . A cheap method of trying an experiment of this kind is to construct a top, as shown



in the figure, making it of metal. . . . If this top can be made to run steadily like an ordinary top, then W. must pay the forfeit," otherwise R. loses.

A Canadian friend and subscriber, J. P., after paying the SCIENTIFIC AMERICAN a pleasant compliment which we appreciate fully, shows, by a similar argument, that the wheel would be

unsteady, and presents several sketches. We select one, a pulley, shown in the next figure. He says: "An experienced mechanic needs but a glance to see that a cylinder keyed on in that way will not run at a high rate of speed, but may yet be in standing balance."



W. G. B. goes at once to the root of the matter. He asks a question which reveals the misconception, which gave rise originally to error in the solution of this really very simple problem. He asks if Haswell is right in saying that "The centrifugal force of two bodies which perform their revolutions in the same time, the quantities of matter in which are inversely as their distance from the center, are equal to one another."

Haswell is right, and another correspondent, H. B., shows why, in the following concise statement: "The centrifugal force is not only proportional to the vis viva , but, at the same time, is inversely as the distance from the center."

"The transformed equation is $F = \frac{W \cdot R \cdot 2\pi^2 \cdot 144}{32 \cdot 16} \cdot N^2$, in which R is the radius of the circle described by the revolving body, N the number of revolutions per minute. It shows clearly the centrifugal force to be in proportion to the momentum and as the square of the number of revolutions. As two bodies on the same shaft have the same number of revolutions, a running balance is established when the bodies are in standing balance and revolve in the same plane, as then the centrifugal forces are equal in opposite directions and in the same line, therefore balancing one another.

"A running balance is not obtained in case of a standing balance, if both weights are on different points of the shaft, because then the centrifugal forces, although equal and in opposite directions, cannot balance each other, since they are not in the same line.

"The forces tend to bend the shaft and therefore exert pressures on the bearings which have constant relation to the revolving shaft, but not to the bearings, and, in consequence, shake the bearings or the whole foundation."

TRACTION ENGINES OR ROAD LOCOMOTIVES.

Under the above heading, Professor R. H. Thurston, of the Stevens Institute of Technology, publishes in the *Journal of the Franklin Institute* a very able and comprehensive article, and incorporates therewith the following *résumé* of facts and deductions drawn from experiments recently conducted by him with the Aveling and Porter road locomotives.

1. A traction engine may be so constructed as to be capable of being easily and rapidly manoeuvred on the common road and in the midst of ordinary obstructions.

2. Such an engine may be placed in the hands of the average mechanic, or even of an intelligent youth of 16, with confidence that he will quickly acquire, under instruction, the requisite knowledge and skill in its preservation and management.

3. An engine, weighing rather more than five tons, may be turned continuously in a circle of 18 feet radius without difficulty and without slipping either driving wheel, even on rough ground, and may be turned in a roadway of a width but slightly greater than the length of the locomotive, by proper manoeuvring.

4. A road locomotive weighing 5 tons 4 cwt. has been constructed, which is capable of drawing, on a good road, more than 23,000 pounds up the almost unexampled grade of 533 feet to the mile, at the rate of four miles per hour.

5. Such a locomotive may be made, under similar conditions, to draw a load of more than 63,000 pounds up a hill rising 225 feet to the mile, at the rate of two miles per hour, doing the work of more than twenty horses.

6. The action of the traction engine upon the road is beneficial, even when exerting its maximum power, while with horses the injury to the road bed is very noticeable.

7. The coefficient of traction is, with such heavily laden wagons as were used in the course of the experiments and under the circumstances noted, not far from four per cent on a well made macadamized road.

8. The amount of fuel, of good quality, used may be reckoned at less than 500 pounds per day, where the engine is a considerable portion of the time heavily loaded and during the remaining time running light.

Professor Thurston's deductions may be briefly summarized as follows: The traction power of the engine is equal to that of twenty horses. This amounts to, excluding the weight of the locomotive, seventy-five tons, while the machine possesses a decided advantage over the animal. The working time of the traction engine may be stated to be ordinarily twenty per cent greater than that of a dray horse, and to be capable of indefinite extension when required. The first cost of steam and of horse power is nearly equal, the difference being in favor of steam, leaving also on the side of the engine the immense advantage arising from its ability to work longer hours when required. The total annual expense of an engine of the above power and capabilities may be reckoned at \$2,439 as a maximum figure, including cost of attendance. And, lastly, a steam traction engine, capable of doing the work of 25 horses, may be purchased and worked at as little expense as a team of six or eight horses.

THE SIGNAL SERVICE BUREAU.

The report of the Chief Signal Officer of the Army for the year 1872 contains an immense amount of valuable and practical information regarding meteorological science. Full details are added relative to the progress of the labors of the Government in the establishment of signal stations, the education of observers, and the publication of reports showing that this important service has materially advanced in usefulness and efficiency during the past year. Ten additional stations have been established within the United States, and the total number of points at which observations are now made is seventy-two. From the first station in the Aleutian islands to those upon the British coasts, the reports from both of which are noticed, there intervenes nearly half a circumference of the earth's surface. From the stations on the Aleutian islands comes the first intimation of storms or meteoric disturbances having their origin on the coast of Asia. The Pacific stations report the first appearance on that coast of the disturbances thus traced. The connection is continued by the Rocky Mountain stations, and thus the news travels in advance of the storm.

The organization of a mobilized corps of observers has been commenced. This will be composed of picked men, and its object is to place at the disposal of the government the power of suddenly increasing the number of stations from which reports are to be had in any section of the country which may, at any season of the year, be especially threatened by the storms which seem, at different seasons, to pass more frequently over particular portions of the territories of the United States. It will be possible to occupy, in this way, the stations as stations of report with very great rapidity.

In regard to the accuracy of warnings and predictions, General Myer states that the percentage of cautionary signals verified, by the occurrence of the winds described within a few hours after the display of the signal, is estimated to have been about 70 per cent. The signal, it is explained, is wholly cautionary, for warning of probable danger.

The experiment of a balloon ascent has been tried with fair results. One hundred and fifty-six readings were made, establishing the fact that very delicate instruments may thus be employed.

Arrangements for an interchange of reports have been made with Canada, and a similar course is contemplated with the West India islands. It is believed that many of the cyclonic storms, the indications of which are first felt by the stations of the United States, as then showing the disturbances upon the Gulf of Mexico or near the Atlantic coast, and which storms are afterward to be traced across the States intervening to the lakes or along the Atlantic sea coast, pass over points on these islands from which their presence can be announced. Since January 1, 1872, state reports of the changes in the depths of water in the principal western rivers, being in direct relation to the meteoric changes, have been reported daily. It is hoped that a portion of the great problem of the protection of the river commerce from ice and freshets, and of the lower river levees from breakage and overflow, will be solved through the timely warnings that will be given.

The practical results of this branch of the service, with all its errors and imperfections, can be summed, it is believed, in the statement that, since the inauguration of its duties, no great and continuous storm has traversed the territory of the United States, or raged along the length of its lakes, its gulf or sea coast, without fair and general premonition, given at the great majority of the points endangered.

ARTIFICIAL FERTILIZATION.

The fructification of soils has its natural pabulum in the sewage of cities, towns and habitations. The devising of means for the utilization of this resource is therefore of paramount importance; but while the problem remains comparatively unsolved, the food required by growing crops must be supplied through the media of artificial fertilizers. These Nature distributes through the globe in the shape of mineral phosphates, consisting of the various kinds of rock guano coprolites, the fossils of marl beds and the minerals of apatite and phosphorite. Before these substances are supplied

to the soil, they must not only be finely powdered but converted into forms which are promptly sensitive to the solvent action of aqueous solutions of carbonic and organic acids, very dilute acetic acid, ammoniacal and potassic salts and of the corresponding influences of the soil and plants as exerted during the progress of vegetation. In order to supply the want for methods simple and economical for changing, not merely the physical constitution of the mineral phosphates, but also their chemical temperament, in such a manner as to convert them into fertilizers at once concentrated and potential, Dr. Campbell Morfit has given to the world a work replete with information of the greatest practical value, entitled "Mineral Phosphates and Pure Fertilizers;" it is issued by Van Nostrand of this city, with an elaboration of paper and press work rarely found in volumes of similar description. Its high price, twenty dollars per copy, is its sole defect; but, written by so eminent an authority and appearing at a time when the subject of which it treats is occupying so large a proportion of popular attention, even that drawback will, we are convinced, not prevent the book attaining the wide circulation that it merits.

Dr. Morfit begins with the description of the raw materials, namely: Animal and mineral phosphates of lime, sulphuric acid, hydrochloric acid, crude ammonia liquor, sulphate of ammonia, chloride of ammonia, sulphate of potassa, chloride of potassium, carbonate of potassa, lime and nitrate of soda. In the United States the principal deposit of phosphate is in the neighborhood of the Ashley River, in South Carolina. The material is in the form of hard nodules called marlstones, and the beds are from 40 to 50 miles in extent. In Beaufort county, in the same State, a different variety of phosphate is found distributed over some 1,600 acres. This bed is calculated to yield 10,000,000 tons.

A chapter is given to the chemical data of the substances employed, and the subject of machinery and the general plan of an establishment for their preparation is minutely explained. To leave nothing unfinished, the letter press is accompanied by twenty-eight plans, large in size and accurately drawn to scale, so that the manufacturer is furnished, not only with full instructions, but with complete drawings from which his machinery may be constructed. The process for refining the crude phosphates of lime, without waste of material and with the reclaiming of other chemical agents found with them, is fully treated upon. The topics of the manufacture of precipitated lime, Columbian lime, and di-phosphate of lime, of pure and commercial superphosphate, of Horsford's, Liebig's and other phosphatic baking powders, of pure biphosphate and of the utilization of phosphate alumina precipitate from sewage as a raw material are also discussed at length. The concluding chapters are devoted to the mode of using hydrometers and thermometers, and to the manufacture of various waterproof cements and paints.

RECENT DISCOVERIES IN THE PYRAMIDS.

The Pyramids of Egypt were constructed 4,000 years ago. Mr. Dixon, of England, has for some time been exploring the two remarkable chambers known as the king's and queen's chambers, in the interior of the Great Pyramid. By means of a wire introduced between the joints of the masonry, he found a space, and was thereupon induced to bore into the walls of the queen's chamber, when he discovered a passage way, eight by nine inches in dimensions, evidently a ventilating flue. Its terminus has not yet been found. Within the passage way he found a bronze hook, which is supposed to be the most ancient specimen of bronze now existing. He also found a piece of worked cedar wood and a granite ball, which latter is believed to have been an Egyptian weight. Its diameter is 2½ inches. As the walls behind which these articles were found were solid on the inner side of the chamber, it is believed that they were placed in the positions where they were found at the time the pyramid was erected.

SILVERING GLASS.

For a long time aldehyde has been employed in the glass silvering process suggested by Liebig; but some difficulties of manipulation have led practical men to prefer other reducing agents. R. Siemens has modified the operation and greatly simplified the reduction of the silver. Dry ammonia gas is passed through aldehyde to produce aldehyde ammonia; 2.5 grammes of aldehyde ammonia and 4 grammes nitrate of silver to 1 liter of water is the proper proportion to take. The nitrate of silver and aldehyde ammonia are separately dissolved in distilled water, mixed and filtered. The object to be silvered must be thoroughly worked to free it of fat, and if it be a globe or bottle, the liquid is poured in as high as it is desired to form the deposit. As soon as the heat, which must be applied, shows 50° C., the separation of the silver begins and soon spreads itself over the whole surface. At first, when the coating is very thin, it looks dark, but soon assumes a metallic luster; when it is a brilliant white, it is time to remove the fluid contents, as the mirror is apt to be injured by too long contact with the aldehyde. Flat objects are laid upon the mixture in the usual manner. In Germany, where aldehyde ammonia can be purchased at a reasonable cost, this process is highly prized. By making his own salt, in the manner described above, the chemist in this country can also avail himself of the method. The simplicity of Siemens' process certainly commends it to favor.

VOLATILITY OF IRON.—It seems that iron is volatile at very high temperatures, the same as gold and platinum. Dr. Elsner, Director of the Berlin porcelain factory, enclosed a small piece of wrought iron in an unglazed crucible and exposed it for several hours to a temperature of at least 3000° C. On removing the cover of the crucible, small needles of metallic iron were easily discerned, clearly showing that iron can be volatilized at high temperatures.

PROFESSOR TYNDALL'S SIXTH AND CONCLUDING LECTURE IN NEW YORK.

We have employed as our source of light the ends of two rods of coke rendered incandescent by electricity. Coke is particularly suitable for this purpose, because it can bear intense heat without fusion or vaporization. Still, refractory as carbon is, if we closely examined our voltaic arc or stream of light between the carbon points, we should find there incandescent carbon vapor. We might also detach the light of this vapor from the more dazzling light of the solid points, and obtain its spectrum; but instead of an unbroken succession of colors from red to violet, we should find but a few bands of color, with spaces of darkness between.

What is true of carbon is true of the metals, the most refractory of which can be fused, boiled and reduced to vapor by the electric current. Professor Tyndall then arranged two carbon points, the end of the lower one being hollowed out. In the cap thus formed, he placed a fragment of the metal thallium. On establishing the current, a flame of a vivid green color appeared upon the screen. On submitting this light to the action of a prism, the spectrum showed as a single green band. Therefore, the lecturer stated, light of one degree of refrangibility, and that corresponding to green, is emitted by the thallium vapor. A particle of silver was then substituted for the thallium. A bright green flame of precisely the same shade as that before obtained appeared, but the spectrum of the vapor exhibited two green bands. By adding to the silver in the camera a bit of thallium, the single band of the latter appeared in the spectrum between the two silver lines. But, continued the speaker, it should be noticed that the thallium band is much the brightest of the three. It is the resistance offered to the passage of the electric current from carbon to carbon that calls forth the power of the current to produce heat. Now thallium is a much more fusible and vaporizable metal than silver, and its vapor facilitates the passage of the current to such a degree as to render it almost incompetent to vaporize silver. As the thallium is gradually consumed, the silver lines increase in brightness until the three bands are of uniform brilliancy.

CHARACTERISTIC BANDS OF THE METALS.

We have in these bands a perfectly unalterable characteristic of these two metals. No other lines except the two green ones, are ever obtained from silver, or any other than the single green band from thallium. Every known metal has its bands, and in no known case are the bands of two different metals alike. Hence, these spectra may be made a test as to the presence or absence of any particular metal. If we pass off from the metals to their alloys, we find no confusion. The lecturer then showed the green bands of copper and the blue and red zinc lines; brass, an alloy of copper and zinc, gave the bands of both metals. But we are not confined to the metals; the salts of the metals yield also the bands. Chemical union is ruptured by a sufficiently high heat, and the vapor of the metal is set free. The chlorides of the metals are particularly suitable for experiments of this character. Common salt, a compound of chlorine and sodium, yields the spectrum of the latter element.

DISCOVERY OF NEW METALS.

When Bunsen and Kirchhoff, after having determined the spectra of all known substances, discovered a spectrum whose bands did not correspond to any known bands, they immediately inferred the existence of a new metal. By operating upon the mineral waters of Germany, evaporating immense quantities of the fluid, they discovered the metal rubidium, and afterwards a second metal which they named "cesium;" subsequently Mr. Crookes, by the same method, added thallium to the list of metals.

APPLICATION OF SPECTRUM ANALYSIS.

Kirchhoff showed how spectrum analysis might be applied to the investigation of the sun and stars. A spectrum is pure in which the colors do not overlap each other. We purify the spectrum by making our slits narrow and by augmenting the number of our prisms. When a pure spectrum of the sun has been obtained in this way, it is found furrowed by innumerable dark lines. Four of them were first seen by Dr. Wollaston, but they were afterward multiplied and measured by Fraunhofer with such masterly skill that they are now universally known as Fraunhofer's lines. Kirchhoff had proved, for every ray of the spectrum, the doctrine that the body emitting a ray absorbed with special energy a ray of the same refrangibility. According to this principle, vapors of metals, if crossed by solar light, ought to absorb rays of the same refrangibility as those which they emit. Kirchhoff proved this to be the case; he was able, by the interposition of a vapor, to cut out of the solar spectrum the band corresponding in color to that vapor. Now, the sun possesses a photosphere, or vaporous envelope, doubtless mixed with violently agitated clouds; and Kirchhoff saw that the powerful rays, coming from the solid or the molten nucleus of the sun, must be intercepted by this vapor. One dark band of Fraunhofer, for example, occurs in the yellow of the spectrum. Sodium vapor is demonstrably competent to produce that dark band; hence Kirchhoff inferred the existence of sodium vapor in the atmosphere of the sun. In the case of metals which emit a large number of bands, the absolute coincidence of every bright band of the metal with a dark Fraunhofer line raises to the highest degree of certainty the inference that the metal is present in the atmosphere of the sun. In this way solar chemistry was founded on spectrum analysis.

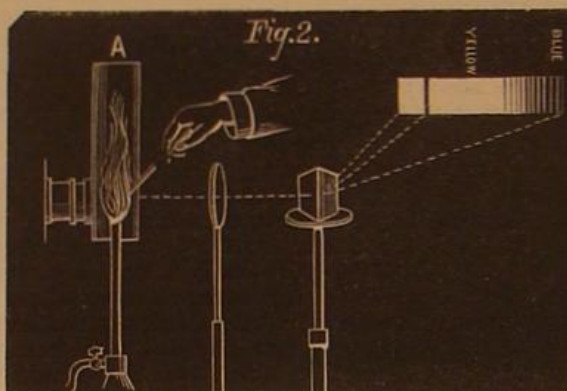
Fig. 1 shows a comparison of the bright lines in the spectra of terrestrial substances with the dark lines in the solar spectrum. The spectrum I in the engraving is that of the

sun, 2, that of sodium, 3, of thallium, 4, of silver, and 5, of lithium.



EMISSION AND ABSORPTION INTERPRETED.

Professor Tyndall then proceeded to explain the physical meaning of emission and absorption through the analogy of sound. Sounding a tuning fork, he showed that, out of a number of other forks, that of the same rate of vibration as the sounding one continued the sound even when the first was quenched. This is an instance of the absorption of the sound of one fork by the other. The speaker then exhibited on the screen the bright yellow band forming the spectrum of the sodium flame. He then arranged the apparatus shown in Fig. 2, in which A is the burning sodium, held in a shade



so as to screen the light. On sending the white light of the electric beam through this flame, the spectrum appeared on the screen with the yellow sodium light as it were cut out, and to all intents a dark Fraunhofer band was produced in its place.

THE CAREER OF OPTICS OUTLINED.

Professor Tyndall then proceeded to review the course of investigation as regards light, which had been passed over in the lectures delivered. Begun by the Arabian philosopher Alhazan in 1100, it was taken up in succession by Roger Bacon, Vitellio and Kepler. Then came the fundamental discovery of Snell, and its application by Descartes to the explanation of the rainbow. Newton followed with his experiments in the analysis and synthesis of white light, by which it was proved to be compounded of various kinds of light of different degrees of refrangibility. In 1676, Olaf Roemer, a Dane, determined, from the occultations of Jupiter's satellites, that light requires time to pass through space and that it moves with a velocity of 190,000 miles a second. Then an English astronomer, Bradley, determined that the rays from a star overhead are caused to slant by the motion of the earth through space. By knowing the speed of the earth in its orbit and the obliquity of the rays due to this course, he also calculated the velocity of light, with results identical to those obtained by Roemer. Dollond next proved that Newton's idea, that refraction and dispersion were inseparable and that one could not be abolished without abolishing the other, was wrong. By combining two different kinds of glass, he found that color might be abolished and a residue of refraction left, and this discovery he applied to the making of achromatic lenses. In 1808, Malus, by looking through Iceland spar at the sun reflected from the window of the Luxembourg Palace in Paris, discovered the polarization of light by reflection. In 1811, Arago discovered the splendid chromatic phenomena which we have had illustrated by plates of gypsum in polarized light; he also discovered the rotation of the plane of polarization by quartz crystals. In 1813, Seebeck discovered the polarization of light by tourmaline. The same year, Brewster discovered those magnificent bands of colors that surround the axes of bi axial crystals. In 1814, Wollaston discovered the ring of Iceland spar.

Professor Tyndall then reviewed the undulatory theory, as developed and asserted by Dr. Young, at considerable length. After Young came Fresnel, who grasped the theory in its entirety, and followed the ether into its eddies and estuaries in the hearts of crystals of the most complicated structure and into bodies subjected to strains and pressures.

CONCLUDING REMARKS.

Professor Tyndall then announced that he had reached the terminus of the course he had projected; and he concluded his lecture with an able disquisition on the study of science and its progress in America. Science, he said, must

be cultivated for its own sake, for the pure love of truth, rather than for the applause and profit that it brings. Could we watch the true investigator in his laboratory, unless animated by his spirit, we could hardly understand what keeps him there. Many of the objects which met his attention might appear to us to be utterly trivial; and, if we were to step forward and ask him what is the use of his work, the chances are that we would confound him. He might not be able to assure us that it will put a dollar into the pocket of any human being, living or to come. That scientific discovery may not only put dollars into the pockets of individuals but millions into the exchequers of nations, the history of science amply proves; but the hope of its doing so is not the motive power of the investigator. The speaker then alluded to the need for original investigation in England and America. If the spirit of our great investigators die out, we shall find ourselves eventually in the condition of the Chinese, mentioned by De Tocqueville, who, having forgotten the scientific origin of what they did, were at length compelled to copy without variation the inventions of an ancestry who, wiser than themselves, had drawn their inspiration direct from Nature.

PRACTICAL APPLICATIONS DEPENDENT UPON ANTECEDENT DISCOVERY.

To keep society as regards science in healthy play, three classes of workers are necessary: First, the investigator of natural truth, whose vocation it is to pursue that truth, and extend the field of discovery for the truth's own sake, and without any reference to practical ends. Secondly, the teacher of natural truth, whose vocation it is to give public diffusion to the knowledge already won by the discoverer. Thirdly, the applier of natural truth, whose vocation it is to make scientific knowledge available for the needs, comforts, and luxuries of life. These three classes ought to co-exist, and interact upon each other.

It is at our peril that we neglect to provide opportunity for those studies and pursuits which have no practical rewards and from which therefore the rising genius of the country is incessantly tempted away. If great scientific results are not achieved in America, continued Professor Tyndall, it is not to the small agitations of society that I should be disposed to ascribe the defect, but to the fact that men among you who possess the genius for scientific inquiry are laden with duties of administration or tuition so heavy as to be utterly incompatible with the continuous or tranquil meditation which original investigation demands. I do not think this state of things likely to last. I have seen in America willingness on the part of the individuals to devote their fortunes in the matter of education to the service of the commonwealth, for which I cannot find a parallel elsewhere.

This willingness of private men to devote fortunes to public purposes requires but wise direction to enable you to render null and void the prediction of De Tocqueville. Your most difficult problem will be not to build institutions, but to make men; not to form the body, but to find the spiritual embers which shall kindle within that body a living soul. You have scientific genius among you; not sown broadcast, believe me, but still scattered here and there. Take all unnecessary impediments out of its way. You have asked me to give these lectures, and I cannot turn them to better account than by asking you in turn to remember that the lecturer is usually the distributor of intellectual wealth amassed by better men. It is not as lecturers but as discoverers that you ought to employ your highest men. Keep your sympathetic eye upon the originator of knowledge. Give him the freedom necessary for his researches, not overloading him either with the duties of tuition or of administration, not demanding from him so-called practical results—above all things, avoiding that question which ignorance often addresses to genius: "What is the use of your work?" Let him make truth his object, however impractical for the time being that truth may appear. If you cast your bread thus upon the waters, then be assured it will return to you, though it may be after many days.

A Needy but Liberal Inventor.

The Commissioner of Patents lately received the following letter from an inventor who stands in need of one thousand dollars:

JANY THE SIXTH,
CINCINNATI, OHIO.

Commissioners Esqs of the patent office. Dere sirs—if you will send me one thousand dollars Cash I will invent a improved self acting operating automaton machinery and one million—after the machine proves satisfaction if i dont accomplish it i will refund the money in ten years.

Experiments with the Lay Torpedo at Newport.

A second trial of the Lay Torpedo was recently made at the United States torpedo station on Goat Island, Newport harbor. After being launched the boat started off in good order, but, after having run some five eighths of a mile, she became unmanageable. The wire of her cable parted so that she refused to mind her port helm, describing a series of circles until her motive power was shut off. The total distance run was about two miles, which she accomplished in twenty minutes and thirty seconds.

HARNESS DRESSING.—Long continued observations show that harness and other leather, exposed to the action of ammonia continually given off in stables, becomes weak and rotten sooner than other leather. Even when care is taken to protect it with grease, this takes place. Professor Artus recommends the addition of a small quantity of glycerin to the oil or fat employed in greasing such kind of leather, asserting that it keeps it always pliable and soft.

Air Power.

A letter from Brunswick, Me., to the *Portland Argus*, gives the following information relating to the use of air as a motive power in that village:

"On the Androscoggin River, some three fourths of a mile below the railroad station, is the site of a mill, long since burned, and the motive power which operates the condenser is a water wheel at the place. The wheel, it is said, is capable of driving four condensers of equal power with the one now in use. But it is only with results already accomplished, that we have to do. At the railroad station is an engine of ten horse power, running circular saws for sawing wood and various machinery in the blacksmith shop in the vicinity. Thence a small pipe passes on through the village, furnishing power to Worthly Brothers, jewelers, who are running a small engine of about one horse power. Parent and Dafford also use an engine of two horse power in their blacksmith shop; Dennison & Co., box makers, an engine of two horse power, and Professor Brackett, of Bowdoin College, one of three horse power, for the manufacture of instruments, while the laboratory of the College has one of six horse power. So that, nominally, this small condenser furnishes in all twenty-four horse power, and all unite in saying that the air power is much more efficient than steam in working the same engines; it does not drag, but recovers itself instantly from any strain or check, and is in every way a success."

REMARKS BY THE EDITOR.—The employment of pneumatic power for industrial purposes is constantly increasing. By its use the Mt. Ceniz tunnel, through the Alps, seven miles in length, was bored. The Hoosic tunnel, in Massachusetts, five miles in length, now nearly finished, is being cut by the same means. The St. Gothard tunnel, in Switzerland, lately commenced, which is to be thirteen miles in length, will also be cut by means of compressed air. The Hell-Gate rocks, under the East River in this city, are in process of removal by the same agency. In planing mills, the pneumatic method is used to carry the shavings from the planers to the furnaces of the steam boilers; in grain and wool houses, to convey the stock. At the iron furnaces pneumatic elevators are used to lift the cars and their loads of ore from one point to another. In London the pneumatic method drives five ton freight cars in tubes under ground; the post office department of that city has now in use several miles of pneumatic tubes laid under the streets, in which letters are conveyed with great rapidity. In this country the largest scale on which the system has been applied is at the works of the Pneumatic Transit Company, on Broadway, where a railway passenger car, running in a nine foot tunnel under that street, is operated by compressed air. For an underground railway this pneumatic method is especially useful; cinders, gas, smoke, dust, noise and locomotives, all are avoided; the cars may be driven smoothly along with great rapidity. In England, some years ago, during the experimental trials of the pneumatic cars, the trains were driven by this method at a velocity of sixty miles per hour. The pneumatic car under Broadway has carried between two and three hundred thousand passengers, but, owing to the shortness of the tunnel, so high a speed cannot be reached. As soon as the Legislature grants the necessary authority, the works will be extended through the city from the Battery to Harlem river. New York will then be able to boast of having the safest, most agreeable and most rapid means of passenger conveyance of any city in the world.

A SIMPLE PHOTOMETER.

The photometer is an instrument used to compare the intensities of two lights. If, for instance, it is desired to determine whether the flame of one lamp is brighter than that of another, or if one kind of gas has greater illuminating power, according to M. Yoon the following simple and ingenious process may be employed: Bend an ordinary white card, as at A, in the accompanying illustration, so that the two faces will be at right angles, and stand it upright on a table. One of the faces is to be exposed to the light to be examined, and the other to the second light to which the first is to be compared. Let B and C be such lights, placed on lines perpendicular to the faces of the card. It is clear that if one is stronger than the other, one of the faces of the card will be more brightly illuminated and will appear, at the angle, in relief against the darkness of the other face;



but if the two lights are equal in intensity, the two sides of the card will be equally illuminated, and the appearance of relief will totally disappear. It is only necessary to practice moving the lights toward or from the faces until the relief at the angle becomes invisible, then to measure the distances from the lights to the corresponding faces on lines perpendicular to the latter. The intensity of each light will, of course, be inversely proportional to the square of its distance from the face of the card.

The experiment can be more satisfactorily performed by looking at the angle of the card through a small tube, as at D, or even through the hand partially closed.

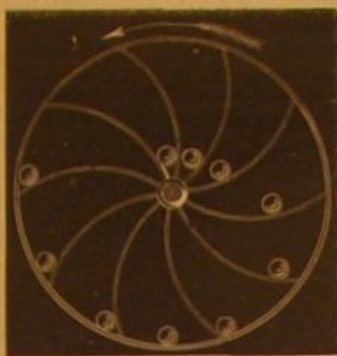
Correspondence.

Perpetual Motion.

To the Editor of the *Scientific American*:

In the *SCIENTIFIC AMERICAN* of January 18, I notice a question by A. J. S., respecting perpetual motion, and also the extremely simple experiment with the tub. Since valuable discoveries have been made by persons in search of such motion (Sir Richard Arkwright, for instance), I for one would like to encourage A. J. S. to persevere, as he might discover some motion, if not a "perpetual" one.

If, by reason of want of perseverance, muscular power, or moral influence, the experiment with the tub should fail, then let him make a wheel, as sketched, with spokes curved and with a groove on each side, so that a metal ball could run freely in it without falling out; let him place one of



these balls between each two spokes, and then, may be, he will see something move without the aid of either cog wheels or levers. If he does not, let him call upon

BRUMAGEM.

Williamsburgh, N. Y.

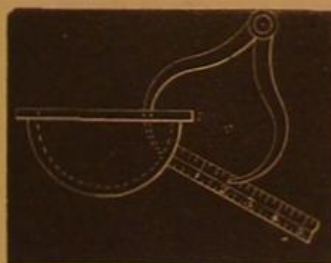
REMARKS BY THE EDITOR.—Our correspondent is evidently laboring under the impression that the example of perpetual motion which he presents differs in principle from the attempt of a man to lift himself in a tub. But a glance at his diagram ought to satisfy him that both plans are alike. One half of his balls pull up, the other half push down; just as the man in the tub pulls up with his hands and pushes down with his feet.

If our correspondent thinks that his wheel will move, why does he not try it? It is easily made. He will find that it stands still. He intimates that the plan he gives contains no levers. But every one of the curved spokes is a lever.

A Wrinkle.

To the Editor of the *Scientific American*:

A few days ago, having to get the thickness of a casting where the use of the calipers alone was impracticable, the idea here shown occurred to me, and I found it to be of great service. Pattern makers will doubtless find it useful in their daily avocations.



Hold a common rule, as shown, in line where it is required to know the thickness, and set calipers to some equal figure on the rule, say 2 inches; this allows the calipers to be removed without changing their distance. By measuring the calipers, the dimension above 2 inches will be the thickness. Various crooked bodies may be measured in this way, as well as the thickness of plates, etc., with flanges all round.

JOHN WALKER.

Woodberry, Md.

An Invention Wanted.

To the Editor of the *Scientific American*:

I would pay a handsome sum for an invention (and it would be worth it) by which any music played on the piano could be reproduced. CHARLES T. SHELTON.
489 Chapel street, New Haven, Conn.

Bursting Cylindrical Boilers.

To the Editor of the *Scientific American*:

I was somewhat disappointed in the promised letter "to the point" by S. S., in the *SCIENTIFIC AMERICAN* of December 7.

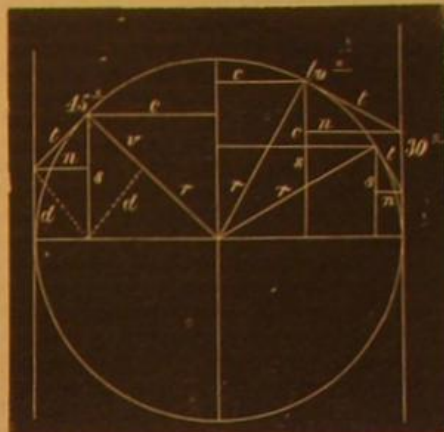
The letter, however, with four formidable diagrams, is strong in proof of an undisputed point, namely, that the horizontal forces give the pressure, required to rupture, as the diameter. This singular oversight may be my excuse for repeating what I stated in your paper of October 19, to which S. S. refers. "Let the diameter be 1, the half circle 1.57, and the steam force 1 lb. per inch; then, by the resolution of the radial forces into horizontal and vertical, a steam force of .637 lbs. will be the mean horizontal pressure on the half circle of 1.57, or .637 × 1.57 = 1, being the diameter, and so far agreeing with the current error.

But, in the resolution of the vertical forces, we have a mean horizontal force from them of .363 lbs. steam pressure on the half circle, or .363 × 1.57 = .57, in addition to the former, exclusively horizontal. I further repeat in substance, from my reply to Mr. Creuzbaur of December 14, that, with-

out the action of the vertical forces, the ring would be elongated horizontally, unless arrested by the ignored vertical forces, to preserve the circle, and at the expense of increased strain on the said horizontal forces.

The direct horizontal pressure of .637 lbs. is the mean of the cosines, and the additional derived from the vertical, of .363 lbs., is the mean of the complement to the cosines. It is incumbent on the diameter advocates to dispose of the vertical forces in some way, and not evade or rule them out of existence by labored and fruitless efforts.

Some of my communicants are on the "anxious seat," and desire to know how I arrive at the mean additional force of .363 from the vertical forces. For their information, I refer to the diagram:



REFERENCES TO DIAGRAM.— r, r, r , radii; t, t, t , tangents to radii; s, s, s , sines and vertical forces; c, c, c , cosines and horizontal forces; n, n, n , horizontal forces from the vertical.

VALUES.—At 30° , $\sin .500$, $\cos .866$, $\tan .577$, $n .134$; at 45° , $\sin .707$, $\cos .707$, $\tan .707$, $n .293$; at 60° , $\sin .866$, $\cos .500$, $\tan .577$, $n .500$.

FORMULAE.—At 30° , $r : s :: t = n .134$; at 45° , $r : s :: t = n .293$; at 60° , $r : s :: t = n .500$.

If the test of the parallelogram law be applied, we have for example the vertical force on sine at 45° resolved into the forces or lines t and v , the dotted lines completing the parallelogram. It is strange that so great a geometrical error as 57 per cent should so long have remained undiscovered or taken for granted. Its ramifications are numerous and important. The error assigns to a sphere the explosive pressure as the area of the bi-section, instead of the entire in-surface of the hemisphere.

I am aware of the responsibility of opposing an opinion hitherto considered invulnerably orthodox; but I am sustained by eminent scientists, both of England and this country; and by a recent letter from Professor Henry, of the Smithsonian Institute, I have his entire approval of my position. THOMAS W. BAKEWELL.

Pittsburgh, Pa.

The Superheated Steam Question.

To the Editor of the *Scientific American*:

If the discussion upon the superheated steam question is not closed, allow me to give your readers the following facts for their consideration:

The pumping engine of these works is supplied with steam from an ordinary tubular boiler, but, for the purpose of testing the comparative efficiency of the Miller boiler, the inventor was allowed to locate his boiler in the rear of the tubular boiler and connect with the same steam pipe. For the testing, a run of forty-eight successive hours with each boiler was contemplated, and was begun during the month of August last. We made and completed our first forty-eight hours run with the tubular boiler with no results that bear on this subject. The Miller boiler consists of a series of sections of tubes about three inches in diameter by ten feet long, arranged so as to give two in a horizontal row and five in a vertical row to each section, the size of the boiler being made up of the number of sections. Of these five vertically arranged tubes, four are inclined at an angle of about 30° with the horizon and the fifth is horizontal. The inclined tubes are water tubes, having interior circulating tubes of about an inch and a quarter diameter. One end of these water tubes is closed, the other connecting into a casting common to a section. The fifth or upper tube is for superheating, and it is so arranged interiorly that it is almost impossible for water to enter it. There are other pipes and connections which I need not describe here, my aim being to show that the same fire that reaches the water tubes also reaches the superheating tube. Unfortunately we had no thermometer in the steam pipe; but one in the steam chest indicated a temperature of 316° , when that due to saturated steam was about 236° , showing about 80° of superheat.

We commenced our run with the Miller boiler at 9.30 A. M. on August 22, 1872. The pressure of steam carried was about the same as on the other boilers, namely, 65 pounds. The temperature due to this pressure is 298° , and assuming that the superheating did not exceed 80° the temperature of the steam was about 378° . The steam cylinders are steam jacketed, and covered with felting and black walnut lagging. Pine ribs touch the cylinders, to which the lagging is fastened. At about 1.30 P. M., smoke began to creep through the crevices of the lagging near the steam chests, and it constantly increased from that time. I then had no apprehensions that it would actually set the lagging on fire, although the smoke continually increased in volume. At 3.20 P. M., while I was absent from the engine room for a few minutes, it increased very rapidly, so much so that it drove the men out of the

engine room. I then gave orders to stop the experiments, and have the fires hauled and fire hose attached; but before the orders could be executed, the front part of the engine was enveloped in a sheet of flame. This occurred during broad day light; no lamps were used about the engine, and the boilers were in another room. Will some one inform me to what to attribute this fire if not to superheated steam?

A. F. NAGLE.

Mechanical Engineer, Providence Water Works.

REMARKS BY THE EDITOR.—This fire was probably occasioned by the presence of oil in the jacket or in the wood covering, or both, the increased heat being sufficient to excite the combustion. It is well known that oil and wood, oil and cotton rags, oil and various other materials will, under certain conditions, spontaneously ignite without being aided by artificial heat. But under other conditions they require to be assisted by a certain degree of exterior heat before they inflame. Such probably was the case in the present example. All engineers understand the importance of guarding well against fires from oily wiping rags or cotton. Care should also be taken to prevent access of oil to the jackets and wooden coverings of steam cylinders, pipes and boilers.

Although in most cases of spontaneous combustion in mechanical establishments, it will be found that oily matters were present and were the inducing cause, still it is well to remember that there are conditions in which substances will spontaneously inflame without the presence of oil. For example, charcoal may be so prepared, its water so completely expelled by heat, and its particles rendered so finely porous that it will absorb oxygen from the air so rapidly as to ignite spontaneously, with but very little assistance from exterior heat. Clean cotton, when sufficiently dried and its fibers placed in a favorable position, may if gently heated be made to inflame spontaneously. There have been well authenticated instances of spontaneous fires in cotton factories where clean cotton had been allowed to remain in proximity to steam pipes. As one example of this kind, we might refer to a fire which broke out in the picker room of the Utica Steam Cotton Company, Utica, N. Y., in January, 1872. There are various kinds of inflammable materials which, if they are arranged so as to furnish the proper conditions of porosity and temperature, will spontaneously ignite.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the items of meteorological information, for those of auroras, and for some of the computations in the following notes, I am indebted to students.

The places of the planets and the times of rising and setting are given approximately, the aim being to furnish to every-day readers such information as will enable them to recognize the principal planets.

M. M.

Position of Planets for February, 1873.

Mercury.

Mercury is very near the sun throughout the month. It souths at 41 minutes before noon on the 1st, and at 38 minutes after noon on the 28th. It rises on the 1st at 6h. 40m. A. M. and sets a little before 4 P. M.; on the 28th it rises about 7 A. M. and sets at 6h. 15m. P. M.

Venus.

On the 1st, Venus rises a few minutes after 9 in the morning and sets a few minutes after 9 in the evening. On the 28th, she rises about a quarter after 8 in the morning and sets a quarter before 10 in the evening.

At this time (January 20) Venus as seen through the telescope has the appearance of the moon at first quarter, or half moon.

Mars.

Mars is increasing in apparent diameter. He is near the star *A Virginis* on the 1st, being a little above it when on the meridian. It passes below this star, and, on the last of the month, souths nearly at the same time with *α Libræ*, but is above that star in altitude.

On the 1st it rises at midnight, souths 21 minutes after 5 in the morning and sets 20 minutes before eleven. On the 28th it rises at 10h. 58m. P. M., and sets at 9h. 16m. A. M.

Jupiter.

Jupiter rises on the 1st at 6h. 24m. P. M., and sets at 8 A. M. He rises on the 28th at 4h. 20m. P. M., and set sat 6h. 6m. A. M.

On January 19, the bands which cross the equatorial portion of Jupiter's disk were seen to be flecked by dark and light spots, brown and white, while a rosy tinge colored the belted region. The dark spots can be seen with telescopes of small power; the white spaces are seen only by the use of a good telescope.

Saturn.

February 1, Saturn rises at 6h. 20m. A. M., and sets at 3h. 44m. P. M. February 28, he rises at 4h. 48m. A. M., and sets at 2h. 12m. P. M.

Uranus.

Uranus is among the small stars of *Cancer*. February 1, it rises at 4h. 17m. P. M., and sets at 6h. 53m. A. M.

February 28, it rises at 2h. 26m. P. M., and sets at 5 the next morning.

Neptune.

Neptune, which cannot be seen without a good telescope, rises on the 1st at 10h. 15m. A. M., and sets at 11h. 9m. P. M.

On the 28th, it rises at 8h. 30m., souths at 2h. 58m., and sets at 9h. 26m. P. M.

Occultations.

The star *τ Tauri* was occulted (the moon seemed to pass over it) on the 9th of January. The star disappeared at 10h. 38m. 59.4s.

Sun Spots.

A very large spot can be seen at this time (January 20) on the sun. It has passed the center of the disk, but can be seen for some days.

Aurora.

There was a fine aurora on January 7. It was first noticed about 6 P. M. At times during the evening, it extended from the northwest far around to the east, with red and greenish tints; and between 10 and 10.20 P. M., the flashes were brilliant, and followed one another with unusual rapidity.

Meteorological Items.

FROM DECEMBER 15 TO DECEMBER 31, INCLUSIVE.

Highest thermometer	2 P. M., December 20	35°
Lowest	9 P. M., "	25
Highest barometer	2 P. M., "	30.53
Lowest	7 A. M., "	29.11

Amount of rain very slight. Prevailing wind northwest, not violent.

FROM JANUARY 1 TO JANUARY 15, INCLUSIVE.

Highest thermometer	2 P. M., January 3	43°
Lowest	7 A. M., "	12
Highest barometer	9 P. M., "	30.64
Lowest	9 P. M., "	29.55

Amount of melted snow and rain, 2.75 inches. Prevailing wind south, not violent.

PLUMBAGO, BLACK LEAD, GRAPHITE.

"Plumbago (black lead, graphite), its uses and how to use it; by Orestes Cleveland, President of the Joseph Dixon Crucible Company, established 1827. Jersey City, N. J. Published by the Company. 1873."

The above is the title page of a valuable little work, in which we find the following useful information concerning plumbago. Most of it is new to the public, and will be read with interest.

The purposes for which plumbago is valuable, the best methods of applying it, the properties and true character of the mineral itself, its sources, and the circumstances that surround it in the commerce of the world, the various grades and adulterations, are all points upon which great numbers, even of those who come in daily contact with it or use it, are by no means familiar, and many are wholly ignorant.

We have been forty-five years engaged in the manipulation of plumbago, being the oldest house in the trade in this country, handle more of it now than any other single establishment in the world, and have been successful in its application to different branches of industry; we may, therefore, offer information without being accused of not understanding the subject treated.

The black lead of commerce, and what is so called by the trade, in first hands, is found only in Europe, principally in Germany, that which comes to this market being wholly from that country.

The plumbago of commerce comes mainly from the island of Ceylon, in India, but is found in many parts of the United States, being mined successfully, however, only at Ticonderoga, in the State of New York. It is also mined to a small extent in the Ottawa region of Canada, though I believe so far without profit.

It is, therefore, known in trade as Ceylon plumbago. It is very refractory. I have experimented by subjecting, for two hours, a piece, with sharp projecting angles, to a heat that would melt steel, and on cooling found the sharpest points perfect; but it will exhaust if left on top of such a fire. It is found in veins in a pure state, is removed in lumps, and a selection of these forms the "prime lump" of commerce.

The formation most common in the pure state is that of laminated crystals, elongated at right angles with the sides of the vein, if not more than from four to six inches wide; but when the vein widens the crystallization often radiates from numerous centers, and the whole formation is very beautiful; the foliated variety is equally valuable and more brilliant, but rare in any quantity; the acicular form of crystal is not apt to be as pure in the lump, but is useful for most purposes; the granulated variety, the purest of all, is of little use for crucibles, but, with suitable manipulation, produces the finest grades for electrotyping and fine lead pencils, and is unequalled for lubricating. Pure plumbago is free from grit, when pulverized and rubbed between the fingers, and the polish produced in the same way is instantaneous and very bright, being like a darker shade of polished silver. It is found mixed with iron, rhombospar and other forms of lime, the rock and earth in which the vein is carried, and many other foreign substances injurious for all the purposes for which pure plumbago is needed; so that much care is necessary in purchasing the raw material for a given purpose. Lime, for instance, is fatal to plumbago for crucible making. The plumbago is mined in the interior of the island of Ceylon, and is brought down to Colombo in bullock carts. It is there selected into grades; so much as may be finely broken up is sifted, and the coarser part of this is called "chips," while the finer part is called "dust." The "dust" from prime lump is, of course, very different in character from the dust left from the poorer grades of lump, and all of it, whether lump or dust, after being handled and packed in barrels in Colombo, becomes so black and bright, by the poor particles rubbing against the good, that the touch of an expert is required to distinguish between the grades.

The German black lead is not refractory, and is therefore useless for any purpose that brings it in contact with the fire. It has no value for the crucible maker, or for stove polish, and is of but little use as a lubricator. It has a very low conducting power, even in its pure state, and the best quality that comes to market is far from pure. None of it comes in its original state as mined, but all of it is washed

and floated, and so the grades are produced. In fact, it resembles a weak black clay more nearly than it does true plumbago in nature as well as appearance. It is used often on account of its cheapness, when it would be cheaper to use the real plumbago even at five times the price.

As this is only intended for a preliminary circular, to be followed by an elaborate work in which the subject will be fully treated, I shall pass at once to such points as seem to me useful for the trade, either as dealers or manufacturers.

PENCILS.

The first, and still the most widely extended, use of plumbago was for marking-crayons or pencils. The original method of manufacture was very simple. The lumps of mineral were cut into the required shape, and used in the natural state. At a later date it was sawn into the shape now used, and covered with wood, making the well known lead pencil; but the Borrowdale mine in England, the best known, finally ceased to produce the mineral pure enough for the purpose, and that method was reluctantly abandoned. The refuse about the mine was then utilized by purifying and pressing it into blocks, and these in turn were sawn into "pencil leads." But the leads made in this way were weak and unreliable; and even had they been useful, the march of civilization required pencils of different grades, some soft and others harder, while the sawn leads were all alike. The present method consists in selecting the best granulated plumbago (found till recently only in Germany), pulverizing it very finely, and floating it in water through a series of vats, the coarser particles settling to the bottom of the first vat, the finer in the next, and so on till, after passing through several, that which settles in the last vat is considered fine enough for the purpose. A suitable clay is found as yet only in Germany, and this is treated to the floating process, the finest only being fit for use. The plumbago and clay are then mixed together with water to the consistency of cream, and ground together like grinding paint. When this operation is completed, the mass is plastic, water enough having evaporated to leave it in that state. It is then placed in a press and forced through an opening of the size desired for the pencil leads, and the leads are cut to a suitable length, straightened, and dried. When dry enough to handle, they are placed in a crucible, the air excluded, and subjected to a high heat, which bakes them and brings them out ready to be placed in the cedar for pencils. The different grades are produced by the different mixtures of clay and plumbago; the more clay the harder the grade produced. Skill in the manipulation, the exercise of great care as it progresses, and an expert to select the raw materials, are absolute pre-requisites for a perfect product, and our success has been greater than we hoped for, to start with. We shall have five grades of the commercial pencils, ranging from the very soft up to a very hard grade. They are smooth, reliable, and pleasant to use beyond any heretofore made, and are a credit to us and to the country as an American manufacture. We are the only Americans making fine pencils, but are not unwilling to place our common commercial polygrade pencils by the side of the finest drawing pencils heretofore used by artists, ours being made by machinery only, while those are made by hand. All of the fine pencils used in this country have so far been imported, but we propose to turn the tide of trade homeward.

CRUCIBLES OR MELTING POTS, RETORTS, ETC.

Forty-five years ago the only plumbago crucible was made by the Dutch, the melting pots used in most countries being made of clay and sand; but the late Mr. Joseph Dixon, the founder of our house, in 1827 made crucibles by using the plumbago found in the State of New Hampshire, of a quality so far superior to the Dutch black lead pots that he took the market from the first. He afterwards saw specimens that had been brought from Ceylon as curiosities, by captains in the India trade; and finding them so much better than the New Hampshire plumbago, he procured a shipment, being the first importation of Ceylon plumbago in the United States.

Captain Rogers, who brought that shipment, is still alive and residing in Boston.

For crucibles, the pure lumps known as "prime lump" only should be used, ground to a fineness that leaves the particles bright and glistening when held to the light, but not so fine as to destroy this appearance. It is then mixed with clay, and the best known for that purpose is found at Mayence, comes down the Rhine, and is shipped to this country from Rotterdam. A small amount of finely pulverized charcoal should be added to render the crucible porous. As little clay should be used as will suffice to hold the plumbago together, the object in using the clay being only to cement the particles of plumbago.

After a thorough mixture, the crucibles are turned into the desired shape, much the same as pottery ware; they are then dried and baked in a kiln like pottery.

In use the crucibles should be placed in the fire, and not on it. The fire should surround the crucible to the very top.

If used with a blast, the blast should not strike the crucibles direct, but there should be coal for the blast to strike against.

The crucible should be kept in a dry place, the least dampness being fatal. If they are well made no annealing is needed, the object of annealing being only to complete the shrinkage that should be fully accomplished in the "burning" by the crucible maker. To provide against slight dampness, however, it is well, when possible, to use the crucible for the first time in a new fire, placing the crucible in the furnace at the time of lighting the fire, so that it heats up gradually with its surroundings. After the first time even this pre-

caution is unnecessary. For melting brass, copper, gold, silver, or alloys of metals, a Dixon plumbago crucible should run from twenty to forty meltings according to the fuel, draft, care, or other circumstances.

I have known them used seventy and even eighty times, with a natural draft and great care. For melting steel, they will run from four to six times. They can be made to run longer by care and a system of cleaning the slag from the surface after each melting, and coating the crucible with a mixture consisting of fire clay, plumbago, charcoal and silica, pure fine quartz sand being, in my judgment, the most useful form of silica to employ; other substances have been used, but these are all that are of any real value. The carbon from the interior of gas retorts would be better than charcoal, but it cannot be had in quantity and is too hard to pulverize cheaply; and in consequence of that hardness is used successfully in electric batteries where a carbon is wanted.

STOVE POLISH.

Plumbago of the best quality is the only suitable material for stove polish, but lower grades will produce a fair polish for trade; and if the manufacturer is sufficiently expert in the examination, he may use the best grade of Ceylon "dust," but much of that which comes to market is too poor. For stove polish, the plumbago should be pulverized till the particles are too small to glisten, and what would otherwise be a shining mass becomes a dead black flour, and this appearance is so near that of the German black lead that the difference can only be discovered by handling. Plumbago cannot be pulverized fine enough in stone mills without running it over so many times that the cost is too great, and hence so much poor stove polish is found in market, offered by respectable manufacturers. The black lead, even when pulverized equally fine, has a harsh feeling between the thumb and finger, polishes but little and with considerable rubbing, leaving a dark, poor polish; while the plumbago, if good, feels smooth, almost oily, and polishes with very little rubbing, leaving a bright silvery polish. The finer the plumbago is pulverized, the better it is for stove polish, as each particle should be so small that it flattens out at once on the iron, adheres to it, and polishes quickly; while larger particles will fly off and be wasted, as well as creating a dust, and requiring more labor to produce a fine polish. The polish from pure Ceylon plumbago will last on the iron for a long time, while the polish from the German black lead will burn a reddish brown when the stove is raised to a red heat. But as the German is less than half the price of the Ceylon, it is used with it as an adulteration, and for the cheaper kinds the German is used alone. The Ceylon is adulterated also with coal dust, pulverized slate, and many other substances. Dishonest makers of stove polish have this temptation, that only experts can detect the adulteration; and they succeed in palming off their mixtures because the particles of adulteration do not prevent the particles of plumbago from polishing the iron to a small extent. For instance, a thousand particles of adulteration and a thousand particles of plumbago, mixed together, can be sold at a low price, and the particles of plumbago will do the polishing, while most of the particles of adulteration will fly off in the process. It is true that the polish will not be as bright, and will require more time and labor to produce it, than if the one thousand particles of pure plumbago had been used alone, so that half the quantity of the pure article is better than the double quantity adulterated. In using the mixture, a great number of particles of the adulteration are rubbed against the iron with particles of the plumbago outside, and in all such cases the polish on that point is poor and the plumbago wasted, because it cannot get to the iron. I do not believe that an adulteration of an equal number of particles of base matter with the best plumbago is worth more to use than from one fifth to one fourth the value of the pure article, and a vast amount of stove polish offered in market has not a fourth part of plumbago in it, and even that is of the lower grades, used only for its cheapness. A thimbleful of the best plumbago, pulverized to the degree of that used by our company for stove polish, will, with the least amount of labor, polish as much surface as a quarter pound package of the usual merchantable stove polish with much time and hard rubbing bestowed upon it, and the polish of the former will be creditable after that of the latter will be a disgrace to a neat housewife. For stove dealers the difference is very great, a poor article being dear to them if it costs nothing. Perhaps no article except mustard can be so successfully adulterated as plumbago. I have been particular in speaking of the adulterations because the remarks will serve to enlighten those who buy for other purposes than stove polish. The proper methods of pulverizing I leave to be described in the future work.

LIQUID STOVE POLISH.

Liquid stove polish, called by quacks in trade "inventions" and advertised as such, are mixtures in which there is no value except the little plumbago they contain, and the liquid is generally water, with a little soluble blue for a "blind." But recently there have appeared "inventions" of this sort which are made with various volatile fluids, the object being to apply something that will evaporate quickly. These liquids are of no value in themselves, plumbago being used in the mixture for the polish; the article would be better if made of only plumbago and water. But some of the mixtures are dangerous to have about a stove from the explosive fluid used. A "patent" article I have seen is dangerous in any kitchen, and no insurance company would write a policy on any building where it is used, if the ingredients were known. Liquid stove polish is the dearest form in which it is put up, because, in order to make the mix-

ture cheap, very little plumbago is used. A ten cent package of Dixon's stove polish would make a dollar's worth of liquid polish, and so you pay ninety cents for a worthless mixture, labor, bottles, cans, etc. Many makers of liquid stove polish are shrewd enough to use in their mixtures a good quality of plumbago, so that when it is tried, of course it gives a good result; but the deluded purchaser forgets that he can buy good plumbago for himself at many times less money.

HOW TO POLISH A STOVE.

The remarks about stove polish and its adulterations should be read by every stove dealer; but the prejudices of the men who polish stoves for the stove dealers are deeply rooted, and their practice very stupid.

For instance, the majority of them still apply a varnish to the stove and then throw against the wet iron a handful of plumbago, allowing the surplus above what sticks to the stove to fall down into a large pan or box placed so as to catch it.

Now, if the plumbago is ground fine enough to be economical to use, this method would scatter it over the stove so that everything would be covered with it and a great waste be the result; but the most of that used by stove dealers is so coarse that this does not take place to any great extent; many dealers will pay the price for good plumbago, pulverized fine enough to make it cheaper for them than a low priced article. The varnish creates a disgusting odor when a customer gets the stove home and makes a fire in it, besides being more expensive than water. The proper way to polish a new stove is to mix the plumbago with water to about the consistency of cream, have it in an open dish, apply it to the iron like paint, and with a dry stiff brush polish quickly till dry, and this polish will be brighter and last longer than any varnish polish; and if the plumbago is right this method is much more economical in material and labor.

LUBRICATING.

As a lubricator none but the very best plumbago will answer. For coarse and common purposes a plumbago not quite pure may be better than none; but for metal surfaces, journal boxes, car axles, and all metal bearings, the plumbago should be pure and entirely free from grit. From the "prime lump" should be selected the very choicest lumps, and these should be pulverized till the particles will not glisten, but the mass becomes a dead black.

It cannot be made fine enough if separated by bolting, but must be separated by floating either in water or air. The simplest method is the water separation, and during the process it should be treated to a bath of dilute sulphuric acid, which will take up the particles of spar and iron, leaving the sulphates of lime, magnesia and iron easily washed out. Details of the whole process will be given in the future work. I have seen a very attractive preparation, very smooth between the thumb and finger, free from grit, and useful for many purposes, but the particles under the microscope show themselves in light scales instead of infinitesimal grains, and this was separated in water; but I think the defect was in the method of pulverizing, it having evidently been done by the use of stones.

The Dixon lubricating plumbago is pulverized by rolling 32 lb. iron balls, and is brought into infinitely fine grains, giving it more body and usefulness than the scale form.

There is no purpose for which plumbago should be as pure and as fine as for lubricating, except for electrotyping; but a large part of that which is offered for sale as a lubricator is adulterated, some of it being composed mainly of the German black lead, and is of no more use than common clay for the purpose. For blowing cylinders, the best quality of Ceylon plumbago, pulverized to the finest grade, pure and left with a good body, is the most economical. For engines, rolling mills, and machine bearings, the very finest should always be used. For wood bearings, after oiling with the plumbago a few times, the oil can be dispensed with, and the pure plumbago only applied in the dry powder. For metal bearings, it should be freely mixed with oil. On hot axles or journals, apply it freely dry, and then oil up as usual. If the railroads would all use the best grade of Ceylon plumbago, pulverized and prepared as described, hot journals would be very rare, and much delay and loss in freightage saved, as well as annoyance to passengers avoided. No substance is known that is so useful for lubricating as plumbago, and yet although used for that purpose more than two hundred years ago, the true method of preparing it was not known till within a few years, and it comes upon the market now little understood, and almost like a new material. It is destined to work great changes. Mixtures and quack nostrums are sold with sounding names, but the plumbago in them is all they contain of the least value, and it is better to use it pure.

ELECTROTYPING.

To the electrotypist absolute purity in his plumbago is a necessity, and hence any adulteration will discover itself at once on trial. The purest selected Ceylon lumps should be treated as described for lubricating, but the separating process should be carried to a finer point, and the acid bath given with care. The acid should be applied till with a thorough stirring no effervescence takes place, or bubbles rise to the surface. In electrotyping, the great conducting power of the plumbago asserts itself.

FACINGS FOR MOLDS, OR FOUNDRY FACINGS.

For this purpose plumbago is but little understood, although it is used to a limited extent. That it is valuable most skillful molders are aware, consequently much of the trash that is sold for "facings" is called plumbago, to make it sell, without containing a particle of anything even resembling the real mineral. Most of that which is sold to

the stove plate and other smooth casting foundries for "black lead," is innocent ground slate, but some of it is a mixture of ground coal and German black lead, while charcoal would be better than either if ground fine enough. Ceylon plumbago combines the two qualities of a substance almost as refractory as asbestos, and the most perfect conductor of heat. These are the essentials of a perfect "facing." It cannot be pretended that any other substance will answer as well, unless it will combine and form a flux upon the surface of the metal. As for the mechanical operation of filling up the pores, or smoothing the mold, plumbago has no equal. For iron castings it need not be a perfectly pure article, but that it be pulverized very fine is absolutely necessary for economical work and the best results.

For pianos, plumbago is employed to coat the bridge over which the wires are drawn, because of its perfect lubrication; it prevents the wire from adhering to the wood, and should be as free from impurity as that used by the electrotypist, but need not be pulverized as finely.

For organs, it is used to lubricate the slides, and should be the same as that used by piano makers.

The German black lead imparts a peculiar tone to the colors and a softness and smoothness to the touch of felt hats. The very best lump only should be accepted. As it has once been washed and dried in lumps, they will readily separate again in water, and no pulverizing is needed.

For coloring dark glass for carboys, bottles, etc., the best German black lead is used in lumps, but no inferior grade will answer.

For paint, plumbago has long been known as possessing great value. The elements do not exhaust it, water sheds from it as from oil itself, and fire does not affect it. The grade need not be the highest.

For the bottoms of boats and yachts it has long been used, especially for racing boats; but only the best Ceylon plumbago, very finely pulverized, is valuable.

REFRACTORY MIXTURES.

For tweers, pointing up furnaces, etc., take "prime lump" Ceylon plumbago, pulverized to scales as directed for crucibles. Then mix equal parts of Dutch pipe clay, fire clay, half the quantity (by measure, not weight) of charcoal, and the same half quantity of silica (pure quartz sand, ground fine, being the best); to this mixture add as much of the plumbago as possible, and leave the mass thin enough to work. It should be made just thin enough with water, so that it will run rather sluggishly.

Plumbago for polishing powder should be of the very best quality, finely pulverized. The German black lead is sometimes used, but is not economical for the powder maker, and for high priced powder is useless.

Shot is polished with plumbago, and it should be absolutely pure, pulverized to the finest grade from Ceylon "prime lump."

FOR BLAST FURNACES.

Plumbago thrown into the blowing cylinders, if adulterated with coal dust, will be worse than nothing. It should be pure and very fine, so that each particle that strikes the side of the cylinder will assist in polishing the surface. The German black lead is of no value, because as many particles of the clay character will stick to the iron, as there will be particles of the black lead character to lubricate the iron and render it smooth.

A more extended work upon the subject is to be published, copies of which can be had free by addressing the Joseph Dixon Crucible Co., Jersey City, N. J.

A Remarkable Explosion.

A most remarkable explosion, which illustrates the expansive force of steam, took place on the evening of January 21st, at Pittsburgh, Pa.

While the workmen at Bateman & Garrison's foundry were moving a ladle filled with several tons of molten metal, the crane hooks broke, letting the iron fall into a hole which contained some two feet of water, and a terrific explosion followed. The roof of the building was carried away, and the walls cracked. Houses in the vicinity had windows badly shattered. Several workmen were slightly injured though none seriously. The damage to the foundry will amount to about \$10,000.

The Shaker and Shakeress.

We have received the first number of the new volume of the "Shaker and Shakeress," of which Elder F. W. Evans, of Mount Lebanon, N. Y., has become editor, and Eldress Antoinette Doolittle, editress. The typography of the paper is excellent; the contents are almost wholly original, consisting of contributions from various members of the Shaker Society, relating chiefly to spiritual affairs.

VEGETABLE AND FLOWER SEEDS.—Mr. J. J. H. Gregory, of Marblehead, Mass., is well known as one of the few leading seed growers in this country. He is the original introducer of the Hubbard squash, the Marblehead cabbages, and many other of our new and valuable vegetables. All seeds from his establishment are sold under three special warrants. His advertisements will be found in this number, and we invite attention to them. His illustrated catalogue for 1873 (now ready) will be sent free to all applicants.

A LONG TRAIN.—The Harrisburgh (Pa.) State Journal says that a freight train, consisting of four locomotives and 128 eight wheel cars left that place on the morning of December 15, on the Pennsylvania Railroad, and reached Altoona the same afternoon. The train was considerably over half a mile long.

COMBINATION GRINDING MACHINE.

Since the introduction of solid emery wheels as a substitute for files and grindstones for sharpening saws and other tools, several different machines have been devised, each adapted to the grinding of particular classes of implements. By the apparatus represented in our engraving, it is claimed that all the tools used by wood workers can be sharpened, so that, in one machine, not costly in price, is furnished all that is required for grinding saws, planing knives, molding, and hand tools, in an effective manner, and with considerable saving of room, power, and expense.

The nature and construction of the device is sufficiently shown in our illustration. It is furnished with improved countershaft and patent belt shipper (not represented), and also with improved boxes, which exclude all dust and emery from the bearings. At either side, is shown the saw and planer knife grinding attachments, which may be readily detached whenever the machine is required for other work. Four wheels, we are informed, of different shapes, for grinding molding tools, may be used at once.

The efficiency of this apparatus has received a merited recognition in the shape of premiums from both the Cincinnati and American Institute Fairs of 1872. The machine can be procured only of the Northampton Emery Wheel Company, of Leeds, Mass., or of their agents. A list of the agencies in the principal cities will be found in our advertising columns.

Manufacture of Mad Stones.

A Virginia paper says there is a man in that State who is engaged in the manufacture of mad stones for the cure of hydrophobia. The original madstones were brought from France and Italy, and have the appearance and the weight of the more porous kind of bone. The domestic manufacturer gets the bone itself, and saturates it with some chemical or other, and sells small bits of it at \$5 each. Besides its virtue as a relief for hydrophobia, the bone is said to cure tetanus. "The cases of lock jaw," says the Virginia editor, "are too few to make this discovery important. Can't some one invent a cure for limber jaws? They cost the State a great deal."

IMPROVED SELF CAR COUPLER.

This is an effective and simple device for automatic coupling, so arranged as to preclude the necessity of a man going between the cars. No springs or intricate machinery are used; it is impossible for the pin to be thrown out by any jarring or wrenching of the train, and the apparatus can be readily substituted for the old-fashioned coupling without necessitating the removal of the latter.

Fig. 1 is a perspective view of the invention, and Fig. 2, a sectional view, the former showing portions broken away.

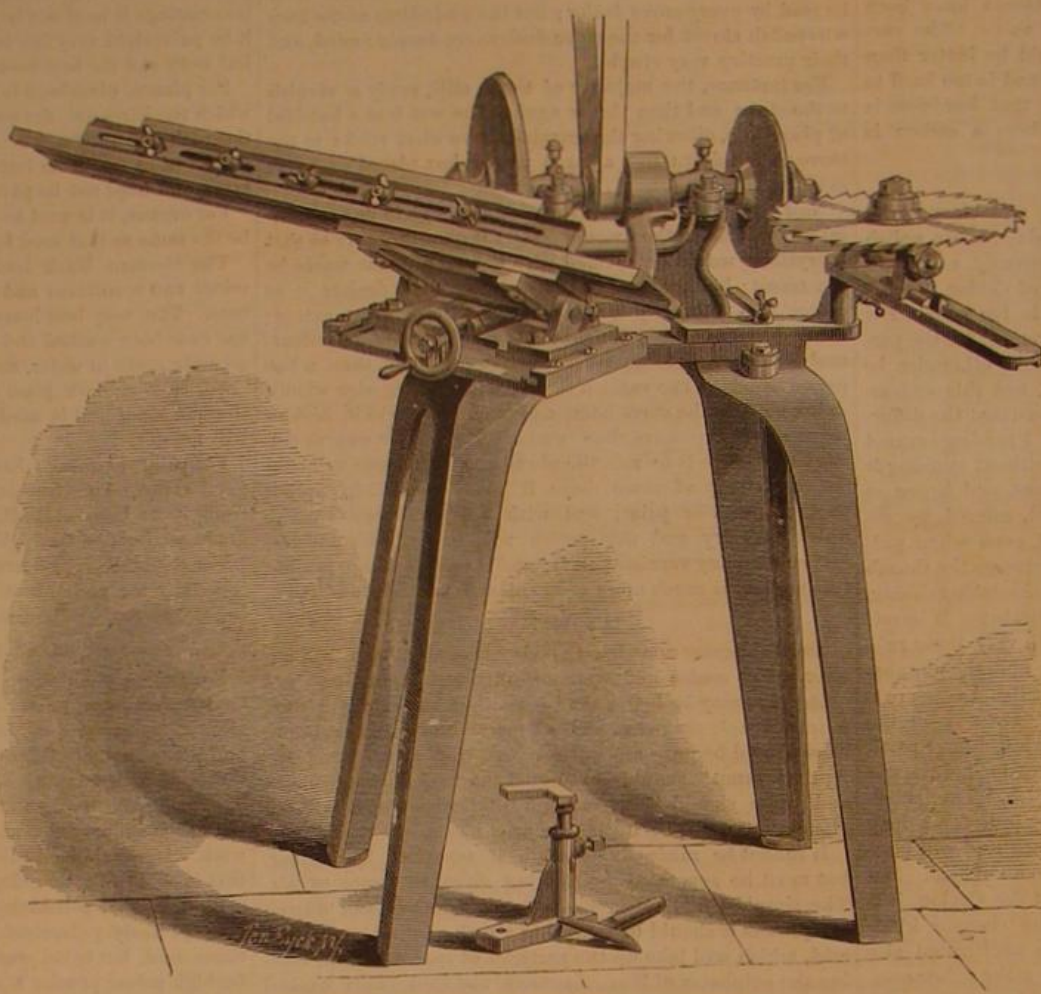
A is the bumper, in the rear part of which works a slotted bar, B. C is a bell crank keyed to a horizontal shaft, D, which passes through the bumper in rear of the bar, B. Through an orifice in the upper horizontal portion of the latter, the pin, E, passes. This pin is of any ordinary description, and its head is countersunk in its support. G is a plate attached to the bar, B, and arranged to turn over the head of the coupling pin in order to prevent it from being jolted or otherwise thrown out.

Fig. 2 shows the device arranged for operation. By elevating the lever, shown on the outer end of the shaft, D, the bell crank, C, which works in the slot in the vertical portion of the bar, B, is turned so that one of the arms comes in contact with said bar and raises it. By this means the pin, E, is also lifted clear of the link opening. While one arm of the bell crank, C, is engaged in supporting the bar, B, the other arm projects into the rear of the opening in the bumper. The upper portion of the last mentioned arm, it will be noticed from the engraving, is curved or beveled. As the link, F, enters the bumper, it strikes this curved end of the horizontal arm. Acting thereon, it forces the latter downward, thus moving forward at the same time the vertical arm. The bar, B, being no longer supported, falls and carries with it the pin, which passes through the link and locks the coupling. In this position the device is shown in Fig. 1.

The chain on the lever which actuates the shaft, D, may be carried to any convenient point, so that by thus actuating

the lever, the car can be instantly uncoupled at any moment. After the link is once forced in and engaged, it does not press anything but the solid iron of the bumper, and is not in contact with the lower part of the bell crank. The bar, B, is locked by the bell crank in whatever position it may be in, and by its weight holds the lever perfectly level. This coupling, it is claimed, will always operate even on the sharpest curves. If it should get out of order it may still be employed in the ordinary manner, the pin, E, being inserted by hand.

The coupling is the invention of Mr. M. Disney, of California.



COMBINATION GRINDING MACHINE.

fornia. Further information may be obtained by addressing Mr. H. C. Kibbe, 419 California street, San Francisco, Cal.

Marine Camels.

E. S. F., of Washington, D. C., comments on C. W. Stewart's letter, published on page 36 of our current volume, and states that the marine camel has already been invented and constructed. It is a floating screw dock which

tuns, with six driving wheels connected, single leading truck and eleven by sixteen inch cylinders.

The passenger cars seat thirty-two persons. It may be well to mention here that the lateral oscillation of these cars, when moving at fifteen miles an hour, is much greater than that upon notoriously ill-conditioned roads of broader gage, at twenty miles or more. How far this fact is due to the diminished gage is an interesting question. The weights of the box cars are about 9,500 pounds; of stock cars, 8,500; and of the flats, about 7,000 pounds; and their working loads are fixed at eight tons.

The construction and equipment of the road, as it now is, cost, according to the statement of the superintendent, Mr. Buchanan, \$15,000 a mile, of which the equipment is estimated at \$1,000 per mile.

Unfortunately, no fair comparison can be made of the cost of construction of the Kansas Central, as it now is, with that of a first class road of any gage; for the cross sections are confessedly too small, and the timber substructure must be considered as at best but semi-permanent.

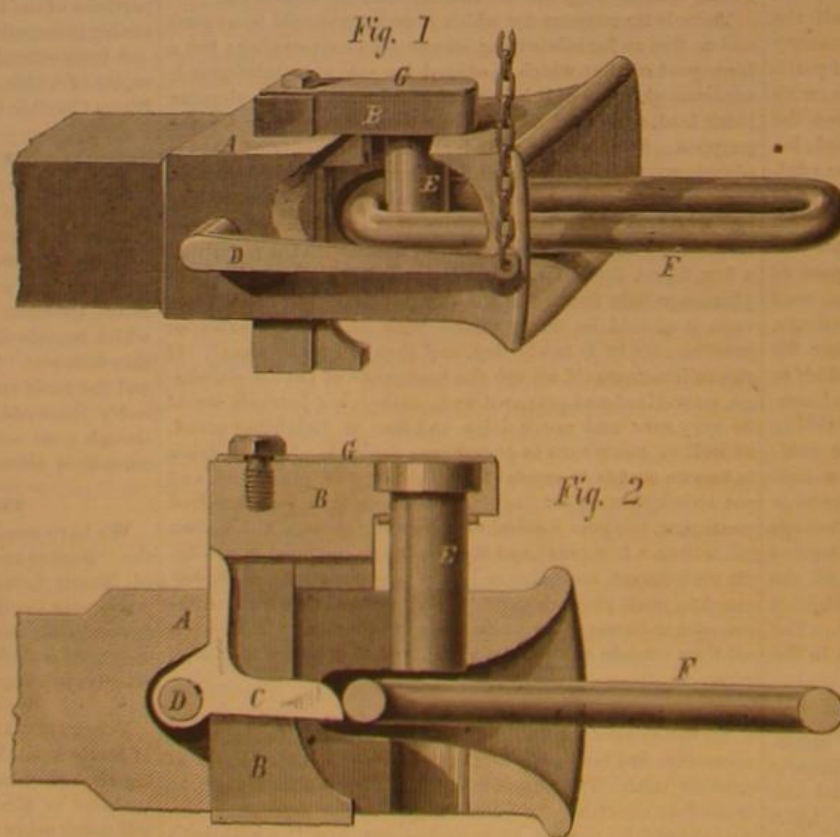
The traffic is very light. They run two daily trains each way, the mail and the mixed. The schedule times for the trains are: The mail, 14½ miles an hour; the mixed, 10 miles an hour.

The foregoing information is given in the *Railroad Gazette*, by Mr. Henry G. Prout.

The Air and Fires in Buildings.

A correspondent, B. G., states that there is a pressing necessity for some system of confining fires to the buildings in which they originate, and he points out that the air has as much to do with conflagrations in cities as fire itself. The force and heat of the air, during a large fire, are sufficient to destroy plate glass windows, and so establish communication between buildings. He therefore suggests the employment of iron shutters to close all openings in buildings; these shutters, to be worked by hand if hydraulic or steam power were not available, could be connected together, so that one operation would suffice to close them all.

At Chicago recently, a lady at church was seen to bow her head as if in pious thought. She suddenly raised it and leaned back against the seat, when an explosion occurred that shook the building. She had pressed too heavily on an air cushion bustle.



DISNEY'S SELF CAR COUPLER.

will lift a vessel of six thousand tons, entirely out of the water if necessary. It can be made to draw not more than ten feet of water; it can, if necessary, be self-propelling. Its lifting power consists of sixty screws, worked by two steam engines, placed on two floating hulls. The hulls are three hundred and fifty feet long by forty feet beam and fourteen feet depth of hold, the vessels to be lifted being placed between the floating hulls. One or two vessels can be raised at a time. It is a Baltimore invention.

THE NEW ST. THOMAS' HOSPITAL.

This hospital is one of several noble charitable institutions, established in London, and endowed by the "Boy King," Edward VI. It originally was erected close to the further, or Surrey, side of London Bridge, but was rendered unsuitable for its purpose by the proximity of the South Eastern Railway, an extension of which took away part of the hospital grounds. With enormous sums, received from the railway company as compensation, and from the sale of the rest of the land, which was very valuable, the trustees determined to erect a new building; and as the neighborhood in which the former building stood was already amply provided by the celebrated Guy's Hospital with the means of relieving the suffering poor, a site in another district was decided upon. A position on the Southern Thames Embankment, facing the Houses of Parliament, was finally selected; and the hospital, consisting of five separate and similar buildings, of which our engraving presents two, was erected and is now in use. The building in the background, between the two sections of the hospital, is the chapel. The river Thames flows in the foreground of our picture, and the hospital buildings extend from near Westminster Bridge towards Lambeth Palace.

The buildings are thoroughly adapted to the requirements of the charity, and are at the same time worthy of their noble purpose. Handsome as the new structure is, all unnecessary expenditure has been avoided and every advantage which science and experience can suggest for the alleviation of the sufferings of the sick poor has been secured.

"These great purposes," said Queen Victoria, in opening the new buildings to public use, "are not least effectually promoted by an adequate supply of careful and well trained nurses; and I do not forget that in this respect your hospital is especially fortunate, through the connection with it of a staff trained under the direction of the lady whose name will always remain associated with the care of the wounded and the sick."

The allusion is to the celebrated Miss Nightingale, who has on her hands the organization of the staffs of nurses of several of the London hospitals, and who gives herself freely and unsparingly to the work with which her name is inseparably connected.

Snow on Leaky Roofs.

R. B. M., of Utica, New York, suggests the application of waste heat from the house by conveying it by a tin tube up to the eaves of the roof. To the lower end of the tin tube should be attached a conductor, arranged over a gas burner. If the eaves are kept warmer than the apex of the roof, the snow will melt and leaking through the roof will be prevented. An iron steam pipe three inches in diameter, three feet below the surface of the ground, will melt the snow for a distance of three or four feet on each side of the pipe, and this when the steam has passed through 5,000 feet of coiled pipe. Of course the boiler for this arrangement is a large one; it is, says R. B. M., of sixty horse power, and works at ninety pounds

pressure. The warming of the side walks by this means would prevent the freezing and bursting of hydrants and water pipes. The heat now wasted is enormous in quantity; but if necessary, reservoirs of heat should be constructed, and a charge made for a supply therefrom.

Light.

According to the theory generally received at present, the

but only the vibration of a substance, which, according to its various forms of motion, generates light, heat, or electricity. —*Spectrum Analysis, by Schellen.*

The Hudson River Ice Crop.

The present winter has been a most favorable one for the New York dealers. The harvesting of ice is now at its height in this vicinity, and within fifteen days it will probably be brought to a close. The

city of New York is chiefly supplied with ice from the Hudson river, along whose banks, commencing some miles above the city, many very large and costly ice houses are to be found. Thirty thousand and tens are commonly stored in a building, but some of the ice houses have a capacity of seventy thousand tons.

The work of gathering the ice is worthy of a passing notice. It is first nicely scraped and planed for a distance of three or four acres, in front of or near the house, and then cut up into blocks or cakes 22 by 32 inches, and in some places 44 inches square, the work of cutting being done by saws made for the purpose. Then a canal is cut from the sawn acres to the mouth of the elevators at the house, and through this canal the polemen shove the ice along till it reaches the elevators, which are worked by steam, which catches it up two cakes abreast and conveys it to open slideways on each floor of the building, when it shoots out and down on to the floor over an inclined plane, where stowers stand ready with hooks to pack it away. Since the company have brought steam engines into use to work the elevators with, instead of horses, each house manages to lift from the river and stow away thirty cakes of ice per minute, each cake weighing about 250 pounds. This is 18,000 cakes per day, and as there are forty-two ice houses on the river, 756,000 cakes of ice are housed daily; or, to get it into weight, 94,500 tons! One single elevator is capable of putting in 2,250 tons per day.

The total amount of ice stored for our city market is one million five hundred thousand tons, being almost one ton of the crystals for every inhabitant of New York and Brooklyn.

In the harvesting of this great mass of ice there are employed 6,500 men, 1,000 horses, and 42 steam engines. There are over twelve companies in the business, one of which—the Knickerbocker Ice Company—en-

joys fully one half. The various planes, plows, saws, elevators, and the operations of ice harvesting generally, were fully illustrated last year in the SCIENTIFIC AMERICAN.

The Cyprus Antiquities for the Metropolitan Museum.

About two hundred boxes of the Phœnician antiquities, collected by General Di Cesnola among the ruins on the island of Cyprus and recently purchased for the Metropolitan Museum of Art, have arrived in this city. The collection, which contains ten thousand pieces illustrative of the history, religion, art and race of the ancient dwellers on the above mentioned island, which were discovered on the sites of the Temple of Golgos and the Tomb of Idalion, is dated at from 1,200 to 1,800 B. C. Twenty thousand dollars of the purchase money has already been paid, and the balance, we learn, is due within two years.



ST. THOMAS' HOSPITAL, LONDON, ENGLAND.

ENGLISH AGRICULTURAL IMPLEMENTS.

We find in the English *Farmer* a detailed report of the recent Smithfield Club Cattle Show, from which we extract the following notes descriptive of various important agricultural implements, and the results obtained by their actual use. We should remark, in passing, that the Smithfield Club, under the auspices of which this exhibition is yearly held at Agricultural Hall at Islington, London, is an association numbering among its members all the great landowners, farmers, cattle breeders, and agriculturists of England. It is devoted to the furtherance of agricultural science in all its branches, and especially to the improvement of the various breeds of cattle.

THE DOUBLE FURROW PLOW.

Chief of all other novelties made, perhaps, within the last two or three years, is the double furrow plow, and the special machine made by Messrs. James and Frederick Howard, of Bedford, who are the largest agricultural implement makers in England, combines the best points yet obtained. The plowman has merely to release a lever handle, when, by the onward progress of the horses, the shares are lifted out of the ground, which greatly facilitates the turning. To show the great saving of labor effected by the use of this implement, an instance of a farm of 320 acres cultivated in the four course system is given. In this case, there would be 80 acres to plow for wheat, 80 acres for barley, and 80, say thrice, for roots or green crops, which together make 400 acres to be plowed, being one hundred days' work for eight horses with four single plows. The same work would be done in the same time by five horses with two double plows, thereby setting two men and two horses at liberty to be employed in other work. These 100 days for two men and two horses cannot be valued at less than 10s. (\$2.50) a day, which gives £50 (\$250) gained, or above 3s. (75 cents) per acre per annum. On a farm using sixteen horses with eight single plows, plowing eight acres daily, twelve horses in four triple teams and four double plows would do the same work, leaving two men, two boys, and two horses to do other labor. It is considered by our contemporary that steam should, for heavy work, supersede the horse altogether. The engines are ready to start into a fresh field the moment they have stopped work, and remove themselves and the whole of the apparatus without any additional manual or animal labor.

FISKEN'S PATENT WINDLASS

consists of two drums carried on a strong angle iron frame, mounted on wheels. These drums are driven by strong spur gearing, to which motion is communicated by means of a friction clutch moving freely up and down on a spindle, on which is keyed the double grooved pulley, round which the endless rope passes and keeps it always running. Both the drums run on eccentric axles or studs, and either or both of them may be thrown into gear at once by means of levers. The main winding drum is underneath the frames and as near the ground as practicable, thus keeping the draft very low, a point which cannot be over estimated. It revolves in a horizontal direction, and the coiling pulleys are allowed to swing freely round to suit any angle at which it may be desired to work. By this means, all undue strains are avoided. The winding forward drum is on the upper side of the framing, and contains 50 yards of steel rope. This rope is pulled out in front and hooked to a claw anchor. When it is required to move forward, as the land is cultivated, this drum is thrown into gear, and as it coils the rope on, the whole machine is drawn forward or backward, the steerages with which each windlass is provided enabling it to follow any hedge, no matter how crooked.

Messrs. Barford and Perkins'

THREE FURROW PLOW

is simple in construction, and the frame being made in parallel bars instead of beveled framing, a lighter weight is required to produce equal strength. The plow is very manageable at the headlands; the steerage is quick, and the holder has perhaps more power over the implement than in other plows of a like kind. The beams are expanding, and furrows of any width, from 8 to 11 inches, can be turned over.

Mr. Murray, of Banff, Scotland, has devised

A NEW STEAM PLOW,

in which the principal novel feature is a combined plow and subsoiler, which is convertible into a three furrow plow or a two furrow plow and two subsoilers. There is a strong bracket attached to the side of the frame, and the subsoiler line is fixed in the same with a strong wrought iron shoe upon it, and runs in the previously plowed furrow close behind the wheel. This line and shoe can be so regulated as to go to any depth, from 3 to 9 inches below the plow; the plow follows, and covers up the loosened subsoil. The second subsoiler runs immediately behind the first plow, and the second plow follows, and again covers up the loosened subsoil, and leaves the firm furrow unbroken in the subsoil for the wheel to pass over in the next "bout," which is, as already stated, immediately followed by the first subsoiler, and thus the whole field is plowed and subsoiled without a wheel or the least pressure upon it, and leaving it in a fine, loose, broken up state, allowing the water to sink freely, and be also operated upon by the winter frost and air.

Regarding

REAPING MACHINES,

they have received a wonderful impetus since the English Exposition of 1851. Americans, Englishmen, and Scotchmen have alike been vying with each other in an attempt to perfect them. There is scarcely a farm of any size (with a tenant of any enterprise) which cannot exhibit one in its shed after the work is over for the season; and on many farms there are four, five, and six in use. We have said that

they were to be seen in the shed when the reaping was over; we regret that this is not always the case, as too often the machines are left out in the rain to their great detriment. A few pounds of paint, well distributed over the implements out of employ, would ensure many of them lasting more years than they do, under the let-well-alone system, and keep them good looking all the while.

Wood's

COMBINED REAPER AND MOWER

is considered the best. The reaper's seat is so placed that he can easily lift the crop and gather down the grain. A seat for the driver has been added, which not only removes weight from the horses' backs, but so balances the machine that all pressure is taken from their necks.

Messrs. Haughton & Thomas, of Carlisle, have introduced a reaping and mowing machine, called

THE ROYAL CLIPPER.

The pole and frame are so connected that, by the application of a screw, the driver can set the fingers and knife to any angle of "cut" without leaving his seat. The crank shaft pinion is fixed near the upper bearing which tends to evenness in the wearing of the brasses.

Messrs. W. A. Nicholson & Son exhibit

A DOUBLE ACTION HAY MAKING MACHINE.

It has four motions, namely: a forward motion of the ordinary rapid one, and also a slow and a quick backward motion. The quick forward speed is calculated for a heavy slow horse, while the ordinary speed is right for a quick stepper. The ordinary rapid back action is best for lightening up and finishing the crop, and the slow motion, for delicate handling of grass that has been allowed to stand until over ripe.

THE SKELETON HARVEST CART

is a light wagon designed for use in the harvest field, where heavy bodied and wheeled carts make such indentations that the plowman has difficulty in getting over them. With a length of 12 feet, it has a breadth of 6 feet 6 inches.

Tasker's patent

BALANCE ELEVATOR

has a trough made of a sufficient length to enable the corn or hay to be delivered at the required height without raising the trough to an almost upright position, consequently the produce elevated is delivered farther in the stack instead of being dropped just at the outside, as is the invariable result obtained from all elevators in which a shorter (and therefore cheaper) trough is used.

The

THRASHING MACHINES

made by Messrs. Nalder, differ from those of other makers in the relative position of the places for the corn, chaff, cavings, and straw. The former is delivered at the back end of the machine, and the chaff behind the head wheel, having a more roomy span than usual, which also enables them to blow the chaff for chaff bagging direct into the bag at once without the use of an extra blower strap, the bags being fixed on a sliding frame and taken away from either side of the machine.

The Cost of Pavements.

Commissioner Van Nort of the Department of Public Works of this city has made careful investigations into the subject of the various kinds of pavements now in use on streets. From his report, we give several extracts below.

It will be noticed that, of the various kinds of wooden pavements that have been laid, none have successfully withstood the test of actual usage. It did not require, however, any official report to advise us of this fact, for the wretched condition of the streets in which wood has been substituted for stone is ample evidence of the unsuitableness of the former for city thoroughfares and heavy traffic.

The bituminous or asphalt pavements are even worse than those of wood. In several of our streets and avenues during the days of the Ring, parties contrived to get permits to lay their combinations of tar, gravel and stone. As a result a large portion has been removed, and the present appearance of the roadway where it remains would be a disgrace to a military corduroy. The Commissioner says nothing on the subject of foot pavements, though we should rejoice to see the department over which he presides take some action in regard to the dangers of the sidewalks which now line our principal streets. It has become fashionable of late to lay massive blocks of granite in place of the times honored blue flagging. The friction which wears away the latter simply polishes the former, so that, on wet days and more especially in icy weather, they present a surface as dangerous as one of smooth ice.

Add to these the system of raised vault covers, which are just curved enough to cause an unwary walker's feet to slip from under him, and it is doubtful if a more complete man trap could well be devised. Iron pavements are even worse and indeed the only materials, over which one can pass in frosty weather without fear of a sudden fall, are the limestone flags or granite of which the surface is made very rough and irregular.

The Belgian pavement, it will be noticed, is considered the best; and among the others enumerated are the old fashioned or cobble stone pavement. The report states, in regard to prices for new work, that they at present range about as follows:

1. For cobble stone pavements, 55 cents per square yard.
2. For Belgian or trap block, \$2.40 per square yard.
3. For Guidet improved, \$6 per square yard.
4. For granite block, like trap, \$2.56 to \$2.89 per square yard.

5. For Fisk bituminous or asphaltic, \$3.50 per square yard.
6. For wooden, \$5 per square yard.

When not subjected to much travel, the cobble stone pavement is durable, if well laid, and comparatively cheap to maintain.

The Belgian granite or trap block pavement is more expensive than the cobble stone, but is much better for travel and infinitely more durable under heavy traffic; and it is easier and cheaper repaired than any other kind subjected to equal wear.

The Guidet improved pavement has been in use but a few years and gives satisfaction so far, but it is the most expensive at first of any in use, and its durability and proportionate cost of maintenance is yet unknown.

The bituminous or asphaltic pavements so far have not proved serviceable in this city and are expensive to lay and maintain. In many European cities they are well thought of, but in Paris the use of horses on them, unless smooth shod, is forbidden, and great difficulty is experienced in travelling on them with smooth shod horses in winter weather.

There are, and have been, many kinds of wooden pavements laid in this city within a few years, but so far all have proved very expensive to lay and maintain, and it is doubtful if any form or preparation of wood can be made and maintained except at great cost, as the same organic difficulty exists with all kinds, namely, speedy decomposition; various preparations of the wood have been tried within the last ten years, but all have failed to preserve the wood from decay. Of all the wooden pavements in use, the stone foundation appears to be the most durable.

Herewith is appended a statement showing the amount of wooden pavement laid in this city since the year 1866, in various places, with the number of square yards and the contract cost and total expense of each.

The aggregate number of yards is 391,688, and the total cost has been \$2,254,478.97, exclusive of 1,416 yards laid at private expense, the cost of which could not at this time be ascertained; the average time the pavement has been laid is about three years, and its condition such as will average about one half rotted and worn out; during the present year there has been expended on repairs to wooden pavements the sum of \$85,000, which, at the cost of \$4 per yard for relaying, gives 21,250 yards relaid, or 5½ per cent of the whole, and the amount of the appropriation for the year has been insufficient to do the needed repairs, consequently many of the streets which were first paved with it are in very bad condition.

Assuming that no more wooden pavements will be laid in this city, it is estimated that at least 80,000 square yards of renewal will be required in each year to maintain the present quantity; and if that is done with patented material at the present price of \$4 per yard, it will entail an annual expense of \$320,000 for 18-3 miles in length of streets, or an average of \$17,486 per mile per year, while the repairs to stone pavements in 290 miles of streets have cost but \$150,000 or an average of \$517 per mile per year.

Steam Improvements.

Sir William Fairbairn, in a recent address, made the following prediction: It has been my province for a great number of years to encourage and promote the use of high pressure steam, and, by working it expansively in properly constructed engines, to effect a saving of fuel under any condition and every circumstance in which it is employed. I need scarcely inform you that much has already been done in that way, and that a saving of one half the fuel has been effected by working high steam expansively, or in other words, it may be stated that the same quantity of fuel does double the work it accomplished forty years ago. This, you will observe, is a well known fact; and it is encouraging to find that we are still far wide of the maximum of pressure by which still greater saving may be effected; and I entertain sanguine hopes that the time is not far distant when another half may be saved, and when we may congratulate the public on a further saving to the amount of one, or a fraction of one, pound of coal per horse power per hour. This can only be effected by an increase of pressure, retention of heat, and a judicious application of the force through the medium of a well constructed engine. I am not prepared to state the amount of pressure to which steam may be increased; but, judging from my own experimental researches, and those of others, I have reason to believe that we are still far short of the maximum to which the pressure of steam and economy of fuel may be carried.

SINGULAR DEFECT IN AUSTRALIAN GOLD.—It said that some 6,000 or 7,000 lbs. of Australian gold, known as "brittle," having recently been coined by the French mint for the Bank of France, all the pieces have been found to admit of being easily broken, and they have therefore to be remelted. This is attributed to the presence of a small percentage of antimony and arsenic, extremely difficult of removal; and these elements are known to produce a similar effect in all metals or alloys which are subjected to the molecular changes induced by the pressure and heat developed under the action of the dies in the coming press. A medal, which bears on the obverse the portraits of Dr. Janssen and Mr. Lockyer, and on the reverse the chariot of the sun with Phœbus indicating the prominences of an eclipsed sun, has been forwarded to the latter gentleman by the French Government, in commemoration of his discovery of the method of observing the sun's chromosphere without an eclipse.

It is stated that the authorities of the Royal Gun Factories, Woolwich, England, have designed and are prepared to construct a 70 ton gun, which shall throw a projectile of 1,400 pounds.

Recent American and Foreign Patents.

Improvement in Revolving Fire Arm.

Otto Schneeloch, Brooklyn, N. Y.—The object of this invention is to throw as many balls of a given size as possible from a barrel of minimum weight; and this is accomplished by constructing the several bores of a triangular shape, one angle of the triangle having its vertex near the center, while the other two have their vertices near the circumference of the cylinder. These triangles may be plane or spherical, and isosceles or otherwise, since the principle involved consists in causing the balls to approximate as nearly as possible to the center of cylinder, and in the closest juxtaposition to one another. This utilizes the greatest portion of volume of the cylinder without impairing the necessary strength of the metal.

Improvement in Pipe Tongs and Cutters.

James E. Roache, New York city.—This invention relates to an adjustable and very simple instrument for clamping pipes, tubes, and other objects of varying diameters, and to means whereby the same instrument can be converted into a cutting tool for pipes and cylindrical or prismatic rods or tubes. The invention consists in the new general arrangement of parts whereby the tongs will be operated by a strong jaw resting on a lever that is vertically adjustable, and has its fulcrum on the end of a screw, so that, by turning said screw and raising or lowering the lever, the size of the tongs will be adjusted for smaller or larger articles. The invention also consists in the arrangement of a cutting tool, which is placed upon the recessed gripping edge of the movable jaw, and thereby held with sufficient firmness to operate in the desired manner.

Improved Oil Cake Stripper.

Washington Hawes, Port Richmond, N. Y.—This invention consists of a revolving cylinder with one or more hooks or points in its surface combined with a table, whereon the oil cake to be stripped of its cloth covering is placed under the cylinder in such manner that one end of the cloth cover is hooked up by pins on the cylinder, and attached to it so that the revolution causes the cloth to be wound on it and stripped from the cake, which is first moved from under the roller and then over it and partly under it again, in such manner that the cloth which is wrapped over the cake endwise will be unwrapped from both sides and the ends, and the cake delivered upon the table, to be removed. The motion of the cylinder then ceases, and the cloth pulled off by hand, the cylinder being revolved by pulling the cloth. An elevating device is also combined with the table for use, if necessary, in pressing the cake upon the roller, to cause the pins to engage the cloth.

Improved Rudder for Vessels.

Augustus H. Murphy, New York city.—This invention consists of adjustable bearings, with friction rollers for the rudder post, placed on the deck and adjusted around it under a collar attached to it by screws, so as to make a close bearing that will prevent lateral play, and at the same time allow it to turn freely, also so as to support a portion of the weight by the collar which, said bearings and the collar being removed, will allow the rudder to be unshipped and a new one to be shipped readily at sea, in case of necessity. The invention also consists of a rod so applied to the rear edge of the rudder in such manner that in case it becomes desirable to support the lower end of the rudder with brace chains, they can be attached above the water and afterward let down to the lower end, or, in case of shipping a new rudder, the chains, after doing service at the lower end, can be raised up to the surface of the water to be detached.

Improved Water Ram.

Christopher Hodgkins, Marlborough, N. H.—The invention consists in holding the valve beam by a slide. The two supply pipes of the ram are provided at their outer ends with valves which are suspended from a beam, for the objects specified in the letters patent of the United States numbered 119,364, and dated October 10, 1871. Instead of communicating directly with the air chamber, the pipes are in the present case separated therefrom by diaphragms of leather, rubber, or equivalent fabric, made slightly bagging above the apertures of the pipes. The spring water or liquid to be raised is admitted through a pipe to a chamber, which is interposed between the diaphragms and the bottom of the air chamber. A valve closes a hole in the bottom of the air chamber. Thus it will be seen that the operating water in the pipes is separated from the water to be raised by the bagging diaphragms. The water to be raised is further separated from the discharge pipe by a suitable valve. When a valve of one supply pipe is raised, the pressure of water within causes the diaphragm above it to be swelled up, and the water in the chamber, being thereby pressed and being less elastic than the air in the air chamber, enters the air chamber, whence it escapes to the discharge pipe. The same action will be effected alternately by the two pipes, as their respective valves are closed.

Improved Wagon Brake.

Erna T. Bucknam, Sonoma, Cal.—This invention relates to improvements in that particular class of self-acting wagon brakes in which the reach passes loosely through the rear axle and permits it to move forward when the wagon is descending a hill and thus put on the brakes. The improvements consist, first, in the peculiar manner of suspending the brakes, and the arrangement of the levers for applying them; secondly, in an improved manner of securing the wagon bed upon the bolsters and rear axle bed so as to cause the full weight of the load to regulate the pressure of the brakes upon the wheels. It also relates to an arrangement of rollers or a revolving sleeve upon the front standards, for the purpose of acting in combination with the rollers on the bolster, to allow the bed to slide forward freely.

New Mixing Apparatus for Soap, Paste, Clay, etc.

James Atkins, Brooklyn, N. Y.—This invention relates to a new machine for mixing soap, clay, paste, or other material of any kind; and consists, first, in making the rotary mixing tool, which turns within the containing cylinder, up and down, movable while being revolved, so that it will reach and agitate all the strata of the contents of the cylinder. This adjustment is done by mounting the rotary mixing tool upon a spindle which has a screw thread cut upon it beneath the containing vessel, and which passes through a female screw secured in or under the bottom of said vessel, so that when the spindle is revolved it will be screwed up or down, as the case may be. A sleeve embraces the said spindle beneath the containing vessel, and is connected with an arm of a rock shaft, from which another arm connects, by a rod, with a weighted lever, so that as the sleeve, by the rotation of the spindle, is moved up or down the rock shaft will be vibrated, whose connection with the weighted lever will cause the same to first swing in one direction and then in the other. This connection of the weighted lever serves to regulate the position of several gear wheels, by which motion is transmitted from the driving shaft to the aforementioned screw spindle. The object of this connection is to reverse automatically the motion of the spindle without reversing the motion of the driving shaft; and this object is attained by the aforementioned connection of the rock shaft with the weighted lever; for when the sleeve has been worked up to its greatest height the weighted lever will be projected to one side and tipped to carry the opposite gear in connection with the driving shaft; and when, on the other hand, the sleeve has been carried down to its greatest extent the weighted lever will be once more tipped in the opposite direction to reverse the transmission of motion from the driving shaft. Thus it will be observed that the invention appertains not only to the mixing tool and mode of turning and operating the same, but also to the means of regulating the direction of motion transmitted from the driving shaft to the screw spindle.

Improvement in the Manufacture of Horse Shoe Nails.

Hazen R. Underhill, Derry, N. H.—This invention has for its object to furnish improved horse shoe nails, stiffer, smoother, and more uniform than nails made in the ordinary manner, being thus more readily driven and less liable to injure the hoof, and which shall at the same time be no more expensive; and it consists in the mode of forming horse shoe nails, that is to say, by rolling, forging, or swaging them into round form, and then flattening them with a drop hammer; and in horse shoe nails made with rounded edges and flat sides.

New Process of Treating Grain.

Alexandre Sezille, Paris, France.—Heretofore grain has been prepared for bread making by grinding. This grinding allows but about eighty per cent of the grain to be utilized, leaving twenty per cent of bran and residuum. His eighty per cent of flour allowing a high yield of forty per cent of

white bread, produces one hundred and twelve kilograms of white bread, out of one hundred kilograms of grain. By this process, without grinding a yield of from one hundred and forty-five to one hundred and fifty kilograms of white bread is obtained out of one hundred kilograms of grain—a yield exceeding the ordinary one by thirty-three per cent. The grain is slightly wet with two or three per cent, according to its dryness, of water heated to 50° or 60° centigrade. Steam may be employed if desired. This wetting is made mechanically and gradually as the grain is required for decortication. In three or four minutes after being moistened, the pellicle of the grain expands and is ready for decortication, for which any suitable apparatus may be employed. The grain after being moistened should not stand more than fifteen minutes before being submitted to the decortication process, as the dampness, instead of being confined to the pellicle, would begin to affect the bodies of the kernels and make the decortication more difficult. The grain when properly decorticated can be preserved for any desired length of time, to be afterward converted into paste, when required. To remove the coloring matter of the grain, which is located directly under the epidermis, and which, upon fermentation, produces the brown bread, the decorticated grain is steeped in a bath of water heated to 80° centigrade for half an hour, by which time the temperature of the water has fallen to 40° or 45°. The water is then decanted, and new water of the same temperature—namely, 40° or 45°, and no more—is put on the grain three or four times in the space of three or four hours. By this time the grain has absorbed enough water to be easily converted into paste, which is done by passing it twice through cylinders similar to those used by chocolate dealers. The paste thus obtained is ready for fermentation, and has then only to undergo the ordinary baking process to become good bread.

New Apparatus for Grinding Gunpowder.

Paul A. Oliver, Wilkesbarre, Pa.—This invention has for its object to facilitate the reduction of gun and blasting powder into grains of the requisite size and configuration; and consists principally in the use of a series of reciprocating knives, which cut the cakes of powder into pieces and gradually reduce the pieces until the desired degree of fineness has been obtained, all without creating waste in the form of dust to such an extent as the same is being created by the devices now in use. The invention also consists in the combination with said reciprocating cutters of adjustable feed devices for moving the powder to be cut, and of means for cleaning the knives of any powder that may adhere to them.

Improvement in Oyster Tongs.

Isaac Smith, Bruceport, Washington Territory.—This invention consists in providing the head of a pair of oyster tongs with transversely perforated ribs so as to render the bars more readily and conveniently detachable.

Improved Cultivator Plow.

Cealy Phillips, Norfolk, Va.—This invention relates to double mold board or shovel plows, and consists in constructing the wings not only with a perforation by which they may be bolted to the shoe, but also with a separate stud on the inside of each shank, which serves to take the strain off the screw and hold the wing securely in position. The ratchets or notches on the side of the shank and shoe, by which this object was accomplished in the improved cultivator plow, patented May 7th, 1872, are somewhat difficult to cast, and hence more expensive than the simple stud under the present plan, while parallel series of perforations allow the required adjustment. The invention also consists in the mode of giving adjustment to the pitch of the plow by a sliding slotted wedge arranged between the standard and beam, whereby, by simply loosening a single clamp screw and moving the wedge in either direction, any desired degree of pitch may be obtained. The invention also consists in a new mode of arranging the handles with respect to the plow from by attaching them about midway between sole and beam, and so that they will be brought into an oblique plane passing under the shovel or plow. This arrangement is found by practical experiment to give the plowman an easier and more complete control of the plow.

Improved Manufacture of Jewelry.

Shubael Cottle, New York city.—This invention consists in a new method of forming an inner barrel on a jewelry base, and in certain novel means by which it is effected with great celerity and economy.

Improved Piano Action.

John Shandelle, Huntsville, Ala.—This invention has for its object to produce a pianoforte hammer head, which shall present a thin and elastic surface to the string and retain its original elasticity after long and constant use, and the invention consists in constructing the hammer head of India rubber, and in providing the same with an opening near its tip or striking surface.

Improved Smut Mill.

Charles Kuderli, Waumandee, Wis.—This invention relates to a new smut machine in which a vertical shaft, having a series of horizontal disks and vertical wings, is caused to revolve within an upright cylinder of perforated material having horizontal inwardly projecting ribs, so that the disks and wings will throw the wheat or other grain outwardly against the cylinder, while the ribs of the latter will again throw it in toward the shaft, thus recirculating the grain and insuring the desired result.

New Mixing and Grinding Apparatus for Ink, etc.

Joseph Martin, New York city.—A suitable vessel, the interior of which is made in the form of an inverted truncated cone, forms the outer part of the grinder. The inner part of the grinder is also made in the form of an inverted truncated cone, and fits into the interior of the vessel, space being left between the bottoms of said parts for the ink and paint to pass from the center of the core to its circumference. Upon the top of the core is attached gearing connected with the driving pulley. A tube extends down through the center of the core. To the upper end of the tube is attached a vessel in which the ink and paints are mixed. A post of a smaller diameter than the interior of the tube passes through the core. The lower end of the post is secured to the bottom of the vessel, and its upper end projects into the mixer. A valve retains the ink or paint in the vessel until it has been thoroughly mixed. To the upper part of the post is rigidly attached a cross bar or scraper, in such position as to be close to the bottom of the vessel, so that the ink or paint may be thoroughly mixed before it is allowed to flow down into the grinder. The valve moves up and down upon the post. As the ink or paint passes down through the tube into the space between the bottom of the core and the bottom of the vessel, it is forced, by its own gravity and the centrifugal force engendered by the revolution of the core, to pass up between the outer surface of the revolving core and the inner surface of the stationary vessel, being thoroughly rubbed and ground during its passage. In the upper edge of the vessel is a spout, through which the ground ink or paint is discharged into a receiver.

Improved Car and Cable Coupling.

Winfield S. Neiring, Morris Run, Pa.—This invention relates to a new kind of clamp which is to be attached to railroad cars or other moving devices for connecting them to wire or other cables that are in motion, so that whenever such car or device is by the clamp connected to the cable it will be propelled by the same, while it will remain at rest as soon as disconnected. The invention consists in constructing a clamp of two pivoted jaws which are held apart by an intermediate spring, and can be drawn together against the rope or cable by a cam attachment to a lever that turns on a pin projecting from one of the jaws.

Improved Insect Trap.

Japheth W. Stoll, Gonzales, Texas, assignor to himself and William B. Cavitt, of same place.—This invention has for its object to furnish an improved ant trap which shall be so constructed that the ants can get into it readily, but can not get out, so that they may be easily destroyed; and it consists in the ant trap formed of the ring plate or disk, the two inclined plates roughened upon their outer sides and smooth upon their inner sides, and the two inclined plates smooth upon both sides.

Improved Cultivator.

Frederick W. Tolley, Coxsackie, N. Y., assignor to himself and A. V. D. Collier, of same place.—This invention has for its object to furnish a malleable or wrought iron plow standard, which shall be so constructed that it will not clog or choke with sods, grass, weeds, or other obstructions, and to which the plow plate may be easily and quickly attached and detached. By suitable construction, when the cultivator is being used, the pressure of the ground will tend to force the plow plate upward, and thus more securely fasten it in place.

Improved Wash Boiler Attachment.

Edward Choate, New York city.—This invention has for its object to furnish an improved automatic circulator for wash boilers, and other boilers and vessels in which steam is used as a cleansing, bleaching or cooking agent, and it consists in the flanged plate provided with a discharge pipe, and having one or more openings formed in the flange at the end of the plate furthest from the pipe, and half an inch, more or less, below the said plate.

Improved Wagon.

John N. Stewart, Belfast, Me.—This invention has for its object to improve the construction of slung bodied carts, in which the cart body rests upon springs which rest upon the middle part of a crank axle, so that the cranks of the axle may be securely supported in position; and it consists in the slotted stakes in combination with the bends or cranks of the axle, and with the cart body resting upon springs attached to said axle. By this construction the axle will be held firmly in position, however much the body may move up and down upon the springs.

Improved Turn Table for Railroads.

John Enright, Cleveland, Ohio.—The invention consists in a turn table for railroad cars or locomotives made in two parts, constructed and applicable to each other so as to exclude dust and prevent obstructions to its easy movement. It also consists in forming a step and groove enlarged to receive lubricating material.

New Steam Coupling for Heating Railroad Cars.

Wm. N. McDuffey and Benjamin F. Jaques, Petersburg, Va.—The invention consists in a coupling wherein the steam inlet and outlet valves and the grapples which held together the two parts are operated simultaneously by the same device and by the same movement. The invention also consists in combining, with the heating pipes or coil, a pipe which carries the condensed steam back to the feed water chamber, tank or vessel connected therewith.

New Machine for Bending Bars and Tubes.

Amos Harris, of Minneapolis, Minn., assignor to himself and Franklin L. Putnam, of same place.—This invention relates to an improved apparatus for straightening or bending metal bars, shafts, tubes, rods, etc.; and it consists in the combination of a hook, a screw, and a bearing plate, forming a clamp adapted to control wearing substances on opposite sides of an article to be bent or straightened, and can be used to draw such surfaces nearer together or spread them further apart until the desired effect has been obtained. The invention is applicable to all shafts, etc., while the same are in lathes or hung in bearings in shops, or in any other position whatever.

Improved Elevator.

Andrew Blass and David Brown, Brooklyn, N. Y.—This invention relates to elevators in hotels and other buildings, whether used for elevating passengers, baggage, or merchandise, and consists in one or more plates or shutters connected by chains or ropes with the bottom of the car or freight platform, so as to partition off and close the elevator well when the car or platform is raised, thus preventing danger to life from falling down the well, and stopping the draft of air and closing the communication by which fire is apt to spread from one story to another.

Improved Oscillating Chair.

William T. Doremus, New York city.—This invention has for its object to furnish an improved oscillating chair, and consists in the combination of one or more hinges and one or more rubber blocks with a pedestal and chair seat, and in the combination of a stationary nut, hollow screw, rigid plate, hinged screws, and rubber block or blocks with each other and with the pedestal and seat of a chair.

Improved Saw Filing Apparatus.

Frederic E. Frey, Bucyrus, Ohio.—This invention relates to a new grinder machine for sharpening or gumming saws, circular or upright, sharpening molding bits, or other articles for which emery or grinding wheels are used. The invention consists more particularly in hanging the emery wheel in a jointed frame, which, by virtue of its several joints, is under full and absolute control of the operator, who can therefore set and apply the grinding wheel at any suitable angle to the article to be sharpened.

Improved Reflecting Lamp Chimney.

Adam Kunkle, Birmingham, Pa.—This invention has for its object to furnish an improved lamp chimney which shall be so constructed as to throw a stronger light and be less liable to break than the ordinary glass lamp chimneys, and which will not require a shade when the lamp is used for reading, sewing, and similar purposes, and which shall be easily cleaned. The chimney is a cylinder of suitable material, with its axis horizontal, in the open ends of which are placed lenses.

Improved Nut Lock.

Bernhard Fürst and Peter Göttinger, Lacon, Ill.—This invention relates to a new nut lock in which a spring dog fits into a recess or chamber of the nut to bite against vertical grooves or creases in the screw.

Facts for the Ladies.—Miss Ellen Ferris, Troy, N. Y., earns annually about \$700 with her Wheeler & Wilson Lock-Stitch Machine. See the new Improvements and Woods' Lock-Stitch Nipper.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From January 1 to January 2, 1873, inclusive.

CRUSHING STONE, etc.—A. H. Smith, Brooklyn, N. Y.
DIES.—C. F. Wilson, Northbridge, Mass.; S. H. Miller, J. E. Folk, Brooklyn, N. Y.
HORSE BREATHING MACHINE.—J. H. Small, Buffalo, N. Y.
PAPER FILLING MACHINE.—E. D. Averell, New York city.
PREPARING COTTON.—T. C. Craven, Hudson, N. Y.
SADDLE CHAIR.—W. B. McClure, J. C. Graham, H. O. Cloughton, Alexandria, Va.
SPINNING MACHINERY.—O. Pearl, J. B. Battles, Lawrence, Mass.

NEW BOOKS AND PUBLICATIONS.

THE NATIONAL BUILDER, a complete work on Constructive Carpentry—for the use of Architects, Carpenters, Builders, and Stair Builders. By James H. Monckton. New York: Orange Judd & Co., 245 Broadway. Illustrated. Price, \$12.

A finely printed quarto volume, forming an exhaustive treatise on the subject to which it is devoted. The simplest methods of finding all joints and geometrical forms are given, including splayed work, groined ceilings, framing, roofing domes, niches, raking and level moldings, etc. The topics of stair building and hand railing are treated in an entirely original and excellent manner. The work contains ninety-two handsomely executed plates, with one thousand figures printed in colors, presenting designs for stair cases, newels, balusters, and other carpentry. The trades and professions for which this book is written will find in it a great amount of valuable information condensed into the smallest compass.

THE OWENS COLLEGE JUNIOR COURSE OF PRACTICAL CHEMISTRY. By Francis Jones, Clinical Master in the Grammar School, Manchester, England. With a Preface by Professor Roscoe, F.R.S. Price \$1.25. New York: Macmillan & Co.

This is an admirable text book, written with the careful attention to detail necessary in an elementary work. Although intended, as its title page indicates, for the use of beginners, it may be read with profit by all students of physical science. Any one who becomes thoroughly acquainted with the contents of this little book will have a well grounded knowledge of the principles of the chemical world. In tuition, the catechism at the end of the work will be found exceedingly valuable.

THE PRACTICAL MAGAZINE; an Illustrated Cyclopaedia of Industrial News, Inventions, and Improvements. Price 2s. 6d. monthly. Published for the Proprietary, at 7 Printing House Square, London, England.

A substantial publication, illustrated with numerous engravings, among which we observe Mr. James Short's loom, the illustration and description of which are extracted from our pages. The magazine is well printed, and like most English industrial publications, has its advertising pages well filled.

Business and Personal.

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

All Hot Air Furnaces changed to Steam—Same heaters and registers; no boiler; one Furnace, or whole Patent. H. O. Bullock, Cleveland, Ohio.

Water Front, also Stores or Lots to Rent, Delaney St., E. River. Andrews Bro., 414 Water St., N. Y. Nickel Plating; a new and superior mode, not infringing Patents, for sale and references given by A. Scheller, 121 Forsyth Street, New York.

Buy Gear's Improved Variety Moulding Machine. Warehouses, Boston, Mass.

For Sale, Machine Shop and Foundry. Address, Waggoner & Matthews, Westminster, Md.

Sperm Oil—No lubricator like it. See Kellogg's advertisement on another page.

Patent Steel Measuring Tapes, manufactured and sold by W. H. Faine, Greenpoint, N. Y. Send for circular.

For Sale, or Worked on Royalty, the Patent Weighing Scoop, indispensable in all Families. D. H. Priest & Co., 3 Tremont Row, Boston, Mass.

Iron Roofing. Scott & Co., Cincinnati, Ohio.

Manufacturers of Submarine Excavators, Address, with Circular, Geo. W. Parsons, Salisbury, Md.

Wanted—A good Second-hand Portable Engine on Wheels, 6 or 8 H.P. Address, with price and full particulars, T. F. Cramer, Woodboro, Frederick Co., Md.

Shafting and Pulleys a specialty. Small orders filled on as good terms as large. B. Frisbie & Co., New Haven, Conn.

Steel Castings to Pattern. Can be forged, welded, and tempered. Address Pittsburgh Steel Casting Company, Pittsburgh, Pa. All work warranted.

A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1872, for Best Telegraph Instrument for private use—is offered for sale by the Merchants' Mfg. and Construction Co., 30 Broad St., New York. P. O. Box 683.

Jos. Mincher, Machinist of Troy, Alabama, offers his services as Agent, to represent any thing that may be of use to Plasterers, Builders, or Manufacturers.

Wanted, a Machine to make a flat flour barrel hoop out of black ash timber; also, any Machinery that will decrease the cost of making Flour, Fruit, or Lime Barrels; also, a Machine to shave a flat hoop ready for the barrel. Address P. O. Box 233, Buffalo, N. Y.

Good Words for the "Gardner"—From Powers & Weightman. Philadelphia, January 6, 1873. D. B. Waggoner, Secretary, No 1336 Chestnut St., Philadelphia. Dear Sir:—At the gas explosion which occurred at our store, No. 36 Maiden Lane, New York, on the 11th of December, the Gardner Fire Extinguishers procured from you were used to great advantage. Powers & Weightman.

To Machinists and Manufacturers in want of a prompt, energetic man of long experience to take charge of work, or act as Agent. Address Carrier, 98 P. O., Philadelphia, Pa.

Buy Wood Working Machinery of Gear, Boston, Mass.

To G. G. L.—Having had experience with some patents for chemically preparing and dyeing moss for mattresses, will communicate with you, with your full address directed to H. L. Box 211, Plainfield, N. J.

Hydraulic Presses and Jacks, new and second-hand. E. Lyon, 670 Grand Street, New York.

Foot Lathe for \$22. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Wanted, reliable and responsible parties to Sell Engines, Saw Mills, and other machinery manufactured by the Mansfield Machine Works, Mansfield, Ohio.

For the Best Circular Saw Mills and Steam Engines, Stationary and Portable, of all sizes, apply to the Mansfield Machine Works, Mansfield, Ohio.

For Wait's Improved Turbine Water Wheels, Improved Melay, Gang, and Circular Saw Mills, Paper Engines, Rope Cutters, &c., &c., address Matthew & Van Wormer, Successors to P. H. Wait, Sandy Hill, N. Y.

All Blacksmith Shops need a Holding Vise to upset bolts by hand. For such, address J. R. Abbe, Manchester, N. H.

Circular Saw Mills, with Lane's Patent Sets; more than 1500 in operation. Send for descriptive pamphlet and price list. Lane, Pitkin & Brock, Montpelier, Vermont.

First Class Bed and Platen Printing Presses to order on short notice by Sullivan Machine Company, Claremont, N. H.

Machinists—Price List of small Tools free; Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Wanted, by T. R. Bailey & Vail, Lockport, N. Y., Planer, new or second hand, to plane 5 to 6 ft. sq., 20 to 26 inches wide.

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

Nickel Salts and Ammonia, especially manufactured for Nickel Plating, also "Anodes," by L. & J. W. Feuchtwanger, 52 Cedar Street, New York.

"Minton & Co.'s Tiles," by appointment, Gilbert Elliott & Co., Sole Agents, No. 11 Clinton Place, 8th St., New York.

For 2, 4, 6 & 8 H.P. Engines, address Twiss Bros., New Haven, Conn.

English Patent—The Proprietors of the "Heald & Ciesco Centrifugal Pump" (triumphant at the recent Fair), having their hands full at home, will sell their Patent for Great Britain, just obtained. A great chance for business in England. Address Heald, Sisco & Co., Baldwinsville, N. Y.

For the best Presses and Dies and all Fruit Can Tools, apply to Bliss & Williams, 119 to 120 Plymouth St., Brooklyn.

American Boiler Powder, for certainty, safety, and cheapness. "The Standard anti-incrustant." Am. B. P. Co., Box 777, Pittsburgh, Pa.

Scale in Boilers. I will Remove and prevent Scale in any Steam Boiler, or make no charge. Send for circular. Geo. W. Lord, Philadelphia, Pa.

Gauges, for Locomotives, Steam, Vacuum, Air, and Testing purposes—Time and Automatic Recording Gauges—Engine Counters, Rate Gauges, and Test Pumps. All kinds fine brass work done by The Recording Steam Gauge Company, 91 Liberty Street, New York.

Dobson's Patent Scroll Saws make 1100 strokes per minute. Satisfaction guaranteed. John B. Schenck's Sons, 118 Liberty St., N. Y.

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

Boynton's Lightning Saws. The genuine 2000 challenge. Will cut five times as fast as an ax. A six foot cross cut and buck saw, 24 in. E. M. Boynton, 90 Beekman Street, New York, Sole Proprietor.

The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Boilers. L. B. Davis & Co., Hartford, Conn.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

Steel Castings "To Pattern," from ten lbs. upward, can be forged and tempered. Address Collins & Co., No. 212 Water St., N. Y.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address L. B. Davis & Co., Hartford, Conn.

Williamson's Road Steamer and Steam Plow, with rubber tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

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 Machine—Simple, effective, durable. For description of the above, see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau St., New York.

Belted as is Belting—Best Philadelphia Oak Tanned. C. W. Aray, 30 and 308 Cherry Street, Philadelphia, Pa.

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

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

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. L. B. Davis & Co.

Always right side up—The Olmsted Oilier, enlarged and improved. Sold everywhere.

Gatling guns, that fire 400 shots per minute, with a range of over 1,000 yards, and which weigh only 125 pounds, are now being made at Colt's Armory, Hartford, Conn.

Electro Gold and Silver Plater on all metals, of 12 years' experience, is open for an engagement. Address S. C., 30 Union Street, Newark, N. J.

Hand Brick Machine—Parties building a machine that will re-compress the brick after moulding and partially dried, will please address the Editor of this paper, Box 773, New York City. Send circular.

Notes & Queries

1.—V. asks: What is the cause of the scale which is found on malleable iron castings?

2.—C. asks if there is anything better than wax to fill cracks in wood previous to varnishing; if so, what is it?

3.—H. L. B. asks: How can I remove paint (in pinhead spots) about a year old, from plate glass windows?

4.—H. L. B. asks how to make the carmine stamp ink used on a ribbon stamp for canceling purposes.

5.—C. asks: How can I case-harden part of an object, such as the face of a hammer head, and leave the rest soft?

6.—J. B. B. asks: What varnish or composition will make cloth waterproof without causing it to be stiff and sticky, or to lose its color?

7.—C. asks: Can corundum be used for grinding on a wheel, like emery, and is it better than emery for grinding steel and iron?

8.—A. M. J. says: I would like to know what cement, if any, there is that will stop the leakage of crude petroleum from iron tanks which are caulked and riveted.

9.—J. E. F. asks how to preserve and stuff birds, and how to dress their feathers, which get spoiled in killing.

10.—L. H. W. asks: How can I temper small pieces of steel wire, 1-16 of an inch in diameter and less and 1 inch long? I wish to temper 100 at a time.

ANSWERS TO CORRESPONDENTS

G. G. S. asks: What is the present variation of the magnetic meridian from the true meridian? What is its variation at different times since 1793? Is it still moving westward, and has it been so through that entire period, or has any change from the west to east taken place? If so, when did it occur? Answer: The information desired can be obtained from the United States Coast Survey Report. The variation is still moving westward and has been continuously since the date given. The exact variation at the given locality can be determined at any time by any surveyor who understands his business thoroughly. Apply to the nearest one.

A. H. S. says: I intend to build a residence next spring, and desire to make the house warm and rat proof, if it can be done without too much expense. I proposed to fill every space between the studding with brick and mortar, leaving space of 1½ inches for room for plastering. I am recommended to fill spaces with dry sand or dry ashes sifted fine. If I fill with brick, I must haul them, by team, 8 or 9 miles, while sand may be obtained within half a mile at trifling cost. Which had I better use for my purpose? Will not sand rot wood work, even if put in dry? Will the small nails used to nail on the lath be sufficient to sustain the pressure of the sand, the studding being 15 or 16 feet high? It is suggested that sand would stifle any fire that might start by closing around it, thus rendering building much safer. Answer: There is danger of the outside boarding becoming open by shrinking and warping, in which case the sand will run out through the open joints or laps. Dry sand has been used for deadening between floors to the extent of four inches in thickness, but a special boarding is put in to receive it, so as not to bring the weight upon the plaster; the result in this case as to dry rot has not been determined. But timber encased in plaster and in iron has developed a very dangerous rot in this city. Your safest plan will be to interlath between the studs and plaster one good coat, if you do not wish to incur the expense of brick filling. But you had better fill in at the end of your floor joists with brick, so as to cut off the connection of the floor spaces with the wall spaces, and so prevent the passage of wind or rats into the floors.

S. J. H. asks: Why does not a top fall when spinning, the same as when it is not spinning? Answer: The principle is, in some respects, similar to that of the

gyroscope. Consult Peck's "Mechanics for Schools," etc. We will endeavor to find space and time to translate it into less purely mathematical language at some future time.

E. O. McC. asks: How far can water be drawn on a perpendicular, with a fire engine? Answer: Probably not 30 feet. 30-35 feet is the highest that a column of water can be supported by ordinary atmospheric pressure.

J. V. H. N. says: I have a little turbine wheel with which I run my printing presses. It is situated in my second story. The manufacturer stated that I would lose no power by placing it there, provided I made a draft tube of the discharge pipe, by inserting its end in a tub of water and making it air tight. I had the discharge pipe made siphon like at the lower end. The query is: Do I lose power by the siphon arrangement; and, if it is not perfect, would I lose power by the water and tub arrangement, and if so, how much? If I lose power by either arrangement, I should like to know, for in that event I would place the thing in my cellar. Answer: Any arrangement by which you make a complete seal of the lower end of the discharge pipe against the ingress of the air, and thus retain the tube full of water, will be effective with a properly constructed wheel, provided that it is not placed at a greater height above the discharge opening than that due the pressure of the atmosphere, and provided that the arrangement does not impede the flow of the water. If the seal is imperfect, head is lost and also a proportionate amount of power, by the entrance of the air.

J. F. asks which will be most effective, a circular saw with 48, or one with 25 teeth, in cutting pine board. Answer: The size of saw or speed of its periphery should be given. We cannot give a definite answer as the question is asked. At one speed, the teeth might be set too close if 48 in number, and at other speeds, they would be too far separated if 25 were used.

O. K. asks if it is advisable to drive a 4½ feet burr millstone with a quarter twist belt from the engine shaft to the spindle, and how wide must the belt be. Answer: We do not like quarter turn flat belts, but properly arranged, and with plenty of length, they sometimes do well. Try a 5 inch belt, if you have good distance between the stone and the line shafting.

J. P. W. says: I have lately put into my shop a ventilator 14 inches square and about 14 feet long, extending from the ceiling overhead, 7 feet out of the roof. I have a hood at the top to cover it, which can be raised any distance, from 2 inches to 3 feet; but it will not draw. A current of air sets downwards most of the time. What is the trouble? Answer: We presume that an equally large volume of air rises through the chimney or elsewhere, where the upward draft is more powerful.

T. I. F. asks: In making the driving or band wheel of a common horse power larger, to increase speed, what proportion in length ought the levers to be, to make any gain in favor of the team, if any, as the larger the circuit the slower is the speed? Answer: Increasing the size of the band wheel in the horse power machine will increase speed of driven pulley at the expense of the driving force, which will diminish in similar proportion. No alteration for the purpose of regaining the lost advantage will be successful except by sacrificing the speed gained.

O. N. asks: Which end foremost will a log, thirty feet long and twenty inches in diameter at one end, tapering to a point at the other, tow easiest in water? Answer: The log will move more easily with its sharp end foremost. The principal resistance in propelling properly formed bodies in water comes from the friction between the surface of the body and the water. In the case of a blunt log or a blunt vessel, the resistance is increased by the piling up of the water in front. If the log is moved sharp end first there is no front piling of the water, but the latter is divided and swings away sideways with little or no resistance, like the pendulum of a clock.

T. R. L. says: Last summer I noticed on the grass of my lawn a circle or ring of a bluish or ash color, about 8 inches wide and 10 feet in diameter. Upon examination I found that each blade of grass composing the circle was covered on both sides with a kind of mildew, which, when undisturbed, was of the bluish color; but when rubbed between the fingers, it became black. The grass was about 4 inches long, and when the mower was run through it, this substance rose in a cloud and was blown away. On another part of the lawn, there was another portion of a circle, about one half. As I never saw one before, can you let us know what caused it, and why it assumed the circular form? Answer: It would be impossible to give a positive answer without some of the substance for microscopical examination. But it is very probable that a mushroom would have been found in the center of the circle, and that the "mildew" was caused by a scattering of the myriad spores of the fungus.

E. A. N. says: A discussion has arisen between myself and an old experienced engineer relative to some trouble that I am having with the feed pipe of the engine that I have charge of. The bonds in the heater last but a very short time, and I have had to renew the whole pipe from the pump to the check valve (some parts of it several times) in the last twelve months. The tank is round, and about 8 feet in diameter at bottom, and just taper enough to hold hoops; it is between 8 and 9 feet high and is raised 9 feet from the ground. The pipe from the tank to the pump is one inch gas pipe. The pump has a solid plunger 2½ inches in diameter and the pipe that troubles is 1 inch gas pipe. The old engineer contends that the pipe is large enough, and that the water contains some mineral that injures the iron when heated; I say that the pipe is entirely too small, and I suggested to him that the pressure of the tank greatly assisted the atmosphere in promptly filling the vacuum produced by the pump, while the heat communicated to it (the water) would expand it and thus, having the pressure in boiler to contend with, would create great friction. In proof of my position, I called his attention to the stand pipe (which is 1½ inch gas pipe from the check valve to the boiler) and is seemingly as sound now as when put in. Will you give your views on the subject? Answer: We think the pipe too small altogether, unless the pump runs very slowly indeed. If the trouble arises from oxidation by anything dissolved in the feed water, it should be easily detected.

D. M. says: I have a brick building covered with tin, with a parapet roof; and from some defects in putting on the tin, it leaks badly, especially during very heavy rains. The mechanic blames the tinner, and the tinner the mechanic. I think both are to blame. Please advise me whether I had better tear off the roof or not. I had the parapet roof to secure safety from fire from buildings a short distance off. It may be best to change the roof from a parapet. Answer: Do not alter the parapet, but insist upon the tinner's making the roof tight; and if the parapets are of brick, as we presume they are, he should take paint skins and cement the joint

where the tin enters the brick work. Most likely the fault lies here.

O. H. asks: What power for each square inch of water passing through pipes from an elevation of 400 feet a distance of five miles could be obtained? I am desirous of this information, as my farm is about the above distance from the water works, and the water pipes to supply the city are more than half the distance down in the streets; and if I could convey the water the distance named, it seems to me I should have, with a five or six inch pipe, a power to cost less than to build a steam engine of ten horse power. Answer: Every ten gallons of water, under the head indicated, is capable of developing about a half horse power, if used in an ordinary water wheel of small size. The pressure will be likely to vary immensely from that due the head with the greater or less amount of water used in the city, and the friction of the pipes will cause considerable loss. The power actually derived from the source referred to will be probably but a small proportion of that due the head, but we cannot undertake to say how small that friction may be. We should anticipate that steam power would be cheaper than water power, and also more reliable, under such circumstances.

I. P. H. asks: When was the game of chess invented, and by whom, and in what country? Who is the standard authority on such games? Are there any reliable books on taxidermy, and whose is best for beginners in that art? Can you inform me where Batern is located, as I cannot find it on any of the maps? I think it is in the Austrian empire or near it. Answer: The game of chess is said to have been invented in India 5,000 years ago. Staunton and Hoyle are the standard authorities. Professor S. F. Baird has published directions for taxidermists in the Report of the Smithsonian Institute for 1866. Batern is the German name for Havana.

J. asks for a simple method of detecting explosive oils, and states that his neighbors use a burning fluid of which the vapor escapes through a burner. He believes a good refined coal oil to be preferable to this fluid, whatever the latter may be. Answer: A perfect test for mineral oil was described on page 341 of our last volume, under date November 30, 1872. J's letter is one of many asking for instruction on practical matters which come to us every day, answers to which have been already published in our journal. Better evidence of the continued usefulness of the SCIENTIFIC AMERICAN could not be adduced.

C. H. says: On December 13, about sunset, there was a bluish light, apparently about the size of a common barrel, at a considerable height in the air. It traveled westward, and would not have been noticed by many but for the tremendous noise, which jarred the earth and made the windows rattle. It continued roaring all over the sky for several minutes. What was it? Answer: If the blue light had been invested with a tail, it would be easy to account for the phenomenon; but wanting that appendage, science fails to offer a satisfactory solution.

W. H. C. says: I have had an argument with a friend, who takes the position that the sails of a ship, being the first part seen as she approaches, is not a proof of the rotundity of the earth. He argues that the circle of the earth's circumference is too great, and approaches too near a straight line to produce this result within the distance that a ship can be seen with the unaided eye. How is this? What is the rotundity of the earth per mile? Answer: Eight inches.—How far can a large ship be seen on a smooth sea? Answer: About 17 miles, if the masts are 300 feet high.—Suppose a straight line, 50 miles long, to touch the circle of the earth at the center of the line, how far would each end of that line be from the circle? Answer: About 4½ feet.

R. H. M. says: We have two fine boilers, each of the following dimensions: 15 feet long, 4 feet diameter, with 48 three inch tubes; the grate surface is 5 feet by 4 feet. They are said to be of fifty horse power each. We have also two other boilers, each 16 feet long, 4 feet 6 inches diameter; one has 64 three inch tubes, the other, 62. The grate surface is 5 feet by 4 feet 6 inches; said to be of 70 horse power each. On the last named boilers our working pressure is 30 pounds; we very frequently find great difficulty in keeping up this pressure, with only one hundred horse power of work on our engine. The length of steam pipe is barely 50 feet, consumption of fuel, 6 tons best soft coal, in twenty hours. What I desire to know is this: Is the estimated power correct according to dimensions given, allowing the usual percentage (which I believe is 15 per cent) for condensation, etc.? Is the consumption of fuel out of proportion to the amount of work obtained? And is the grate or fire surface sufficient? Answer: Good builders of steam boilers usually allow twelve feet of heating surface per horse power, and, with good engines and boilers, it is sufficient. Five hundred and sixty pounds of coal per hour, with a good engine and boilers, should give at least 120 indicated horse power, and with the best engines and boilers in the market, 100 horse power should be obtained with a consumption of one half the amount of coal given by our correspondent. The proportions of the boilers described seem to us good. Examine the engine and the setting of the boilers. There is a serious defect somewhere.

C. F. W. says: In estimating the power of an friction cam, I take it for granted the law is the same as for an inclined plane, namely, as often as the height is contained in the length the power is doubled; but in my case the length of the plane is 6 inches, the height 3 inches, and when used, both planes work at the same time, but the height is double, making 6 inches. Is there, or is there not, any power gained besides what is gained by the lever to work the same? Answer: The relation of force exerted to resistance overcome, in the whole combination, can be determined by multiplying the force exerted by the distance over which it moves in its own direction and dividing by the distance traversed by the table of the press. The result gives the resistance which may be overcome, whatever the intermediate mechanism, and provided there is no friction.

M. D. K. asks: 1. What is the highest speed attained in printing cards, circulars, etc., and what is the name of the press? 2. How can I ascertain the power of a toy steam engine? 3. Is there an illustrated dictionary of mechanical terms published? 4. How are colored lithographs made, and are all the colors printed at one impression? Answer: 1. About 1,000 per hour, by the Gordon press or some one of its modifications. 2. Toy steam engines are generally too small for the ordinary formula to accurately represent. Set your engine to work raising a weight, and remember that force sufficient to raise 33,000 pounds a foot high in a minute is a horse power. 3. Consult a bookseller. 4. Each color on a lithographic print is produced by a separate impression.

A. A. D. asks whether the power of a hydraulic press is doubled or quadrupled by the use of two or four small pumps, which inject the water into the large cylinder, instead of one; or, if not, whether the effect of two or four of such small pumps would simply equal to the effect of one larger one, the diameter orb

rather the area, of the piston of which is equal to the sum of the others. Answer: To determine the power of the hydraulic press, measure the diameters of the pump plunger and the ram of the press. The square of the diameter of the ram is divided by the quantity obtained by multiplying the square of the diameter of the plunger by the distance from the center of the plunger to the fulcrum of the pump handle and dividing by the whole length of handle. The result will be the number of times that the force exerted by the press exceeds that exerted on the pump handle. Friction is not considered. The action of four small pumps worked by the same handle would be equivalent to that of a single pump of double diameter, that is, of area equal to the four combined.

J. K. asks: Is it safe to use any remedy, when chemicals are used, to remove scales from boilers? Answer: Mechanical means are always to be preferred, in the removal of scale once formed, whenever they can be employed. The use of chemicals, in weak solution, where their action can be carefully watched, is proper. If they contain any acid, however, they will injure the exposed metallic surfaces wherever they may come in contact with them. Some apparently harmless remedies produce acids by their decomposition, and serious injury is thus sometimes caused.

To E. E.—To form a perfect cube in perspective, inscribe a regular hexagon in a circle, then connect each alternate angle with the center by a radius. This will give a cube.



To W. G. B.—This communication was received too late to comply with request relating to an earlier note. The desire of our correspondent is, however, fully complied with in our last remarks upon the subject of the balance wheel. The only real gain in attempting to balance a reciprocating piece by a rotating one is that derived from changing the direction of the disturbing action of the momentum. For example, the reciprocating parts of a horizontal stationary engine, if running at high speed, produce horizontal strains which its foundation and holding down bolts are less well fitted to resist than to meet the vertical strains which are produced by the momentum of the rotating piece, which may be used to neutralize those horizontal strains.

J. H. D. says: A friend claims that, if a weight of 40 lbs. be put on a wagon axle (which is 200 lbs. on each wheel), the pressure is the same on the top of the wheel as on the bottom; while I assert that, if there are 14 spokes in the wheel, there is just one fourteenth of the weight on the top. Which is right? Answer: The problem proposed involves the higher mathematics. If the rim is absolutely rigid, and if the joints are unyielding, the strains on the several spokes will vary in proportion to the squares of the cosines of the angles which they make with the vertical. In this case, the force resisted by the vertical spoke, either at top or bottom, is about two fourteenths of the total weight on the wheel, where all the spokes take their proportion of the weight, as indicated above.

X. Y. Z. says: Will some one inform me what causes stinks, hollows, or low places in brass castings? Answer: The defects you speak of are due to various causes, such as uneven shrinkage, molds not thoroughly dried, etc.; but principally uneven pouring and too little pressure in the metal from the pot.

J. G. W. sends a mineral specimen and says: The piece I send you is broken off from a larger piece weighing $\frac{1}{4}$ of a pound. It was found while excavating for a cellar, in a soil composed of sand and clay. When found, it was covered with an oxide fully $\frac{1}{4}$ of an inch thick. Many who have examined it think it is of meteoric origin. But I have always supposed that meteors contained a considerable percentage of iron; this does not appear to, for the minutest particles are not in the least affected by a powerful magnet. Answer: It is not of meteoric origin, but is iron pyrites (sulphuret of iron) which is not attracted by the magnet.

S. S. W. C. says: I am using a plain slide valve engine, 10 by 24 inches. The valve cuts off at about two thirds of the stroke. Is it possible to set the eccentric so as to cut off sooner and still give sufficient lead, without changing the length of the valve? Answer: The engine referred to is probably as well arranged as will be found possible. To cut off shorter with a single slide valve would probably cause excessive cushioning. To make a change would require, also, a change in the length of valve face.

C. asks how to make a machine to sand-paper wood. Answer: Use canvas belts strongly sewed together at the ends. The threads may be so tied together as to leave the face on emery side of belt perfectly smooth and level. Size the belt with a coating of thin glue and then let it dry. Bind the belt over two pulleys, so that it can be easily turned. Use the best glue, of about the consistency for gluing wood; put it on hot with a brush, lifting the sand or emery on at once. Go round the belt as quickly as possible, then lay it on a smooth plank, and roll the sand or emery into the glue as much as possible (on iron pulley, loose on a mandrel, is best); then hang up the belt to dry.

M. H. B. asks: How can I work a blue color into soap? Answer: Ultramarine and smalts or saffre are the materials used; the pigment ought to be stirred into the soap when the latter is in the mold. The fear that either of these materials will turn green is entirely unfounded.

S. L. A. says that a steel square which he had kept oiled has lost its spring, and asks if oil affects the temper. Answer: The simple covering with oil cannot effect the hardness and elasticity of steel. It is a fact that oil and fat are used to anneal steel, especially thin articles, like springs, but in this case they are dipped into a bath, heated to the point of ignition. Sometimes the tools are covered with the fat or oil, whereupon the latter is ignited.

B. St. J. says: I am running a steam saw mill. When getting up steam after the boiler is cold,

there is a thumping or pounding, like striking with a heavy hammer, from the time we get 3 lbs. of steam till we have 40 lbs., when it ceases. What is the cause of said pounding? The boiler is a large tub boiler, four feet in diameter and eighteen feet long. The connection pipe from the pump is exposed three feet to the fire, and is a four inch pipe. When in front of boiler the thumping sounds at back, and at back, sounds in front, and is so heavy as to jar the whole mill and to be heard four or five rods outside. Answer: We presume that the action described is due to the presence of cold water in the steam pipe. Open the throttle valve and the pet cocks in the cylinder, or in some other way drain the steam pipe and allow steam to blow through until the pipe is thoroughly warmed.

D. M. O. asks: Is there any process by which grained sugar can be made from sorghum? Answer: The attempts to make granulated sugar out of sorghum have not proved economical. Several pamphlets have been printed by agricultural publishers on this subject.

J. K. M. asks: What is the most powerful bleaching process, and how can I apply it for bleaching an animal substance? Answer: The best bleaching agent for ordinary purposes is chloride of lime. Potassium permanganate of potash is also much employed. For household use, what is called Javelle water, to be had of druggists, can be used to bleach linen and remove wine stains.

J. P. C. says: I wish to illuminate a magic lantern with an electric light; what is the best battery to use, and what is the number of cups? Are there any magnetic or other machines that would answer the purpose? Answer: It is difficult to manage the electric light without employing Foucault's lamp, and this is expensive. Professor Tyndall made use of three of these lamps at his recent lectures in New York, and ran them with a bichromate battery of 50 cells. It is more convenient to illuminate a magic lantern with the calcium light.

J. F. asks for directions for testing bleaching powder (chloride of lime)? Answer: It is not easy for any one but a professional chemist to test bleaching powders. The directions for accomplishing an accurate analysis are given in Fresenius' work on quantitative analysis.

W. E. G., of Ky., sends a mineral specimen, asking what it is, and of what use. Answer: It is pure galena, the great lead ore of commerce.

J. M. W. asks for a demonstration of the manner in which a bird rises through the air without exertion on its own part, and states that this will open a new field for perpetual motionists. Answer: If you have read the SCIENTIFIC AMERICAN carefully, you will know that a bird does not rise without exertion on its own part, and you will have a wholesome dread of anything further on the subject of perpetual motion.

F. A. K. says: A lever L has its fulcrum at the angle; the power moves the upper part, and the pressure is exerted perpendicularly at the right hand extremity of the lower part. Another lever, of similar dimensions and with its fulcrum similarly placed at the left hand extremity of its lower part, is of shape 1. Which will exert the greatest pressure? Answer: The latter, or 1 form. If the two arms of L are equal in length, there will be merely a transmission of power, less the friction, and no leverage at all. But in the latter form, the leverage and increased power will vary as the point where the power is applied is moved further from the fulcrum; and the leverage will be as this distance is to the length of the horizontal or lower arm of the 1.

E. M. asks: What cheap preparation can I use to make a box water tight against either hot or cold water? Answer: Dip the box in hot paraffin.

J. B. W. asks for information with reference to the commission for observing the transit of Venus next year. Who has it in charge, and what has been published with reference thereto? He suggests that a table of contents for each number would be a valuable addition to our paper. Answer: Write to Professor Newcomb, Washington, D. C., for information relating to the commission for observing the transit of Venus. We publish a table of contents for each number on our editorial page.

C. M. asks if anthracite coal is injured by exposure to the weather, or by immersion in water? "I have soaked it in water for some days without any increase in weight." Is carbon soluble in any liquid without chemical change? Answer: Anthracite coal is considerably deteriorated by exposure to the air, a fact that is too much overlooked by dealers. There is no solvent for carbon.

A. G. T. says: I read the article on the use of arsenic in paper hangings, etc., and its effect on the health. I have a large case of stuffed birds in my sitting room, which are, of course, prepared in arsenic. Do you consider them injurious to the health of the occupants of the house; and is the profession of taxidermist an unhealthy one? Is Ure's Dictionary of Arts and Manufactures an illustrated work? And could I find in it full descriptions of the manufacture of frames and organs, and weaving of silk? Answer: Stuffed birds should be kept in close cases, and the room be well ventilated, as moisture and changes of temperature will liberate some of the poisonous arsenic. Taxidermists are liable to all the symptoms of poisoning unless they are very cautious. The article on silk manufacture, in Ure's Dictionary, is fully illustrated.

D. W. P. says that he and another person have a dispute as to whether the heat of the sun's rays is increased by passing through plain glass of uniform thickness. "I hold that it is not; he says that it is." Answer: The heat of the sun's rays is very much diminished in its passage through glass, but not nearly so much as the artificial heat from other sources.

W. S. B. asks: Am I right in supposing that a cubic foot of atmospheric air, at a pressure of say one pound to the square inch, would, at a pressure of two pounds to the square inch, occupy a space of two cubic feet and so on, and is it the same with all other gases? What is the best rule for determining the pressure of water at different heights? Answer: The volume of gases is governed by Mariotte's law, which is that, at the same temperature, the volume occupied by the same bulk of air is in inverse ratio to the pressure which it supports. If the pressure of the column of mercury in a tube is equivalent to one atmosphere, adding this pressure to that which the atmosphere exerts on the mercury we have the air subjected to double its usual pressure, and it is, consequently, reduced in volume one half. If we subject it to a pressure of three atmospheres, it will be reduced to one third, of four atmospheres, to one fourth, of its original bulk. The only variations in the law are near the point of liquefaction of gases. For the pressure of water, see hydrostatics in any book of physics.

H. C. S. asks if frost will follow down an empty pipe, covered at the top, so as to freeze at six or

twelve inches below the frost level. Or, will a hydrant freeze, if the pipe is empty and the cut off valve is from six to eighteen inches below where the ground is frozen? Answer: If both the pipe and the hydrant are empty, what is there to freeze?

J. L. asks: Is the air which is injected into the receiver or heater of the calorific engine warmed by the exhaust before it is injected or not? Also, is the rigidity of a frozen road bed the only cause of the rattle breaking? It is denied by some scientific authorities that iron is less tenacious when it is frosty, but experience seems to contradict such a theory. Answer: The air entering a hot air engine is not usually previously heated. Rails have slightly greater strength, probably, when cold, but they have less elasticity and consequently are less well fitted to resist concussion. We presume that the last fact may fully reconcile experimental deductions with our experience.

E. H. B. says: The water in Lake Michigan, at one point, is nearly two feet lower now than it was in June, 1871. Some persons have an idea that the wearing away of Niagara Falls and the changing of the current in Chicago River is the cause; but I am of the opinion that it is caused by the action of the elements or by evaporation. Will you please inform us what is the cause of the great depression of the waters of this great inland sea? Also where is the wash or caving in of the bluffs and great clay banks along this shore deposited? The wash is immense every year. Answer: The height of water in the great lakes is greatly influenced by the violence and direction of the winds prevailing during the season, as well as the greater or less amount of rain which has fallen within the drainage area from which the water flows. We do not suppose that the wearing away of Niagara Falls has had the effect noted, but it would probably require a geological survey to determine the real cause precisely. We presume that the soil washed from the banks is widely distributed over the lake bottom, and some of it is probably carried down the Niagara River.

C. A. M. says, in answer to A. J. query 3, page 10, that horn is clarified by first putting into boiling water, and, when thoroughly heated, it is placed upon a wooden pin of a convenient length, and scraped from the tip downwards, removing a shaving the whole length of the horn at each stroke of the shave. It now has a clean surface, and is sawn into one or more cylindrical pieces of convenient size, each of which is split lengthwise by passing it over a circular saw projecting through a table. These pieces are now placed again in boiling water, and, when hot, transferred to boiling whale oil, from which, while still hot, they are taken and rolled or flattened and placed between sheets of Russian iron in a powerful screw hot press. The press is made of several adjacent cast iron boxes containing square openings to receive the charcoal with which they are heated. The pieces remain in about five minutes according to the temperature of the press, and when removed are in the form of flat, amber colored, transparent plates. The color will be darker according to the length of time the pieces remain in the press.

R. B. M. says, in answer to E. S. S., query 3, page 59: Jacket your pipes with asbestos paste, one half inch thick, and then protect the paste by a cover of thin boards or tin; charcoal pulverized, or any other non-conducting material will answer for the jacket. I have jacketed my pipes with fine hay, and have had no freezing since.

A. G. C. query 24, page 59, can temper his taps in the following manner: After hardening, polish the bottom of one of the cutting grooves until it is bright (an old fine cut file will answer); then place the shank of the tap in the tongs, with point of the tap from you and the polished groove on the upper side, and the point a little elevated; if a taper tap, the large part of the tap should come nearest the fire. Then move it back and forth over a slow fire, that has the coal charred so that it will not smoke. Heat evenly and slowly until the bright groove assumes a deep red color.—Z. D.

C. M. says, in answer to W. L. L., who asked for an explanation of the configuration of frost crystals on windows: The crystalline forms which the vapors of a room assume, while being condensed on the cold panes of a window, depend mostly on the surface condition of the glass. A glass plate, absolutely clean and flat, would show no forms, the frost being equally distributed. The wiping or cleaning of the window inside the room is usually done in a roundish, spiral, or scroll like manner; hence the first adhesion of vapor, and the subsequent crystallization (if we can call it so) follows these lines and produces the well known fern-like or leaf-like forms. But wipe one pane before a frost carefully by horizontal streaks only, and the next to it by vertical streaks; and the frost crystals will be formed in the same directions, respectively, much more resembling those of some chemical salts than vegetable shapes. Snow crystals, forming in the air without any chemical or mechanical obstacles, are always hexagonal, with secondary formations of the same system.

H. M. W. says: C. A. de S. wants to be helped in his indexing. Having had to index 29,000 words, I think I have a right to speak about it. In the first place, I got hold of a somewhat stiffish paper (old ledger paper is excellent); then I cut it into slips of convenient size (1 inch by 2 inches will be about right). I put down on each slip one word or sentence (depending on the kind of index), with page and other reference if such is necessary. When every word or sentence which I wanted in the index was noted down, I got hold of 24 cigar boxes, which I lettered from a to z. I now distributed those slips into the boxes. To do this, I put the contents of each box in a separate paper bag, put the now empty boxes again before me, got hold of a, and distributed all slips bearing words beginning with a, and distributed those boxes, thus, aa, ab, ac, ad, etc., to the end of the chapter. This done, I got hold of aa, and successively ab, ac, etc., and distributed those slips further. When arranged alphabetically I pasted those slips belonging to a in proper order on brown wrapping paper. Having treated a in this way, I took hold of b, and so on to the end of the alphabet. It took me a fortnight (6 hours a day) to get through with the distribution, and after that the copying took me several months.

A. G. C., on page 59, asks how to temper taps. He must first of all bear in mind that a tap is simply a series of cutters on a bar; hence the cutting parts must be uniformly hard enough to cut, and the base soft as possible to insure durability. This can be best accomplished by dipping at as low a heat as possible and making the outside hard, while the inside will be comparatively soft when rubbed off ready for tempering. Heat a heavy ring (a broken pulley hub is as good as anything), which have on side of your fire for use while hardening taps, and also a heavy pair of tongs, made hot in the same way. Take the lever end of the tap with the hot tongs, and insert the tap in the center of the hot ring, but do not let it touch the sides. It is better to keep turning it round. If the temper draws too fast, where held by the tongs, cool it off; move backward and for-

ward until the right color is attained. This, too, depends on quality of steel and the size and make of the tap, and lastly the purpose for which it is intended.—P. McC.

W. A. W. says, in answer to J. E. S., query 22, page 10, who asked how to make a boiler for a small steam engine, to be heated by a common stove: Anything that you can make tight, with heating surface enough to make the requisite amount of steam, will answer the purpose. I saw a boiler and furnace in Grand Rapids, Mich., that was made something like a box stove with boiler set in the top, about one half the diameter of the boiler being in the firebox; there was no grate in firebox or door in boiler. It was cast iron and evidently all cast whole, except the bottom of the furnace and front end of boiler. The cylinder of engine was 3 by 5 inches. A safety valve one inch in diameter will be plenty large enough. Ten pounds pressure will be all you will need. Why not gear up higher and run your engine at 100 revolutions per minute instead of 150?

J. W. says, in answer to J. E. S., page 378, volume XXVII., and W. G. B., page 71, volume XXVIII., on transmission of motion: I would say that it is simply absurd to refute a thing we have not seen practically tested. W. G. B. seems to be a true disciple of doubting Thomas, and much like the man who, when he heard of the first iron ship being built, swore it would sink. I simply assert that I have seen belts as wide as four inches work admirably on the plan described by me. And further, it has come under my notice, since I wrote my communication, that seven inch belts were worked on this plan at the planing mill (recently destroyed by fire) on President street, Baltimore, and will be used again in the reconstructed building. I have only to add that, in constructing the shifter, it should only allow the edge of the belt to come fairly with the edge of the loose pulley, so that the pressure of the shifter with the pliability of the belt brings it in contact with the revolving fast pulley, when it takes hold quite easily.

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 Equatorial Protuberance of the Earth. By J. H.

On Aero Steam Engines. By D. B. T.

On Flux and Reflux. By R. W.

On the Action of Water on the Turbine. By J. B. R.

On a Unity of Action by Inventors, concerning Foreign Patents. By J. A. B.

On the Wheel Question. By H. E. M.

On Protection from Fire. By H. & B.

On Financial Science. By N. L.

On Tidal Water Power. By W. B. S.

On the Astronomy of the Ancients. By C. A. L.

On the Motions of the Sun. By A. D.

On the Mineral Wealth of Virginia. By W. De H.

On Marine Camels. By E. S. F.

On the Servant Question. By L. C. G.

On the Use of River Water for Extinguishing Fires in New York. By W. B. D.

On the Detection of Explosive Oils. By J.

[OFFICIAL.]

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FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

January 7, 1872,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

SCHEDULE OF PATENT FEES:

On each caveat.....	\$10
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Vol. XXVIII.—No. 7.
(NEW SERIES.)

NEW YORK, FEBRUARY 15, 1873.

[\$3 per Annum,
IN ADVANCE.

BORING MACHINE.

The invention herewith illustrated is adapted to the boring and turning of pulleys, gears, spiders, etc. A is the bed or frame, which is cast in a single piece, and arranged to fasten to a post, as at B. C is the face plate which is cast with the hollow shaft, D. The latter fits in the boxes, E, and serves throughout its whole length as a bearing for the bar, F. The cone pulley receives motion from a suitable belt, and transmits it to the gear wheels, G and H. In the hub of the latter is a feather which, acting on a slot in the bar, F, communicates power to the latter.

The work to be bored is fastened upon the chuck, I, as in an ordinary lathe. If the exterior of the object is to be turned, a set screw in the shaft, D, is screwed down upon the bar, F, and motion is thus imparted to the shaft, D, face plate and chuck. The operation completed, the screw is loosened, the face plate set by a dog or pawl, and the cutter is adjusted in the hole, J, at the extremity of the bar, F, where it is held by the set screw shown. The shaft, D, now remains motionless, but the cutter rotates with the bar, F. The feed gear is set in motion by a reversible lever at the end of the machine (not shown). K the feed screw is held in position by a slot planed along its entire length and a stationary feather or lug to keep it from turning.

It is claimed that this device occupies but little room and will do twice the work of a lathe for the same purpose. It will bore any sized wheel, from ten inches upwards to any required size.

Further information may be obtained of Messrs. T. R. Bailey & Vail, of Lockport, N. Y. This is the same firm recently alluded to as manufacturers of the excellent form of key seat cutting machine, a short time since illustrated and described in our columns.

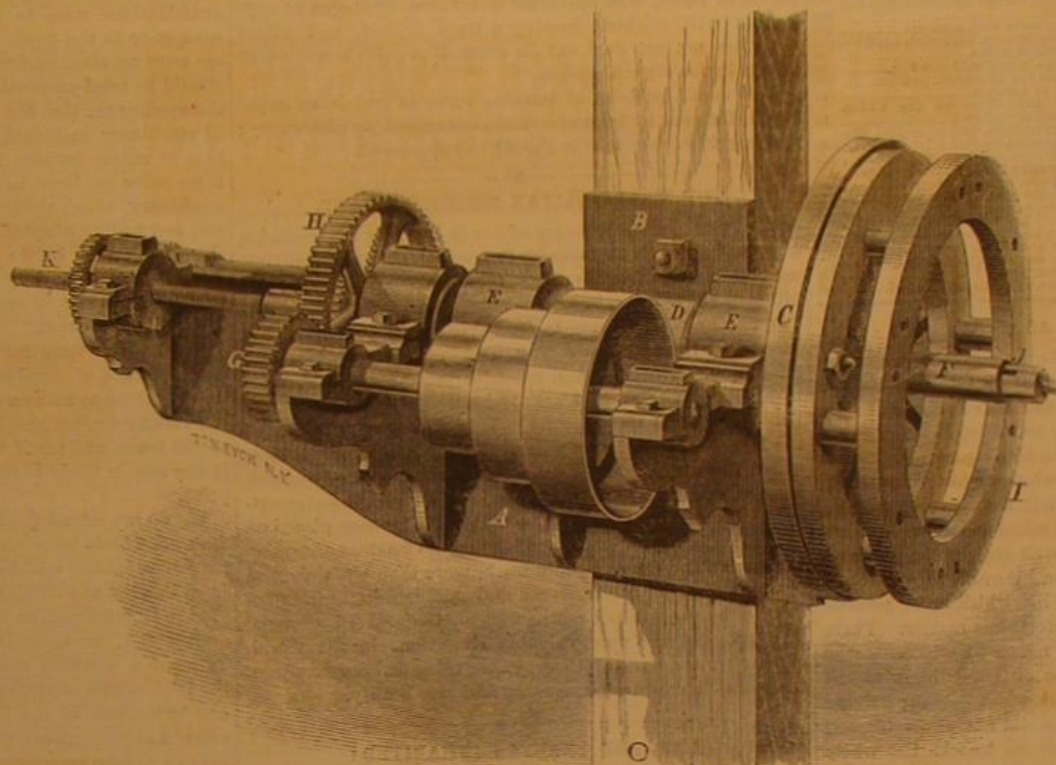
PADDLE SHAFTS FOR PACIFIC MAIL STEAMERS.

Our illustration conveys an excellent idea of the immense size of two paddle wheel shafts, probably the largest ever forged, recently made by Messrs. Lazell, Perkins & Co., of Bridgewater, Mass., for the Pacific Mail Steamship Company. These are intended as spare shafts for the steamers Japan and China, to supply the deficiency in case of break down.

The one belonging to the Japan weighs 78,530 lbs., that of the China 68,400 lbs. They were transported from Bridgewater to San Francisco by rail, and reached the steamer, in the latter port, which was to transport them to their

destination, the depot at Yokohama, Japan, in twenty days from the time of leaving the forge.

These immense masses of iron are each 38½ inches in largest diameter by 39 feet 8 inches and 37 feet 3 inches (respectively) long, and are made of the best Swedish scrap iron, worked with charcoal and open forge fires. The hammer used in forging them is 11 tons in weight and has a ten foot stroke. It is believed to be the largest machine of its kind in use



IMPROVED BORING MACHINE.

in the country. The time consumed in making and finishing the shafts was about six months, 350,000 lbs. of iron and 900,000 lbs. of coal being employed in their manufacture.

Experimental Researches on the Treatment of Asphyxia.

By whatever means air is introduced into the lungs of an asphyxiated person, whether by pulmonary insufflation or artificial respiration, experience proves that its introduction is completely useless when the circulation is arrested. This happens in the case of a drowned person in some four or five minutes.

M. Le Bon, of Paris, further states that if the physiological causes be inquired into regarding the impossibility of restoring drowned animals to life after this short delay, it will be found that the heart always contains voluminous black clots of blood. To renew the movement of the heart when it has ceased is not difficult, but to force out these enormous clots, which completely block the passages, is manifestly impossible.

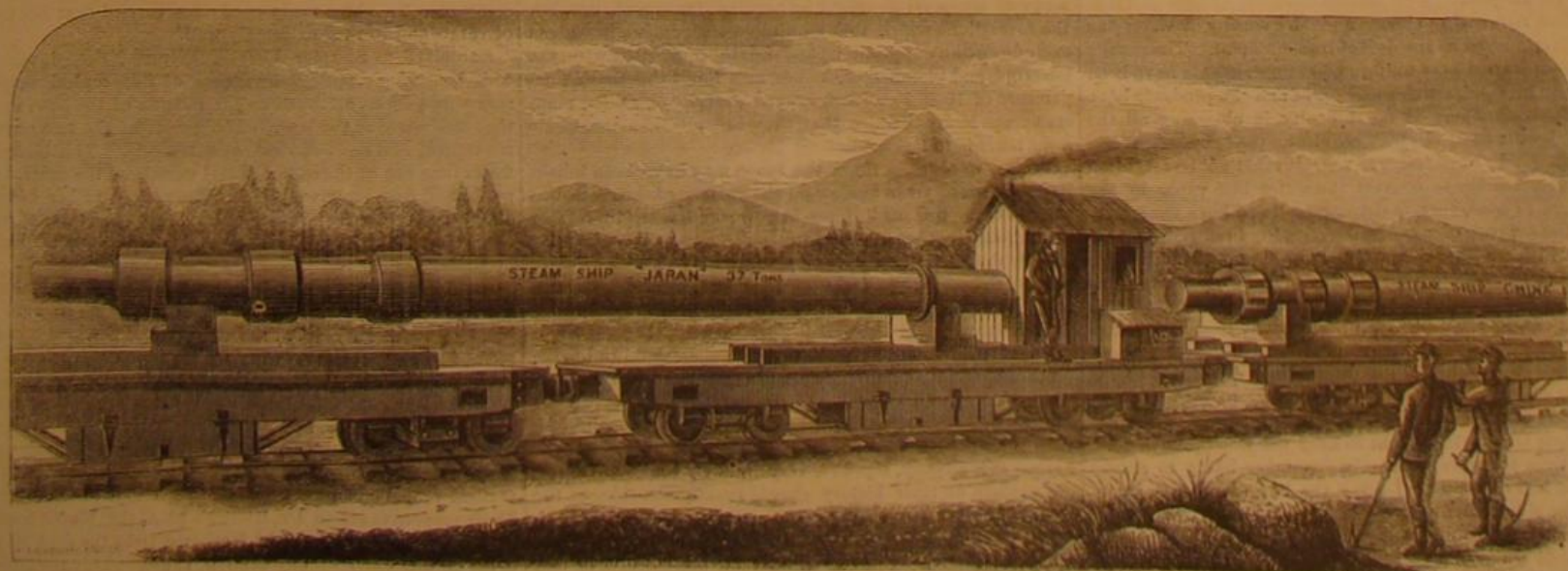
Max Muller on Darwin.

In a lecture recently delivered in connection with the Liverpool Literary and Philosophical Society, Professor Max Müller addressed himself to the phase of Mr. Darwin's theory, which deals with the possibility of the higher animals acquiring the faculty of articulate speech.

The lecturer gave various illustrations of the essential difference between the expression of emotions and the expression of ideas or abstract conceptions, and argued at length as to the impossibility of mere emotional signs and sounds developing into articulate speech; and he ridiculed the notion that the materials of language being given, all the rest was a mere question of time, a natural gradation from the neigh of the horse to the poetry of Goethe. Man and animals possess emotional language in common, because man is an animal; but animals do not possess rational language, because they are not man. This distinction between emotional and rational language, so far from being fanciful and artificial, is radical, as proved by various evidence, especially by the testimony of pathology in reference to certain brain diseases. Rational language is to be traced back to roots, and every root is the sign of a general conception or abstract idea of which the animal mind is incapable. Mr. Darwin has said there are savage languages which contain no abstract terms; but the names for common objects, such as father, mother, brother, etc., are abstract terms, and unless Mr. Darwin is prepared to produce a language containing no such names, his statement, said the lecturer, falls to the ground as the misconception of the real nature of a general idea as distinguished from an emotion. This phase of the controversy lies within the Professor's peculiar domain, and he was able to entertain his audience with technical illustrations that in ordinary hands must have proved tedious, but in the hands of the most accomplished linguist of the day proved a source of wonder and amusement to his hearers. He concluded as he had begun, by maintaining that language is the true barrier between man and beast.

Photo Obituaries.

The latest style in mourning is to have a black frame printed in the paper at the head of the obituary notice of your friend, in which a photo portrait of the deceased is pasted after the papers come from press. We have received a copy of the Marlboro' (Mass.) Journal containing such a photo obituary of an enterprising citizen of that place, and the general effect is quite pleasing.



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Scientific American.

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NEW YORK, SATURDAY, FEBRUARY 15, 1873.

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BURNING WATER AS FUEL.

It is astonishing how prevalent the notion is that water can be advantageously burned as fuel. All that can be said and written on the subject appears to have no effect, and easily deluded capitalists are always ready to invest in the newest contrivance that comes along for the above purpose. There has recently been a tedious suit in reference to the invention of Moses Thompson for burning wet tan, during which a ponderous volume of testimony was taken and a tangle of scientific evidence elicited that might well stagger the judge on the bench and the practical tanner in his yard, provided any of them have that faith in a long life which must precede the perusal of such an amount of worthless matter. There is the usual array of high sounding names of witnesses who testify as experts, and he must be an exceedingly expert angler after truth who can make out what they are driving at. It is clear that Judge Blatchford did not allow himself to be deluded by these experts, for he knocks the whole crowd off their feet and fires a round shot through the enemy's camp by the following conclusive sentence: "It is apparent from the evidence that Thompson was the first to discover and put in practice the true method of economically burning wet fuels, and obtaining from them better results than from equal quantities of dry fuels," which goes to show that the Judge believed the following claim put forth by Thompson: "The water in the fuel, in the presence of carbonaceous substances in the furnace, will be decomposed, giving its oxygen to the carbonaceous matter, dispensing with the draft and its cooling and wasteful influence, and rendering combustion so perfect that no smoke is visible." We hardly know whether the inventor proposes to shut the water and carbonaceous matter up in a strong box to "disperse with the draft," and, by the decomposition of the water and the re-combustion of the hydrogen, create a perpetual motion for affording heat such as the world never before saw, or not. The science of the proposition is too deep for us, and we cannot blame the Judge for being captivated by it. People will always believe in the perpetual motion whether in mechanics or in combustion, and it is better to join them to their idols and leave them alone. As our readers, however, do not belong to this class, it may be well to let in a little outside "draft" on the laws of combustion by way of ventilating the subject.

The heat required to elevate a given quantity of water one degree is employed as the unit of measurement. The results obtained are called heat units; and as experiments have been tried upon all combustibles and gases and the products have been tabulated, there is no difficulty in obtaining all the information that any one may require on the subject. When it is designed to burn water as fuel, it must not be forgotten that it is necessary to convert the water into vapor by the absorption of heat, then to decompose it and burn the hydrogen at the expense of oxygen over again, thus reproducing vapor, which when it escapes, after having passed through all of these stages, must carry away heat as irrecoverable as that blown off through the safety valve of a boiler. There is, therefore, no possible theoretical gain of heat in attempting to pass water through these circuitous processes.

Air-dried wood contains at best a large quantity of the elements of water, and most people prefer to burn the dry article. If the advocates for consuming wet wood were honest in their belief, they ought to keep the wood pile in soak all the time to prevent the disadvantages likely to accrue from the loss of water. During the last fifty years, something like sixty patents have been taken out in the United States relating to water gas in one form or another. The list affords a curious collection of attempts to accomplish

impossible results, and it would be a real service to the country if they could be posted up as warnings to ambitious inventors. Sometimes the hydrogen of the water was carburetted by being passed over tar or oil; that is the favorite method with this class of gas inventors. The water must first be converted into steam, then decomposed by the glowing coals, and the resulting hydrogen brought in contact with turpentine or other hydrocarbons, when it is carburetted and ready to burn for both light and heat. Other inventors decompose the water by passing it through iron grates on which are placed the live coals; on closer examination it was discovered that they obtained their hydrogen at the expense of the iron of the grates, and this was pronounced to be decidedly too expensive for practical use. Another apparatus introduced steam through an iron tube; but finding the tube disappear, they substituted a fire clay mouthpiece and were disgusted to find the operation no longer successful. As long as there was any red hot iron to decompose the water, they got enough hydrogen; but when that was removed, the decomposition ceased. In general, the sixty patents were founded upon the principle of burning up some valuable substance, including the furnaces themselves, in order to obtain an apparent gain. They robbed Peter to pay Paul, and had to pay the penalty for such unscientific conduct. In 1850, the world was astonished by the famous water gas patent of Paine, who converted water into hydrogen or oxygen at will, without leaving a trace behind, and whose fame has not yet died out in connection with more recent efforts in the same direction.

This whole business of burning water as fuel is an imposition, fostered by ignorance and encouraged by dishonesty; and it is high time that it should be suppressed.

THE METROPOLITAN MUSEUM OF ART.

The Metropolitan Museum of Art in this city has rented a large and splendid building on Fourteenth street, and will immediately proceed to prepare it for the reception and exhibition of the many rare objects now in possession of the society. The present lease is for eight years, the premises being only intended as a temporary place of deposit and exhibition. The large and splendid permanent Museum is to be erected in Central Park, and will be finished by the time the present lease expires. This temporary opening of the Museum in the lower part of the city is an excellent idea, as it will be conveniently accessible to all classes of our citizens, who will learn to understand and appreciate its importance. Among other curiosities that are to be soon placed on exhibition is the remarkable collection of Chaldean, Assyrian, Phœnician and Grecian antiquities, more than ten thousand in number, recently discovered and exhumed in the island of Cyprus by the United States Consul, General Di Cesnola. This is one of the most valuable collections in the world, embracing ancient sculptures, vases, coins and ornaments, of the most elaborate workmanship and rare beauty.

ARE THE PLANETS INHABITED?

The *Evening Mail* contains, under the above head, an argument tending to an affirmative answer to this question; but it is founded more on poetical imagination than on sober truth. The writer says: "Reasoning from analogy, it is hardly possible that such magnificent worlds as are within telescopic inspection, far surpassing our own in magnitude and celestial beauty, are solitary globes, destitute of living forms organized for enjoying as much as we," etc., and he ends with the statement that the spectroscope has demonstrated that the composition of these worlds as to their metallic resources is essentially like that of the earth; and he asks, finally, "why not in all other respects?"

The answer to this question is that in all other respects the conditions required for organic life are exceedingly complex. One of them is a temperature between 32° and 100° Fah., and this condition prevails only on two of the planets, the Earth and Mars; all the others are too hot, and their moons are too cold; at least, it is probable that the moons of Jupiter, Saturn, and Uranus are as thoroughly cooled off as our own moon; which is as totally unfit for the existence of organic life as the tops of our Himalayas. If the spectroscope had not demonstrated that the celestial bodies were compounded of the same elements as our earth, we might perhaps argue that, for other elements unknown to us, another range of temperature might be required for organic life, but the revelations which this admirable instrument has given exclude such a supposition; and as, in connection with the telescope and photometer, it has also taught us that a temperature of 1000° Fah. and upward prevails on all the planets except Mars, the idea that they are all inhabited at the same time, is fallacious.

We say at the same time; the moon may have been inhabited millions of years ago, when the surface of the earth was as red hot as that of Jupiter is now; and when by further cooling during thousands of centuries our earth will have become desolate, it may be the turn for Jupiter and other planets to become the scene of the most luxurious organic life.

A German saying is: "God works slowly, because He is eternal." No doubt the universe was not created in a hurry; planets have been revolving around central suns for millions of centuries, and according to unalterable laws have their periods of preparation, disturbance, evolution, organization, then their period of full organic development, and finally of decay; it is already, *a priori*, very unlikely that these different periods of their history should exactly coincide, as the planets differ individually and are placed in different conditions; the larger ones must cool slower than the smaller, and those further from the sun faster than those nearer to that

orb. Each has its own individuality, its own history, and will go through the different periods of its destiny in its own time, a time so long that our longest historical period is comparatively a mere instant; while it sweeps in its course through spaces so large that all the empires of our earth are comparatively a mere handfull.

THE NEW YORK STATE REWARD FOR IMPROVEMENTS IN CANAL NAVIGATION.

Our readers will remember that in 1871 the Legislature of the State of New York passed a law offering a reward of one hundred thousand dollars to the introducer of a plan, for navigating the Erie canal in this State, which should prove on actual trial, to be better and more economical than the existing method of towage by horses. The following were the chief requirements of the law:

A Board of Commissioners were appointed, consisting of George B. McClellan, Horatio Seymour, Erastus S. Prosser, David Dows, George Geddes, Van R. Richmond, Willis S. Nelson, George W. Chapman, William W. Wright, and John D. Fay, whose duty it was to practically test and examine all inventions that might be submitted to them, by which steam, caloric, electricity, or any motor other than animal power could be practically and profitably applied to the propulsion of boats upon the canals. Such tests and examinations were to be confined to the seasons of canal navigation in the years 1871 and 1872, and the Commissioners were required to demand that the competing inventions should be tried practically upon the canals at the expense of the applicants; that the boat should, in addition to its weight of machinery and fuel, be able to transport at least 200 tons of cargo, be able to run at a speed of not less than three miles per hour, be easily stopped and backed by its own machinery, which should be simple, economical, and durable, and readily adapted to the present canal boats. Lastly, the law requires before an award is made that "the Commissioners shall be fully satisfied that the invention or device will lessen the cost of canal transportation, and increase the capacity of the canal."

The limit of time for competition for the reward expired with the close of canal navigation last fall, and it may not be uninteresting to make a cursory review of the operations of the various competitors, give an outline of the construction of the boats, and see if we can determine who among them, if any one, is likely to carry off the hundred thousand dollar prize.

We do not intend to give the particular numerical order in which the boats were put upon the canals, but for convenience of reference will designate each exhibit at random. If from this list any exhibitors have been omitted, we shall be glad to be informed, so that correction may be made.

Exhibit 1. Steamer Dawson. Inventor, Thomas Main. This was a common canal boat altered for the purposes of the trial, which alteration consisted in making a concave recess in the bow of the boat, in which a common propelling screw was set. About 20 horses power were employed, 200 tons of freight were carried, and a speed in excess of three miles an hour, on an average, was obtained, except when detained by lockage. The average running time through the canal was 2:02 miles per hour.

Exhibit 2. Steamer Baxter. An ordinary canal boat fitted with two stern propellers of the ordinary construction, driven by one of William Baxter's patent compound engines. The only peculiarity claimed for this boat was that she was simple, and could be run on less coal than any other boat; and such indeed proved to be the fact. She made two or three successful trips through the canal, and proved to be a useful and economical boat.

Exhibit 3. Steamer Montana. An ordinary canal boat fitted with a single 9 foot feathering wheel encased in a box in her stern. A. H. Brown, inventor. Forty horse tubular boiler, 2 engines 9 x 18, direct action. Burns less than one ton coal in 24 hours. Speed 3½ miles an hour loaded, and 5½ miles light. Ran very well.

Exhibit 4. Steamer Hemje. Charles Hemje, inventor. This was a well modeled boat, provided with an ordinary stern screw propeller, and the chief peculiarity consisted of a cylinder in which the screw was enclosed. This cylinder was movable and served as a rudder, and was used to steer the vessel. By turning the cylinder, the column of water ejected from it by the screw was deflected, which assisted steering. This boat made good time, carried over 200 tons of cargo, and worked extremely well.

Exhibit 5. Steamer Eureka. Hiram Niles, inventor. This boat was propelled by means of two conical shaped screw propellers, arranged on the outside of the bow, upon the same angle as the bow. The points of the two screws converged, like the two lines of a triangle. This boat ran faster than any of the experimental vessels on the canal, and performed extremely well. But she proved rather heavy, and, in order to carry 200 tons of cargo, required 7 feet of water, which the canal did not, on an average, afford. Built by Niles, Buffalo.

Exhibit 6. Steamer Port Byron. Inventor, F. M. Mahan. Through the hull of this boat, from bow to stern, runs a trunk or water way, and in the after part of the boat a common paddle wheel is set within a chamber, which forms a part of the trunk. The motion of the wheel draws in water at the bow, and discharges it at the stern. This boat made successful trips, and operated very well.

Exhibit 7. Steamer Forest City. Built at Russel and Eads yard, Buffalo. An ordinary canal boat fitted with two vertical propellers, placed one on each side of the stern. These propellers are on Dr. Hunter's plan, the blades feathering, and so made as to be feathered from the deck so as to act on the water at any desired angle. This facilitates

steering, as the propellers may be made to act sidewise, or in line with the vessel's keel. This boat performed well, made good time, and carried 200 tons.

Exhibit 8. Steamer Excelsior. This boat, built of iron, was fitted with Mallory's patent propeller, which is constructed somewhat on the principle just described. By its use the vessel is steered as well as propelled. The blades of the propeller are made to feather from within the boat, and they act upon the water at any angle desired. Very good results were obtained, although we believe the owners did not compete in carrying cargo.

Exhibit 9. Steamer Geo. M. Pheter. This was an old canal boat altered for these experimental purposes. A little abaft the middle of the boat, an opening on each side is made and water ways or trunks inserted, which converge into one discharging trunk at the stern. In each trunk a 4½ feet screw is placed. Engine, 40 horse power. This boat made one trip and operated very well. Built by Russel & Eads.

Exhibit 10. Steam Pump boat. Propelled by a piston at the stern, operating in a cylinder. Results not satisfactory.

Exhibit 11. Steam Pole boat. Propelled by poles which were made to operate on the bottom of the canal and push the boat along. Results not satisfactory.

Exhibit 12. Steamer Vermont. Endless belt of paddles on each side of the vessel, passing over rollers at stem and stern of boat. Results not satisfactory.

Exhibit 13. Stern wheel steamer. A recess in the stern in which an ordinary paddle wheel was placed. Resembled the ordinary stern wheel steamers. Result not very satisfactory.

Exhibit 14. Tow path locomotive. This was a trial of Williamson's road steamer Enterprise, placed on tow path of the canal. It was a twenty-four horse steam engine, mounted on three wheels, with a hinged smoke stack. Four boats, three loaded and one light, were attached by rope to the steamer, which made four and a quarter miles per hour with them, and ran from Albany to Port Schuyler. The experiment was considered to be a success, demonstrating that towage could be expeditiously and economically accomplished by this method. But it is alleged that the tow path of the Erie canal is unsuited for road steamers in many parts, and would need, in order to permit their successful use, an improvement and strengthening of the path, involving great expense. This trial was not within the limits of the competition, which applied only to devices for propulsion not moving upon the bank.

Exhibit 15. Steam rope towage. This method consists in having a wire rope laid on the bottom of the canal along its whole length. A steam tow boat is employed, on which there are a series of gripping rollers; the rope is brought on deck and passed between the rollers, which are driven by steam and pull the boat along, with other boats in tow. This is known as the Belgian system, and works very well on the few miles for which it has been adopted on the Erie canal. Full accounts have been heretofore given, in our paper, of its operation. This method was excluded from the present competition.

Exhibit 16. Steamer Success. Captain W. F. Goodwin, inventor. The distinctive feature of this exhibit consisted in having a train of boats, specially made to join and work together. No other exhibit on the canal presented this feature. The propelling power was contained in the front boat, the bow of which was provided with a hollow paddle wheel, extending entirely across the bow, and well enclosed. The exterior of the wheel was provided with a band of cogged teeth, with which meshed the teeth of a driving pinion, and motion was thus communicated to the wheel. Twenty horse power engines. This exhibit brought through the canal and down to New York a cargo of 13,200 bushels of corn, or 400 tons, in 10½ days running time. In respect to cheapness of running per ton of cargo carried, this exhibit of train boats was a decided success, and the inventor is confident that the principles of construction are in the main correct, and that, with such modifications as the experience gained on the canal has suggested, he will be able to solve the problem of canal steam navigation in the most satisfactory manner.

It may be said, in respect to nearly all of these exhibits, that they have demonstrated that canal boats may be successfully operated by steam power. But have any of them fully and satisfactorily fulfilled the intent and conditions of the law? We think not. Before any of the exhibitors can expect an award, the Commissioners "shall be fully satisfied that the invention or device will lessen the cost of canal transportation and increase the capacity of the canals." It is evident that none of the exhibitors are entitled to an award, for they have all come short of these requirements. The next inquiry is whether any of the exhibits are likely, on further trials and the addition of new improvements, to accomplish the design of the law? It seems to us that an affirmative answer may be conclusively deduced from the results of the experiments, and we will proceed briefly to point out the reasons.

It was demonstrated, by a majority of the boats tried, that they could steam through the canal, except for detentions, at about one third the cost of horse towage. But a single steamboat, if delayed, rapidly runs up expenses, as the cost of maintenance is almost the same, whether moving or standing still.

It was further demonstrated that one steamer could carry nearly 200 tons of cargo, and tow three additional boats carrying 240 tons each, making in all 920 tons of cargo, with but little additional expense over the cost of running a single steamer, and it became evident that the solution of the canal problem depends upon the successful running of boats in trains. But it was also demonstrated that, in the present

defective condition of the canals, the crowd of horse boats, the rocks, wrecks, sedimentary deposits, shallow places and other obstructions, the towage of boats by lines in the ordinary way was productive of great confusion and serious delays. If the towing boat slackens in speed, the boats in tow jam together; they collide with horse boats, and are in other respects comparatively unmanageable.

It is, then, to the introduction of better means of working and controlling boats in trains that we are to look, in order to lessen the cost of transportation or increase the capacity of our canals.

In respect to this matter, the suggestion which has been made, of placing side screws at the bows of the front boat so as to work the boat laterally when steerage way is lost, we consider to be of much importance. Resort is at present had to poling by hand, a slow and laborious operation. If some quick and ready method of applying steam power could be introduced as a substitute for poling, almost half the difficulty of canal navigation would be overcome.

Another appliance needed for train navigation is the placing of steam power in the rear boat. The principal towage power should be in the front boat; but there should be a reserve power at the stern, to assist in guiding the train and swaying the train promptly as circumstances require. Other minor improvements will suggest themselves to experimenters. But those we have specially mentioned, it seems to us, are absolutely required.

Another deduction, made evident from the results of these experiments, is that the limit of time fixed by the Legislature for the competition was altogether too short. The construction of experimental machinery of any kind is always more or less slow, and alterations have to be frequently made to adapt new inventions to practice. Many of the competitors in the present case were compelled to go through the canal with defective machinery, for lack of time to change or strengthen it.

Then again, by some remarkable fatuity, the canal officials, when applied to by competitors for information as to the depth of the canal, invariably replied that it was 7 feet in mean depth; width at surface, 70 feet, bottom, 56 feet. Many of the competitors built their boats to run in this water, but found, on entering the canal, that 6 feet of water was all they had to depend on, and this only in the center of the canal, the sides shoaling very rapidly, whereby the boats were frequently grounded and greatly injured.

The exhibitors have joined in a memorial to the Legislature, asking for an extension of the time for trials and the apportionment, for the purposes of new trials, of those parts of the canal that more nearly furnish the volumes and depths of water that were originally and impliedly assured to them by the law under which they engaged in the competition.

The subject is one of great importance to the State; and if the Legislature will now grant the petition of the memorialists, and encourage their enterprising efforts, we have no doubt that, ere another two years have elapsed, valuable methods for practically reducing the cost of transportation and increasing the capacity of the canals will have been produced.

ARMY AND NAVY PATENTS.

The question has lately arisen whether officers in the army and navy are entitled to the same privileges, as relating to patent rights on military inventions, as are accorded to private individuals, and whether the Government should compensate such inventors, by royalty or otherwise, for such use as it may make of their devices. The subject is one which has long been agitated in both arms of the service, in which it is the general opinion that the absorption, by the country, of private privileges, whether patents or inventions or shares of copyright of professional books, works an injustice, besides tending to check a spirit of investigation and a desire to perfect crude ideas which might, if fostered, prove of material benefit to the nation. The provisions of the bill recently introduced in the Senate to allow to the widow of Rear Admiral Dahlgren a suitable compensation for the use, in the navy, of her husband's patented guns and projectiles, bring the matter prominently before the public, and afford an opportunity for a decision which will furnish a precedent for the future.

To our mind, there is but one view to be taken of the subject. The officers of the army and navy enter the service at an extremely early age, and for the residue of their lives are the wards of the nation. Educated and supported at the expense of the people, their first duty is manifestly to their country. It is clearly a moral and, by the implied contract which they assume, a legal obligation upon them to devote their best efforts in return for the benefits they receive. Clearly, therefore, if they so employ the advantages freely afforded them in such a manner as to render the same productive of valuable results, such fruit of their efforts belongs not to themselves but to the country which, for this very specific end, has intrusted to their keeping the knowledge, of which their ideas are but the outgrowth.

To descend from general principles to a definite case, if the Government pays one of its servants to perform certain work, if such services comprise the experimenting upon, examination and improvement of munitions of war, for example, it is evident that, if no especial result be attained proportionate to the value expended in conducting such investigations, the loss will fall, not upon the individual but upon the nation. Why then, on the other hand, if he be successful in fulfilling the very labor which he is paid for performing, should the servant, who runs no risk, receive an extra compensation, while the Government, which incurs the entire responsibility, is obliged to expend even a greater sum than if his toil had been fruitless?

We do not deny the right of a military employee to obtain a patent on an original device, if such be his inclination. But we believe that the authority of the nation over matters which are clearly within the line of his duty, as is the case with the designing of improvements or inventions of a professional nature, is paramount; and, while the patent should hold good as against all the rest of the world, the Government should be entitled to its free use and enjoyment.

In the special instance of the claim of Mrs. Dahlgren, we agree with Senator Morrill in his opinion that its grant will establish a dangerous and impolitic precedent. As regards the intrinsic merits of the case, however, we consider that it would be but a graceful and just recognition of the worth and appreciation of the services of an able, faithful, and brave officer if Congress would appropriate an adequate sum for the maintenance of his family; not in satisfaction of any claim, but as the free and unrestricted gift of the people in whose service his life was passed.

THE EMPLOYMENT OF WOMEN.

The presence of Miss Emily Faithfull in this country at the present time has revived the discussion of the woman question, and been the occasion of public assemblages to consider a report upon the best form in which to disseminate correct information and influence popular opinion on the subject. A meeting was held a few evenings since at Steinway Hall which must have given great encouragement to the advocates of the new movement. It was not one of the unfeminine exhibitions with which we are too familiar in New York, the tendency of which has been to repel delicate and sensitive women from taking any part, but it was a dignified, refined assemblage of the very best representatives of the sex to be found in New York. The woman artist, the author, the teacher, the artisan, the editor, and every trade into which woman has been able to find her way, were represented by their chosen delegates. There was no loud talking, no expression of woman's rights, no complaints, no recrimination, but a straightforward presentation of facts and statistics that must have carried conviction to any but the most selfish and mercenary hearer. Mrs. Henry M. Field, formerly Director of the School of Design for Women, presided and introduced Miss Faithfull to the audience. Miss Faithfull's address was reported in full in the morning papers and need not be repeated here, but the ideas suggested in it, and the remedies for the evils complained of which were there advocated, are deserving of careful study and consideration on the part of mechanics, tradesmen, and thoughtful citizens everywhere. If we study the progress of invention we shall find that, in many directions, some new contrivance has invaded the special avocations of women and taken from them the ability to earn a subsistence by work which at one time was their monopoly. Not many years ago the baking, brewing, spinning and weaving were conducted by women at home in the domestic circle. It enabled the females to contribute to the support of the family, and oftentimes the sister sustained the brother at college without being compelled to leave the sacred precincts of the home circle. Some of the best men in our country owe their opportunities for education to the self-devotion of women at home. How does the case stand at the present time? The baking is conducted by men, even in small towns. Machinery for sifting, stirring, and kneading the flour has been invented, which must be superintended by men, and it is only in limited circles that bread baking can be conducted at home. It is true that men complain that women know too little about baking, but that has nothing to do with our argument, and we must let the women defend themselves from the aspersion. The fact is that baking on a large scale has been taken away from the women.

The same historical record must be made in reference to brewing. Home brewed ale was the favorite beverage in Old England and in New England, many years ago. The farmer's daughter could formerly contribute largely to the support of the family by her skill in compounding a domestic brew. Perhaps they seasoned the beverage too well, for the taste for it increased more largely than the supply, and it soon became necessary to establish immense breweries, to be again supervised by men, and this part of woman's avocation was gone. So we could go on drawing illustrations from the great mills for spinning and weaving, only that in these latter mills women are permitted to earn a support, and there has been some compensation to them for the wholesale theft of what was formerly the chief home avocation of our grandmothers. Enough has been said to show the encroachments upon woman's peculiar province by the invention of machinery and the introduction of modern improvements. These inventions and improvements have certainly tended to advance the prosperity of mankind, and it ought not to be made a reproach upon our civilization that they have been made at the expense of the women. It was claimed at the meeting that the sex was entitled to some recompense for the wholesale robbery.

There are plenty of avocations which men have monopolized which they ought to be willing to exchange for the stolen property they now hold in their hands. For example, there are 14,000 appointments under government, not including post offices, of which women get 600; there are 250,000 clerkships of all sorts, in shops, telegraph, insurance and other offices, for which women are peculiarly fitted, and yet they get no more than a beggarly 7,000. Now would it be asking too much of some of the lubberly, hulking fellows, whose sinews and muscles are evidently intended for deeds of prowess and strength, to give up jumping counters, doing up parcels in red tape, directing wrappers, and keeping petty accounts, and to turn their attention to some of the avocations for which women are unfitted and where their strength can have full play? There are many employments to which

women are not physically adapted, such as hunting, trapping, mining, manning ships, running heavy machinery, farm labor, engineering, and the outdoor exposure of expressmen, conductors, hackmen, drivers, and a long list quite enough to afford men an opportunity to earn the lion's share of wages and keep matters generally under their control. The statistics of New England show that, while men have devised methods for adding to their wealth, the ability of women to earn a livelihood has diminished. In Massachusetts alone there are 50,000 more women than men. The men have rushed to large cities to look after clerkships or to do the counter jumping, while shipbuilding languishes and the famous New England sailors are fast becoming a myth. In the meantime the daughters of the land remain at home, and, having been deprived of the industries alluded to above, as their numbers increase and the ways and means of earning a support decreases, it is natural that they should feel some anxiety for the future, and demand a larger share in the distribution of work. There are more than 2,000,000 women in England who are compelled to support themselves, and with them the struggle is one of life or worse than death. Miss Faithfull established the *Victoria Magazine* in order to advocate the cause of women and give employment to her own sex in the composing room. Her example has been followed in this country, and in many printing offices women are now constantly engaged. This is one step gained, but it ought to be followed by many others.

It has been said that females are more conscientious and naturally honest than men. If that be true, in times like the present, when charges of bribery, defalcation and dishonesty are freely made on all sides, it would be well worth the experiment to see if the gentler sex are better able to resist the temptations that always surround positions of responsibility or trust.

One thing is very certain, the right of woman to her share of honest labor cannot be put down by ridicule or despotism. It must be met fairly and squarely, and now that it has been taken up by our most refined and gifted women, we trust that the question will be soon settled to the entire satisfaction of all parties.

ARSENIC COLORS.

Since the publication of our article on arsenic pigments, we have received numerous letters enclosing specimens of calico, wall paper, etc., asking our opinion in reference to their poisonous character. We have had some of these examined by competent chemists, and in all instances sufficient traces of arsenic have been found to prove the dangerous character of the articles presented. From Lee, Mass., we have a sample of calico in which the green band is colored with arsenic, and no washing would render it safe to wear such goods. The misfortune is that even some of the aniline colors are so impregnated with arsenic that they are as dangerous as the older Scheele's green, of which we recently complained. Toy books with green covers are always to be suspected, and in fact the only absolutely safe thing to do is to avoid green colors altogether. The detection of arsenic is so simple that any one can perform the experiment in a few moments. We cut off a piece of suspected calico and immersed it in some strong ammonia, which we had poured into a tumbler; a blue color at once indicated the presence of copper. A drop of the blue liquid put upon a crystal of nitrate of silver turned immediately canary yellow, which reaction denoted arsenic. This is an experiment that anybody can try. To confirm our suspicions we poured some of the liquid into a Marsh apparatus, and easily obtained the well known deposit of metallic arsenic on glass or porcelain. With wall paper a neat and easy way is to put a drop of nitric acid on the green spot, then a drop of ammonia, when the color will turn blue, and on addition of a drop of nitrate of silver, if arsenic be present, a yellow stain will spread in a ring to the outer extremity.

FREE MAIL PRIVILEGES ENDED.

Hitherto the right to frank letters of any size has been granted to the President, Ex-Presidents, the Vice President and former Vice Presidents, to members of Congress, the Secretary of the Senate and the Clerk of the House, the privilege extending to free letters not exceeding two ounces and public documents weighing not over three pounds. The governor of any State could forward official documents to the governors of other States. Cabinet officers, their assistants, commissioners and heads of bureaus, the general and adjutant general of the army, the superintendent of the coast survey and his assistant, and chief clerks of departments were allowed free transmission of official but not of private correspondence. Deputy postmasters could send free all documents relating to the business of their respective offices, and those whose compensation did not exceed \$300 per annum in 1846 were entitled to the privilege of forwarding and receiving free all communications not exceeding one half ounce in weight.

This is what is termed the "franking privilege." Devised at a time when the postage on letters varied from five to twenty-five cents, it was a necessary relief to the government officers, whose salaries would have been materially diminished had they been obliged to pay such high rates for their voluminous correspondence from their private incomes. Since the introduction of cheap postage, the privilege has degenerated to a superfluity and latterly to a positive abuse, and although repeated attempts have been made, in previous sessions of Congress, to pass an act for its abolition, the strong opposition which the measure always encountered rendered such efforts fruitless. The evil has gone on increasing; hundreds of tons of letters and documents, together with bundles

of dirty clothing for the wash, boots and shoes and all kinds of stuff belonging to members of Congress and their friends have burdened the mails, being sent in evasion and often in defiance of the laws governing their transmission, and causing, according to the estimate of the Postmaster General, a loss to the country of over three million dollars a year. Even this large sum, at periods, has been greatly exceeded. It is stated that, for the presidential canvass of 1872, if all the franked letters and campaign documents sent out from Washington and other points had paid the usual charges, fully four million dollars would have been saved.

It is a matter of no small moment, therefore, to the nation that the act abolishing the franking privilege has at length passed both Houses of Congress and only awaits the President's signature to become a law. The bill reads as follows:

Be it enacted, etc., That the franking privilege be, and the same is hereby, abolished, from and after the 1st day of July, A. D. 1873, and that thenceforth all official correspondence of whatever nature, and other mailable matter sent from or addressed to any officer of the Government or person now authorized to frank such matter, shall be chargeable with the same rates of postage as may be lawfully imposed upon like matter sent by or addressed to other persons: *Provided,* That no compensation or allowance shall now or hereafter be made to senators, or members and delegates of the House of Representatives on account of postage.

The direct result of the abolition of the frank will be to increase the receipts of the Post Office Department, and thus to warrant the reduction of the rates of letter postage to two cents, a change which the people will everywhere welcome.

THE BOSTON FIRE COMMISSIONERS' REPORT.

The Commissioners appointed by the city authorities of Boston to make investigations into the cause, effects, etc., of the great fire have recently published quite a voluminous report. Seven hundred and seventy-six buildings, covering a space of sixty-five acres and assessed at the value of \$13,500,000, were destroyed, together with more than sixty millions of dollars worth of merchandise and other personal property. How the fire first broke out is not definitely stated, but its rapid spread in the building first consumed is considered to be chiefly owing to the faulty construction of the elevator which, like most elevators in Boston, was sheathed with wood and destitute of self-closing hatchways. The committee state that, if the last mentioned appliances had been in the edifice, the flames would not have reached the roof before the engines arrived, and the calamity might have been averted.

There seems to have been considerable delay for want of horses and a lack of water. The fire, it is also stated, was greatly aggravated by the escape of gas from the burning buildings, the water valves, which were believed to be sufficiently powerful to cut off the supply, proving of little value. Sliding valves should always be so arranged that the risk arising from the impossibility of isolating a burning district should never be incurred. The report strongly condemns the action of the authorities in allowing the use of gunpowder for blowing up buildings by citizens or others, not regular officials of the Fire Department. Recommendation is made that a system be arranged, for the future, for using a far more powerful and less dangerous explosive, and for training a number of men to use it skillfully. Dynamite is considered as the best material for the purpose, as its force is so directed as to bring the building down rather than scatter it in fragments. It may be dropped or jarred in any way without danger, and cartridges containing it may be safely cut or broken. A quantity of this substance should be kept constantly in proper places.

The Lowry hydrant is recommended for use throughout the city as giving a better distribution of water. Fire escapes should be attached to all warehouses, and every high building should have a permanent stand pipe of iron capable of having a hose attached to it. Finally, the general use of the most approved forms of fire extinguishers and hand pumps in every house is strongly urged. These would prevent many conflagrations from becoming serious, and they would inspire confidence in cases of alarm of fire.

THE SYSTEM OF SNOW PROTECTION ON THE UNION PACIFIC RAILROAD.

The *Chicago Railway Times* gives a graphic pen sketch of the great obstacle presented by snow drifts to the passage of trains on the Pacific Railroad. During the great storm which occurred in the early part of last winter, it is said that drifts thirty feet deep packed full the heaviest cuts as fast as the largest force that could work dug or plowed it out. The snow at other points covered the low bed for miles in a solid mass which had to be cut transversely with trenches, eight feet apart, so that the snow plows could remove it block by block. It packed with such density that locomotives left the rails and ran upon the bed covering the track. Fences, however high, were found of little protection, and cases are cited in which bushes beside the road intercepted the snow, causing it to pile into drifts often completely covering the cars on side tracks.

From the experience gained during last winter, a new system was put in force during the present season which has thus far proved successful. Observations, along the extended portions on which the bed lay from a few inches to three feet above the natural surface, showed the latter light to be the minimum requisite to give sufficient freedom and space for the wind to keep the bed clear of snow. The track was therefore raised and the cuts also widened at the bottom sufficiently to give freedom and space to the snow on either

hand. The sides were sloped 7 in 125, that being the slope which the drifts were noticed to assume naturally. For cuts of moderate depth, this plan has been found to answer without the use of sheds; in the case of deep cuts, however, the widening and sloping of which would be very expensive, snow sheds have been retained or supplied.

In carrying out the plan the locomotive was utilized to draw both plows and scrapers. A massive beam extending across the bed from ditch to ditch was fitted with two heavy plows on each end; and this gang plow, attached to a locomotive, was drawn at a maximum rate of two miles per hour; the locomotive scraper followed, excavating the furrows thus made on both sides and throwing the dirt up against the bed. Each set of these equipments was equal to a force of 200 men; and by this means an aggregate of about 100 miles of the bed of the snow region across and beyond Laramie Plains was raised from three to seven feet. Cuts were also widened—largely by the use of the steam shovel, operated by the locomotive—where their great depth did not preclude widening. To protect the deep cuts, where fencing was deemed inadequate, miles of new and substantial sheds have been built on a plan fully obviating the defects of the old fences; and the latter have been thoroughly repaired, lengthened, or rebuilt of better material. On this work exclusively, a force of 300 men was employed during the entire season. At the shops of the road, the already large equipment of snow plows has been increased and greatly improved. Seventeen plows have been remodeled, and four mammoth ones constructed, weighing from 35 to 50 tons, and costing an average of \$3,000 each.

Improvement in Spring Mattresses.

Among the recent patents is that of W. B. Judson, for improvements whereby the frames, slats, and straps, heretofore required on beds of this description, are done away with, and a light, elastic, durable and comfortable bed is produced, at a comparatively low cost. The inventor uses the ordinary standard upholstery steel springs, so well known in the trade. These are united by ingenious little couplings in such a manner as to produce a maximum of strength and elasticity with a minimum of weight. A double bed, 4 feet 6 inches by 6 feet in size, weighs only 25 lbs., although it contains one hundred and ninety-two steel springs. Of course the real value of such beds depends upon the quantity of springs that they contain, and in this respect the Champion Mattress is ahead, as the purchaser gets from two to six times more springs for the same money than most other beds supply. This new bed is known as the Champion Spring Mattress, and the advertisement of the manufacturers will be found on another page.

Six Inches of Snow in London.

A fearful storm, accompanied by a heavy fall of snow, occurred in England on the 1st inst. Much damage was done to the shipping on the coasts, while in the interior the roads and railways were extensively blocked up by snow drifts. In London six inches of snow fell, which was an astonishing thing for the cockneys to behold. An inch of snow is as much as they generally see there in a generation. The omnibuses, cabs, and street cars were all obliged to suspend travel, and the only available means of local communication was the Underground Railway, the cars whereof were of course densely crowded.

Last year the London Underground Railways carried between fifty and sixty millions of passengers. It is to be hoped that the New York Legislature, now in session, will authorize the construction of a similar work in this city. It is urgently needed.

Luther Tucker.

Mr. Luther Tucker, the editor and proprietor of the *Outlook and Country Gentleman* recently died in Albany, N. Y. Mr. Tucker was born in 1802, and at an early age was apprenticed to a printer, serving his time and learning that trade. In 1825 he embarked in the publishing business, and in the following year established the *Rochester Daily Advertiser*, the first daily newspaper ever issued west of Albany. Having a strong taste for agriculture, in 1831 he projected the *Genesee Farmer*, which was subsequently merged in the *Albany Cultivator*. At the time of his decease Mr. Tucker was treasurer of the New York State Agricultural Society. He was an able and thorough writer, and an acknowledged authority on all matters pertaining to the farm.

SEVERE COLD AT THE WEST.—During a recent cold snap at Sparta, Wis., the mercurial thermometer became useless by freezing, while the spirit thermometer indicated 45° below zero. Mercury freezes at -39°, but alcohol has never been frozen. The alcoholic thermometer is not, however, to be depended upon for accuracy. In Minnesota, by a sudden change in the weather the thermometer rapidly fell below zero in the course of an afternoon, and a blinding snow storm came on. So sudden, so violent, and so cold was it, that many persons, having but short distances to travel in order to reach their homes, were frozen to death in making the attempt.

ACTION OF GAS IN RUBBER TUBING.—In determining the illuminating power of street gas, it should not be conducted through an India rubber tube, since this diminishes its illuminating power. A series of experiments, made by Zukowsky, show that the weight of the tube increases. This phenomenon is probably due to the absorption of the heavy hydrocarbons by the tubing.

THE horse disease has reached Omaha, Nebraska.

THE CHEMICAL DISCOVERIES BY THE SPECTROSCOPE.

Professor G. F. Barker, of Yale College, recently opened the fifth annual course of lectures before the American Institute in this city, by an able discourse on the above interesting subject. He explained the spectroscope and its uses, illustrating his remarks by pictures of the instrument thrown upon the screen, and described how different substances may be recognized by the autographs written in bands of color on the spectrum. Various experiments were performed showing the spectra of different metals by the aid of the electric light, and a lucid description was given of the method by which new elements have been discovered. The more important portion of the lecture related to the application of the spectroscope to the determination of subjects of general interest. After giving a brief explanation of the

BESSEMER STEEL PROCESS,

the lecturer stated that a flame issues from the mouth of the converter which is exceedingly characteristic, and, by applying the spectroscope to which, we may learn something by which a method may be obtained to stop the decarbonizing blast of air at the proper instant. Dr. Roscoe appreciated this, and accordingly made investigations at the Bessemer steel works of Brown and Brothers at Sheffield. It was found that when the blow begins, the flame is scarcely luminous, a mere glare of red, giving a very faint spectrum, if any. In about four minutes from the time the blast is let on, a flashing through the spectrum of the sodium line may be noticed. In about a minute and a half after this change, we discover lithium and then potassium. As the process continues, the flame becomes intensely luminous, owing to the silicon becoming incandescent. Then it gradually changes, and becomes slightly purplish, and, in a few seconds, passes to nearly the same color as at first. The first spectrum is an exceedingly simple one, but the last is complex, containing as many as 33 lines. The lines disappear in the inverse order of their appearance, and when the last green band becomes invisible, the blast should be shut off and the metal cooled.

ABSORPTION SPECTRA.

It is a singular fact that, if we take various colored substances, such as a set of dyestuffs, no two of them exert the same action upon light. The absorption spectrum is as distinct as the autograph of a metal. We may therefore distinguish one dyestuff from another, and thus we have an infallible means for the

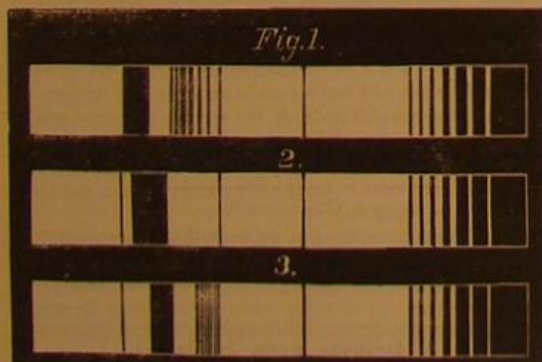
DETECTION OF ADULTERATIONS.

Mr. Sorby got a coloring matter from grape juice, which he called "Vitis purple." If this be suitably treated with citric acid, we have a solution the color of which cannot be distinguished from that of fresh port. If more acid be added a further oxidation is noticeable, and then it resembles the spectrum of port about ten years old. By adding more the spectrum becomes like that of port which is still older, there being a certain coloring matter which changes in its character by oxidation. In regard to adulteration of wines, Mr. Sorby believes that, as a general rule, such is not the case with colored wines. The lecturer stated that, in his own investigations, he had clearly seen the spectrum of logwood in a sample of port, and that he considered the popular belief, as to the use of Brazil wood and the common Virginian poke, to be not without reason.

Mustard, it is found, is almost uniformly adulterated with turmeric. Inferior rhubarb is also caused to imitate superior qualities. There is a kind of cheese bought in the English markets which has a curious yellow color which has been proved to be due to annatto. Professor Barker added that he once tested a suspiciously yellow sample of butter, and that the spectrum obtained was plainly that of carrots, but whether the coloring matter was introduced by the manufacturer or the cow, he was unable to determine.

COLORING MATTER OF HUMAN BLOOD.

Professor Stokes was the first to apply the spectroscope in the investigation of the spectrum of human blood. The various kinds of blood give different spectra; Fig. 1 is the



spectrum of arterial blood, Fig. 2, that of venous blood, and Fig. 3, of the dried coloring matter in blood. To show the utility of the spectroscope as a means of determining the presence of blood, Professor Barker mentioned the following instance

A case of suspected murder by means of some dull instrument was once given to Dr. Herapath to investigate. At some distance from the place where the crime was supposed to have been committed, a hatchet was found several weeks after, lying in the woods. It was stained with a drop of some dark substance. The Doctor, obtaining the implement, drove out the handle, and, slicing off a small portion of the stained wood and adding water to the shavings, obtained a few drops of a brown dirty solution, which coagulated by heat. He then cut off another very small portion of the wood

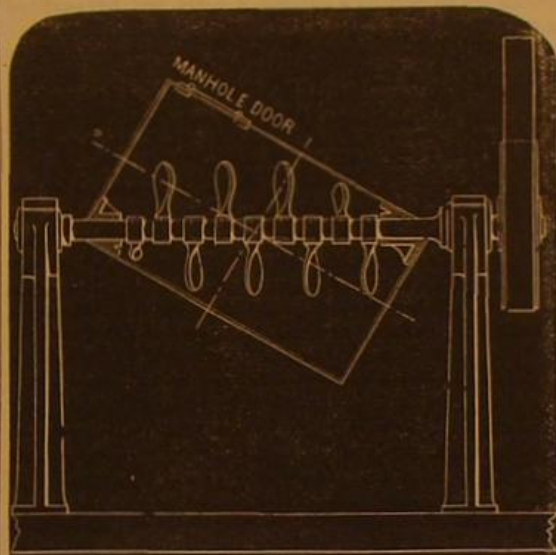
and obtained a single drop of dirty liquid, which he placed in a tube, and light through this, being examined with a prism, gave the characteristic absorption spectrum of pema-tine—the coloring matter of the blood. He estimated the whole quantity of matter examined as weighing 1½ grains. Yet this was sufficient to enable him to detect the substance and bring the guilt home to its perpetrator. Now blood varies in character with the different gases which may have been added to it. This happens in many cases; for instance, when people are suffocated by going down into vats or wells. In these cases the blood contains a certain amount of carbonic acid. The spectrum given by blood in this state is perfectly distinct from that given by blood in its normal condition. In like manner, when blood is compounded with sulphuretted hydrogen, prussic acid or other foreign substances, the spectrum is in each case distinct and peculiar. Knowing these facts, the cause of death may be determined in many cases where it is impossible to detect it by any other means.

Blood corpuscles are so extremely small that 3,900 of them only measure one inch, yet the presence of even a portion of one may be tested by the spectroscope. Dr. Herapath says that it is perfectly easy to detect and ocularly examine the human blood in the stomach of a flea. We may even dilute this blood with a teaspoonful of water without its losing its property, if the insect has been dining off a sanguineous individual.

Professor Barker concluded with a review of the field passed over, and an eloquent tribute to Professor Tyndall for his efforts in behalf of original investigation.

MIXING CYLINDER FOR CONCRETE.

We are indebted to Mr. G. C. Reithelmer, the superintendent of the Government submarine works at Hell Gate, N. Y., for the accompanying excellent design, of his own invention, for a concrete mixing cylinder. The apparatus



was used with every success, by Mr. Reithelmer, in the construction of the great breakwater at Holyhead, England. The revolving cylinder, of boiler iron, is immovably attached, as shown, to the axle which passes diagonally through it. Also, firmly fastened to the axle, are a number of knives or cutting blades arranged in spiral form. Motion is communicated by means of the belt wheel on the right of the engraving. The components of the concrete are introduced into the apparatus through the hinged manhole door. The machine is then set in motion, making some twenty-five revolutions per minute, causing the material to fall alternately from end to end of the cylinder, meeting in its progress the sharp edges of the knives. At the above speed, no effects of centrifugal force which would tend to keep the material in a single position are encountered. After the concrete is thoroughly incorporated, the cylinder is rotated so that the door is at the lowest point, when it is only necessary to open the manhole to allow the mixture to fall into a receptacle placed underneath.

Underground Telegraph Wires.

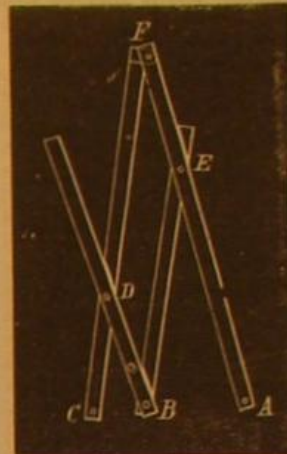
A recent heavy rain followed by a severe frost in this city played great havoc with the telegraph wires. The weight of ice was so great as to cause innumerable breaks, so that the elaborate fire alarm system became useless, and for a time it appeared as if communication with other cities was to be seriously interrupted. This has caused a re-agitation of the subject of underground wires, which, it is justly believed, would prove of great advantage as compared with those now in use. Not only would the unsightly telegraph poles be removed from our streets, but such casualties as the above, due to the weather, would be permanently averted.

Professor Silliman, in a recent letter, points out some of the difficulties incident to the underground plan. He says that gutta percha covering will not answer for insulation where it is exposed to the action of moist earth and vegetable processes. An element also, that is to be carefully considered in carrying out a general system for underground telegraphs in cities, is the facility that must be given for relaying in case of accident or of excavations in the streets for constructive purposes. If, however, says the Professor, the wire is once properly laid underground in insulatory material proof against natural agencies of destruction, the "electrical leakage" is very small, so much smaller than is possible with wires in the air as to be a great saving to the telegraph company.

THE PANTAGRAPH.

The pantagraph is an instrument for copying drawings, producing the copy on an accurately enlarged or reduced scale. It is much used by engravers and designers, and, to some extent, by mechanical draftsmen. It was invented in 1803, by Christopher Scheiner,* a Jesuit, and has been improved and modified by Professor Wallace, of Edinburgh, who rechristened it "eidograph," and by M. Gavard and others. As now made, it is a very neat and quite useful instrument.

The principle involved is that of the proportional compass, and, although, for nice work, it should be made of metal and with great accuracy, any good mechanic can construct it in hard wood, and with sufficient exactness for ordinary purposes.



The four rulers, jointed together by pins at their intersections, as shown in the figure, are supported on light, smoothly running casters, and carry a pen or pencil at A, and a tracer at B, or vice versa, and the point, C, is held fast to the paper by a weight on which it is pivoted, and around which the whole instrument swings. A, B, and C are all interchangeable. The arms are graduated to indicate where the movable points of junction, D and

E, must be arranged for any desired degree of reduction or enlargement of the scale. If the reduction is to be to one half its linear, or to one quarter its superficial dimensions, place the original drawing under the tracing point at A, the pencil at B, and let C remain unmoved. The joints, D and E, must each be made at the middle of the length of the long arms A F and C F, making the distances B B and B E equal to the half length of A F. The tracing point at A being now moved over the lines of the drawing, the pencil at B will describe precisely similar lines, and will make an exact copy, of half size. For the system is a kind of parallel motion, which compels the tracing point to remain, at all times, in the vertex of the angle, D B E, of a parallelogram whose sides are B D, D F, F E, and E B, no matter to what extent the angles may be altered. Then, if the three points move in the direction of the line containing them all, B will move but one half as far as A; and, if the instrument swings about C, B will again move but one half as far as A; and any combination of the two movements, by which any other line may be described, will give B a motion having the same relation to that of A. The point, C, always remains at rest. By putting the pencil at A and the tracing point at B, it is evident that the drawing will be copied on a double scale.

Placing the rods so that their junctions, D and E, shall occur at one fourth the lengths of C F and A F from C and from F respectively, and constructing thus a new parallelogram, D B E F, the original drawing may be reduced or enlarged four times. And, generally, the two triangles C D B and B E A, being similar in consequence of the parallelism of their sides, the distance B C : B A :: D C : E A and C C : C F :: E F : E A. So long as this proportionality is preserved, the instrument will be accurate, and the scales of the two drawings will be to each other as the distances of the pencil and of the tracing point, from the fulcrum or pivot of the pantagraph.

In our sketch, we have represented the simplest form of this instrument, and such as will be found easy to make and yet very convenient and useful. It can be purchased of the dealers in drawing instruments in a variety of improved forms and at correspondingly high prices. We have no doubt that many an apprentice, who reads our paper, will find this little "bundle of sticks" a most useful addition to his collection of drawing instruments.

Gas Burners.

In batswing burners it is found that, though the size of the flame diminishes with the amount of gas consumed, it is not in equal ratio. The cost of a large flame for each candle power per hour may be, for instance, 0.42 centimes, while, with a small one, it will be 0.897 centimes. Or, again, the light of a large flame may be equivalent to 15 candles, while that of two small ones together will be 7.4 candles. The cause of this is attributed to the complete combustion of the gas in the blue zone of the gas flame, which gives little or no light in either case, and has more favorable circumstances for its occurrence relatively to the size of the flame in the small than in the large flame. Another more inexplicable phenomenon is that with a flat flame the intensity of the light is the same, whether the edge or the flat of the flame is tested. This points to the absolute transparency of the flame. The use of cylindrical glass chimneys with round jets (argand, etc.) is concluded to be, on the whole, somewhat more economical than with flattened chimneys, after a series of experiments to settle this point.—M. Offret.

MANUFACTURE OF CHLORATE OF POTASH.—To manufacture chlorate of potash on a large scale, it has been recommended by W. Hunt to adopt the following method: Milk of lime is made to trickle down over bricks placed in a tower where it comes in contact with a continuous current of chlorine gas. Chlorate of lime is the chief product, and, by treating this with chloride of potassium, chlorate of potash is formed, which can be purified by crystallization.

*Pantographica, "stepe Ars Delinendi, etc., Rome, 1623

Correspondence.

A Boiler Difficulty.

To the Editor of the Scientific American:

I am running a cotton seed oil mill with an 18x30 engine, supplied by two boilers, with five 10 inch flues each. Said boilers are 52 inches diameter by 20 feet long, and are set up with the regular western steamboat casing of sheet iron lined with fire brick. They are connected on top with a 30 inch steam drum, 10 feet long, with 10 inch legs, set on the second sheet from front. The mud drum is on the second sheet from back end, and is 20 inches in diameter by 10 feet long, with 10 inch legs connecting both boilers, and is supplied with necessary pipes, checks, and mud valve. The boilers are made of Lilman Son & Co.'s best Tennessee C. H. iron, $\frac{1}{2}$ inch thick, with $\frac{3}{4}$ heads. The trouble is that on increasing my machinery, I was forced to run up to 90 lbs. pressure, and as soon as I did so, the boilers began to leak on the first sheet over the fire. I had them caulked and re-riveted a dozen times, until the first and second sheets bagged on each side of the lap. The makers finally concluded to cut out one half of each sheet and patch across the lap. It looked like a good job when tested by hydrant pressure of 50 lbs.; but on raising steam, both patches gave way in 19 hours. After taking the advice of all our experts, they finally moved the steam drum back over the mud drum, put in an extra mud drum just back of the bridge wall, on third sheet, and put on new patches, but changed their laps so that they run with the boiler sheets. I have been running now two weeks and the boilers seem to hold tight and work well. They were also tested by the United States Inspector of this part at 160 lbs., and stood the test. Now the question arises, was it necessary to go outside of established custom to move steam drum back, when my engine sets front, and to put in two mud drums under a 20 feet boiler? I am using a Stillwell & Bierce superheater, and am well supplied with water. I clean out once a week and show no scale or sediment. The boilers, they admit, are perfectly clean, and the iron shows no signs of being burnt. The boiler sheets are $3\frac{1}{2}$ feet wide, and the flue sheets 26 inches; this, some claim, is unequal expansion and caused the buckle or bag, but my theory is that it is all in the furnace. I use no fuel but cotton seed hulls, which make a quick fierce flame. My grate bars are 22 inches from boilers, while the bridge wall or throat is only 5 inches from boilers; and from that, the bed drops back to 10 inches at back of boiler. Now I claim that in my fuel, which burns somewhat like anthracite, the back flame curls up from the shape of bridge wall; and the draft flame in front, which is very fierce, is checked or forced up hard against the first lap to get over the rolling flame from bridge wall, and that it does not extend to rear of boilers, and shows here through flues, thereby making very intense heat causing unequal expansion. The boilers are caulked only on outside; is this customary? Some experts claim unequal expansion from difference in sheets of boiler and flues, some from not being caulked inside; others that the sheets ought to be connected with checks, while others were in favor of the change that was made. My gage cocks show water level in both boilers and do not vary; but I have been stopped about two months in repairs of boilers, at a loss of about \$15,000 and a bill of repairs of \$1,200. If you will please give me your opinion of my difficulty, I will be under many obligations.

GEO. W. HATFIELD,

Superintendent of Dixie Oil Company.

Nashville, Tenn.

REMARKS BY THE EDITOR:—We should judge that the boilers were of good material, well put together, for only excellent iron and well riveted joints would be likely to exhibit the behavior described by our correspondent. It is not unusual to leave the interior of boilers uncaulked, although it is generally considered better practice to caulk inside and out. We do not think that the caulking can have had any important influence in the matter. Some engineers of large experience and admittedly good judgment believe that, under the action of a very heavy fire, with defective circulation, the water may be driven off of the heating surface immediately adjacent to such an extent that the metal may be so highly heated as to yield under ordinary pressure, or even to become burnt. There is strong evidence that such cases have occurred, and it seems very probable that we find here described another example. We should have supposed the trouble to have been caused by sediment or scale over the fire, had we not been assured that none was found at the weekly cleaning. Wonderfully little incrustation over a heavy fire will make trouble. We should not suppose that the change of position of the steam drum could make any essential improvement, and the changes of mud drums could hardly effect anything unless the trouble arose from incrustation. We presume that the new work prevents the recurrence of the bagging, simply by stiffening that part. It is evident that the boiler was strong enough to bear the pressure, simply. We should feel uneasy still, and should not be surprised were further trouble to occur. In any event, we should first endeavor to diffuse the heat from the fire more generally over the heating surface, and, if unsuccessful in this, should put in more boiler and drive the fires less. We rarely meet with a case in which too much boiler power has been given. It might be found advisable to construct new furnaces, from which no radiant heat could reach the boiler.

Steam Pressure in Boilers.

To the Editor of the Scientific American:

If the true way to estimate the strain in a cylindrical steam boiler is to multiply the pressure by the radius, a boiler 100 inches in circumference, having within it a pressure of 100

pounds upon each square inch, will of course have a strain of 1,600 pounds upon every circle of the boiler one inch wide, will it not?

Has it not been proved by careful test that the breaking point of good boiler iron is about 13,000 pounds to each one quarter inch of sectional area? If this be so, the bursting pressure for a boiler 100 inches in circumference and one quarter inch thick is, of course, 13,000 pounds upon each circle of the boiler one inch wide. According to your method of estimating strain in boilers, 100 pounds to a square inch on the boiler just named is less than one eighth of its bursting strain. Will a boiler thirty-two inches diameter and one quarter inch thick sustain any such pressure as 800 pounds to a square inch?

By using half of the circumference instead of the radius for one of the factors, we obtain a little less than 300 pounds per square inch as the maximum pressure, which I hold agrees best with actual test and practice.

F. G. WOODWARD.

REMARKS BY THE EDITOR:—A boiler of 32 inches diameter, of quarter inch plate capable of resisting a tensile force of 50,000 pounds per square inch, would resist an internal pressure of 781 pounds per square inch could it be made without seams. Experiment shows a single riveted boiler, however, to have but fifty-six one hundredths this strength at the seams. Such a boiler as is mentioned would therefore yield at about 437 pounds. We regret that we are compelled to differ with our correspondent.

Aero-Steam Engines.

To the Editor of the Scientific American:

In No. 1 of the present volume of the SCIENTIFIC AMERICAN, you advocate further experiments in aero-steam engineering. You probably remember obtaining a patent for me in 1866 on the aero-steam generator, with which Warsop afterward (1868) created quite a flurry in England. I have studied the subject for a number of years, and have arrived at the following conclusions:

First, that it is impossible to construct a successful air engine of any great power, for the following reasons: Air, like all gases, expands but one volume for each 493° Fahr. of temperature through which it is raised; and it also becomes highly heated by compression; so that, if we force it into a heater under a pressure of seven atmospheres, the temperature before compression being 60°, we will then have it at a temperature of 435°; then, in order to double its volume, we must raise it 493° more, which will bring it to a temperature of 928° which is entirely too high for practical purposes. And even if we could work it at this degree of heat, we would then be compelled to have a feed pump of half the capacity of the engine, which would be very cumbersome, to say nothing of the cost; and more, our engine would have to be twice the size of a steam engine of the same power. If we work the air at a less pressure, we may reduce the temperature, but we must increase the size of the engine to obtain an equal power.

Second, that the only way in which we can obtain the advantages of air as a motor is to combine it with steam. In this way we can control the temperature of the air, as it is well known that the degree of heat of steam is regulated by the pressure. The air must take the same temperature as that of the steam with which it is mingled, consequently we can have no over heating of the air. But right here comes the difficulty in using air and steam together. As air becomes heated to a high degree by compression, we cannot force it into a boiler under a pressure of seven atmospheres without its becoming heated to a much higher degree than the steam, the temperature of the air being 435° while that of the steam is only 333°, a difference of 103°. The air, in taking the temperature of the steam, contracts; the steam at the same time expands. But the volume of contraction and expansion must be in proportion to the specific heat of air and steam. Air, having a specific heat of only one third that of steam, must contract three volumes, while the steam expands only one volume. The expansion of the air having been produced by mechanical energy applied to the pump, we have here a direct loss of power. This difficulty may be overcome; and in overcoming it, several advantages are gained. What is necessary is to prevent the air from becoming heated by compression. This, I believe, I can do with a pump of peculiar construction of my invention, and without the loss of power, as the heat is extracted from the air as soon as it begins to develop, consequently it will not expand until it reaches the boiler where it will take its heat from the steam, and we will have the former operation reversed, the air expanding three volumes and the steam contracting one volume. This, in my opinion, is the only way in which air and steam can be worked together successfully.

D. B. TANGER.

Bellefontaine, O.

Ignition of Wood by Steam Heat.

To the Editor of the Scientific American:

On page 32 of the SCIENTIFIC AMERICAN of January 18, you make the following statement, editorially: "We maintain that any man of science who has studied the subject of steam, or any practical engineer of common sense, knows that all that steam can do, even when superheated, is to make wood-work hot and dry and to predispose it to catch fire. The spark must be supplied from another source; the steam tubes can never attain, outside the heating apparatus, the high temperature of 900° or 1,000° Fahr. required for the red heat which is necessary to set woodwork on fire." *Per contra*, a no less respectable authority than the *Journal of Commerce* has asserted, within the week, that, when wood has been charred by steam pipes, "engineers say that the least draft between the pipe and the charred wood will then cause

the wood to form a coal, which will readily burst into flame."

Turning to page 41 of Wyatt "On Spontaneous Combustion," republished in this country and annotated by the editor of the *Insurance Monitor*, the following statements will be found: "The Institute of Technology, in Boston, long ago decided upon the danger of steam pipes passing through and in contact with wood." And here is an instance which occurred in a Pittsburgh oil refinery: "Steam was generated in an ordinary boiler and was conveyed therefrom in pipes which passed through a furnace and thence into retorts for the purpose of distilling petroleum. Here the pipes formed extensive coils and then passed out, terminating at a valve outside the building. To prevent the steam, when blown off, from disintegrating the mortar on an opposite wall, some boards were set up to receive the force of the discharge, and, as often as the superheated steam was blown against them, the boards were set on fire." And here is another case in point: "Steam was taken from an ordinary boiler through a pipe forty feet long. Ten feet from the farther end, a collar of wood was fitted closely to the pipe; ten feet nearer the boiler a lighted kerosene lamp was placed under the pipe. In ten minutes the wooden collar was on fire." When superheated steam was turned against a bale of cotton, "the cotton was in flames as quick as a flash." In the report of Mr. Braidwood to the Committee of the Fire Brigade of the city of London (I quote from a newspaper article, embodying the chief points), it is asserted that "Iron pipes, often heated up to 400°, are placed in close contact with floors and skirting boards, supported by slight diagonal props of wood, which a much lower heat will suffice to ignite." "Mr. Braidwood, in his evidence before a Committee of the House of Lords, in 1846, stated that it was his belief that by long exposure to heat not much exceeding that of boiling water, or 212°, timber is brought into a condition that it will fire without the application of a light."

I do not make these questions by way of attempting to controvert the extremely direct and flatfooted position which you have taken, but merely to show that there is another side to the question, be its merits what they may the SCIENTIFIC AMERICAN is a thoroughly practical paper which is read by practical men, and its opinions are doubtless in the vast majority of cases accepted without question. Hence what seems to me the danger which may arise from the positive tone of the article referred to. For the past few years, underwriters, basing their opinions upon such statements as those to which I have asked your attention, have endeavored to impress upon the public that steam pipes in contact with woody fiber are eminently dangerous. And the writer confesses that, in the prosecution of his business, he does not care to have such an unqualified dictum of such an authority as the SCIENTIFIC AMERICAN thrown in his teeth, unless that dictum has been based upon facts as absolute as itself. If steam pipes are not dangerous, it is to the interest of all that the truth should be known. But if the question is still an open one, if a positive answer to the question is as yet impossible, should not so cautious an authority give us the benefit of the doubt, and stimulate discussion rather than check it by enunciating an opinion which nine out of ten of your readers will accept at once as *ex cathedra* and final?

I am sure that the public would thank you greatly if you would give a thorough review of the *pro* and *con* of the matter, whatever your ultimate judgment upon them may be.

New York city.

W. S. N.

Influence of the Earth's Central Fires on its Surface.

To the Editor of the Scientific American:

It is generally conceded that our earth is still a liquid fire, surrounded by a crust caused by congelation, through the elements, in its revolutions through space. Let us examine what influence this liquid fire has on the earth in its different positions, and on its affinity with the rays of light from the sun.

At the period when the rays from the sun begin to be oblique, the earth is turning in position to cause the liquid portion to settle, thereby losing its heating power on the surface and its affinity with the rays from the sun; this change continues to increase, bringing on the coldness of winter according to position in the change. Water freezes, and the frost enters the earth at times when it is comparatively warm; but as soon as the limit is reached and a turn is made in our sphere toward a more congenial position, the atmosphere may still be cold, and the ice on our lakes and streams melt away gradually from the source of heat generated by the internal fires. This change continues to bring spring and summer, and more heat than man really enjoys.

I make these suggestions to draw forth further investigation, for man, from the days of Adam to the present, has attributed much to the Author of Light without considering his own footstool.

EBRUD.

A Swindle upon Inventors.

We have frequently received letters from various parts of the country calling our attention to the swindling transactions of individuals who represent themselves to be agents for the disposal of patent rights. These parties send neatly printed circulars through the mails to inventors, setting forth their advantages for effecting sales, etc., and requesting the forwarding to their address of models and a fee of five dollars or thereabouts. The money is of course taken and the model usually left in the express office.

Our latest advices regarding these scamps state that they have operated at Albion, Mich., at which place they collected some two thousand models, and more recently they have taken up their quarters in Galesburg, Illinois. We would caution inventors generally against any dealing with firms, or individuals regarding whose standing they have not full and satisfactory information.

THE LOST ARTS.

Mr. Wendell Phillips, the distinguished orator, has delivered no more brilliant discourse than that of which the following is an abstract. The "Lost Arts" is a subject of surpassing interest, not only as treating of knowledge long since dead to the world, but as affording evidence that many of our newest discoveries were known and practiced in ages of which history furnishes but meager record. Mr. Phillips began by stating that he had been charged with repeating useless fables with no foundation. Take the subject of

GLASS.

This material, Pliny says, was discovered by accident; some sailors landing on the eastern coast of Spain took their cooking utensils and supported them on the sand by the stones that they found in the neighborhood; they kindled the fire, cooked their fish, finished the meal, and removed the apparatus; and glass was found to have resulted from the niter and sea sand, vitrified by the heat. The story was rejected by scientific men as improbable, on the ground that no mere bundle of sticks could produce sufficient heat to cause vitrification. But Professor Shepherd, continued the lecturer, states that when he was in Mexico his party stopped on the road one day to cook some venison. They made their fire, on stones, of a wood resembling ebony. When the cooking apparatus was removed, there was pure silver got out of the embers from the intense heat of that almost iron wood, a heat more than sufficient to vitrify the materials for glass. Why then, can it not be supposed that Pliny's sailors used some such wood? It is stated that nothing has been observed in ancient times which could be called glass. In Pompeii, a dozen miles south of Naples, which was covered with ashes by Vesuvius 1,800 years ago, they broke into a room full of glass; there was ground glass, window glass, cut glass and colored glass of every description, and the house was evidently a glass maker's factory.

The chemistry of the most ancient period had reached a point which we have never even approached, and which we in vain struggle to reach to-day. Indeed the whole management of the effect of light in glass is a profound study. The Catholic priests, who penetrated into China two hundred years ago, say in their letters that they were shown a glass, transparent and colorless, which was filled with a liquor made by the Chinese, that was shown to the observers and appeared to be colorless like water. This liquor was poured into the glass, and then, looking through it, it seemed to be filled with fishes. They turned this out and repeated the experiment, and again it was filled with fish. The Chinese confessed that they did not make them; that they were the plunder of some foreign conquest. Another story relates to the age of Tiberius, the time of St. Paul, and tells of a Roman who had been banished and who returned to Rome, bringing a wonderful cup. This cup he dashed upon the marble pavement, and it was crushed, not broken, by the fall. It was dented some, and with a hammer he easily brought it into shape again. It was brilliant, transparent, but not brittle. The possibility of glass being thus made is strenuously denied by learned and scientific men. The Romans got their chemistry from the Arabians; they brought it into Spain eight centuries ago, and in their books of that age they claim that they got from the Arabians malleable glass. There is a kind of glass spoken of there that, if supported by one end, by its own weight in twenty hours would dwindle down to a fine line, and that you could curve around your wrist. Von Beust—the Chancellor of Austria—has ordered secrecy in Hungary in regard to a recently discovered process by which glass can be used exactly like wool, and manufactured into cloth. In Rome, there is exhibited a bit of transparent glass, which is lifted up to show that there is nothing concealed, but in the center of the glass is a drop of colored glass, perhaps as large as a pea, mottled like a duck, finely mottled with the shifting colored hues of the neck, and which even a miniature pencil could not do more perfectly. It is manifest that this drop of liquid glass must have been poured, because there is no joint. This must have been done by a greater heat than the annealing process, because that process shows breaks.

The ancient imitations of gems have deceived the most experienced connoisseurs. The celebrated base of the Geneva cathedral was considered a solid emerald, but when Napoleon, after taking it to France, presented it to the Institute, the scholars, though asserting it not to be a stone, were unable to tell of what material it was.

ANCIENT AIDS TO VISION.

Cicero said that he had seen the entire Iliad, which is a poem as large as the New Testament, written on skin so that it could be rolled up in the compass of a nut shell. Now, this is imperceptible to the ordinary eye. Very recently the whole contents of a London newspaper were photographed on a paper half as long as the hand. It was put under a dove's wing and sent into Paris, where they enlarged it and read the news. This copy of the Iliad must have been made by some such process. Pliny says that Nero, the tyrant, had a ring with a gem in it which he looked through and watched the sword play of the gladiators, more clearly than with the naked eye. So Nero had an opera glass. Mauritius, the Italian, stood on the promontory of his island and could sweep over the entire sea to the coast of Africa with his *nauscope*, which is a word derived from two Greek words meaning to see a ship. Evidently Mauritius, who was a pirate, had a marine telescope. The signet of a ring in Dr. Abbot's museum, said to belong to Cheops, who lived five hundred years before Christ, is about the size of a quarter of a dollar and the engraving is invisible without the aid of glasses. In Parma is shown a gem once worn on the finger

of Michael Angelo, of which the engraving is two thousand years old, in which there are the figures of seven women. A glass is needed to distinguish the forms at all. Layard says he would be unable to read the engravings on Nineveh without strong spectacles, they are so extremely small. Rawlinson brought home a stone about twenty inches long and ten wide, containing an entire treatise on mathematics. It would be perfectly illegible without glasses. Now, if we are unable to read it without the aid of glasses, you may suppose that the man who engraved it had pretty strong spectacles. So, the microscope, instead of dating from our time, finds its brothers in the Books of Moses—and these are infant brothers.

THE OLD DYES.

For the Egyptians, color was a means of recording history. We find upon the stucco of their walls their kings holding court, their armies marching out, their craftsmen in the ship yard with the ships floating in the dock, and in fact we trace all their rites and customs painted in undying colors. The French, who went to Egypt with Napoleon, said that all the colors were perfect except the greenish white, which is the hardest for us. They had no difficulty with the Tyrian purple. The burned city of Pompeii was a city of stucco. All the houses are stucco outside, and it is stained with Tyrian purple—the royal color of antiquity; and the flaming hues are as bright as if painted but yesterday. Come down from Titian, whose colors are wonderfully and perfectly fresh, to Sir Joshua Reynolds, and although his colors are not yet a hundred years old, they are fading; the colors on his lips are dying out, and the cheeks are losing their tints. He did not know how to mix well. The French have a theory that there is a certain delicate shade of blue that Europeans cannot see. Ruskin says that we cannot imitate in colors that would last for twenty years the magnificent scarlet in old illuminated missals, now five centuries old. The Frenchman says: "I am the best dyer in Europe; nobody can equal me, and nobody can surpass Lyons." Yet in Cashmere, where the girls make shawls worth thirty thousand dollars, they will show him three hundred distinct colors, which he not only cannot make, but cannot even distinguish.

ANCIENT MASTER ARTISANS.

Taking the metals, the Bible in its first chapters shows that man first conquered metals there in Asia, and on that spot to-day he can work more wonders with those metals than we can. One of the surprises, that the European artists received when the English plundered the summer palace of the King of China, was the curiously wrought metal vessels of every kind, far exceeding all the boasted skill of the workmen of Europe. English surgeons going to India are advised to have their instruments gilded because English steel cannot bear the atmosphere. Yet the Damascus blades of the Crusades were not gilded and they are as perfect as they were eight centuries ago. There was one at the London Exhibition, the point of which could be made to touch the hilt, and could be put into a scabbard like a corkscrew, and bent every way without breaking. If a London chronometer maker wants the best steel to use in his chronometer, he does not send to Sheffield, the center of all science, but to the Punjab, the empire of the seven rivers, where there is no science at all. The first needle ever made in Europe was made in the time of Henry the VIIIth, and made by a negro; and when he died, the art died with him. Some of the first travelers in Africa stated that they found a tribe in the interior who gave them better razors than they had. Scott, in "Tales of the Crusaders," describes a meeting between Richard Cœur de Lion and Saladin. Saladin asks Richard to show him the wonderful strength for which he is famous, and the Norman monarch responds by severing a bar of iron which lies on the floor of his tent. Saladin says, "I cannot do that," but he takes an eider down pillow from the sofa, and, drawing his keen blade across it, it falls in two pieces. Richard says: "This is the black art; it is magic; it is the devil; you cannot cut that which has no resistance;" and Saladin, to show him that such is not the case, takes from his shoulders a scarf which is so light that it almost floats in the air, and, tossing it up, severs it before it can descend. George Thompson states that he saw a man in Calcutta throw a handful of floss silk into the air, and a Hindoo sever it into pieces with his saber. We can produce nothing like this.

EGYPT'S MECHANICAL MARVELS.

Taking their employment of the mechanical forces and their movement of large masses from the earth, we know that the Egyptians had the five, seven, or three mechanical powers, but we cannot account for the multiplication and increase necessary to perform the wonders they accomplished. In Boston, lately, we have moved the Pelham Hotel, weighing fifty thousand tons, fourteen feet, and are very proud of it, and since then we have moved a whole block of houses twenty three feet, and I have no doubt we will write a book about it; but there is a book telling how Domenico Fontana, of the sixteenth century, set up the Egyptian obelisk at Rome on end, in the Papacy of Sixtus V. Wonderful! Yet the Egyptians quarried that stone and carried it one hundred and fifty miles, and the Romans brought it seven hundred and fifty miles, and never said a word about it. Mr. Batterson, of Hartford, walking with Brunel, the architect of the Thames tunnel, in Egypt, asked him what he thought of the mechanical power of the Egyptians, and he said: There is Pompey's Pillar, it is one hundred feet high, and the capital weighs two thousand pounds. It is something of a feat to hang two thousand pounds at that height in the air, and the few men that can do it would better discuss Egyptian mechanics.

CANALS.

The Suez Canal absorbs half its receipts in cleaning out the sand which fills it annually, and it is not yet known whether it is a pecuniary success. The ancients built a canal at right angles to ours, because they knew it would not fill up if built in that direction, and they knew such a one as ours would. There were magnificent canals in the land of the Jews, with perfectly arranged gates and sluices. We have only just begun to understand ventilation properly for our houses; yet late experiments at the Pyramids in Egypt show that those Egyptian tombs were ventilated in the most perfect and scientific manner.

Again, cement is modern, for the ancients dressed and joined their stones so closely that, in buildings thousands of years old, the thin blade of a penknife cannot be forced between them. The railroad dates back to Egypt. Arago has claimed that they had a knowledge of steam. A painting has been discovered of a ship full of machinery, and a French engineer said that the arrangement of this machinery could only be accounted for by supposing the motive power to have been steam. Bramah acknowledges that he took the idea of his celebrated lock from an ancient Egyptian pattern. De Tocqueville says there was no social question that was not discussed to rags in Egypt.

OLD HINTS OF NEW THINGS.

Years before Franklin's invention of the lightning rod, and before muskets were thought of, the old soldiers on guard on the towers, if a spark passed between them and the spear head, ran and bore warning of the state and condition of affairs. Solomon's Temple, lofty and situated on an exposed part of a hill, was guarded by a system exactly like Franklin's. The Duchess of Burgundy took a necklace from the neck of a mummy and wore it to a ball given at the Tuilleries, and everybody said they thought it was the newest thing there. A Hindoo princess came into court, and her father seeing her said: "Go home, you are not decently covered—go home;" and she said, "Father, I have seven suits on;" but the suits were of muslin, so thin that the king could see through them. Four hundred and fifty years ago the spinning machine was first introduced into Europe. Yet we have evidence to show that it made its appearance two thousand years before.

We have not an astrology in the stars serving only the kings and priests; we have an astrology serving all those around us. We have not a chemistry hidden in underground cells, striving for wealth, striving to change everything into gold. No; we have a chemistry laboring with the farmer, and digging gold out of the earth with the miner. Ah! this is the nineteenth century, and of the hundreds of things we know, I can show you ninety-nine of them which have been anticipated. It is the liberty of intellect and a diffusion of knowledge that has caused this anticipation.

Ocean Weather Signals.

The suggestion is made that a vessel, connected by telegraph cable with the shore, be stationed three hundred miles out at sea off the port of New York, to warn approaching ships of storms on the coast. This a pretty idea but not of much practical value. In fair weather no skipper would go out of his way to find the telegraph boat; and in a storm he couldn't find her if he would.

Equally valueless is the proposition to have signal buoys anchored at intervals in the ocean between Europe and America, to indicate wind currents, latitude and longitude, afford refuge to distressed mariners, etc. The majority of marine disasters occur directly upon the coasts. Few vessels, comparatively, are lost in mid ocean. The rotary motion of storms is well understood by sea captains, who know how to steer in order to avoid the most violent portions, while the barometer gives notice in advance of approaching storms and change of winds. The proposed signal buoys could add little or nothing to the safety of ships.

A Locomotive Explosion.

A few days ago a locomotive, while standing at the head of a freight train at Lewisville, S. C., exploded with a deafening detonation, producing a concussion which was heard and felt for miles.

The scene around the engine was appalling. Every portion of it except the tender was a complete wreck. One of the large driving wheels on the right side was torn from the axle and buried deep in the embankment. One of the heavy driving shafts was hurled over the embankment of the cut and, in its career, struck the top of a telegraph pole, which it snapped of like a stick of glass. The dome of the engine was thrown far above the cut and fell about three hundred yards distant. The bell crushed in the gable end of a negro preacher's house, about the same distance away, causing the sable clergyman to tremble with fright. The cause of the explosion is inexplicable; the engine was quite an old one. No person injured.

Quantities of Materials used by Photographers.

Dr. Vogel says: From my own experience, I give the following rules: For every square foot of plate, about half an ounce of collodion is necessary; a square foot of plate will consume also very nearly half an ounce of bath solution; and, when we use a developer of a strength of five per cent, with two and a half per cent glacial acetic acid, we will require, for every square foot of plate, nearly half an ounce of sulphate of iron and a quarter of an ounce of glacial acetic acid. Of varnish, about three quarters as much as of collodion is necessary. The consistence of the collodions and the varnishes differs, of course; but we can hardly go amiss if we provide ourselves with one and a half times to double the abovementioned quantities for each square foot of plate.

STEAM FILTER AND CONDENSER.

Our engraving represents an improved form of steam filter and condenser, adapted to the purification of water for boiler feeding or other purposes. Steam enters through the pipe, A, into the annular perforated chamber, B. There it escapes through the numerous small orifices and is met by a copious shower of water which, supplied by the pipe, C, from above, is spread out over and percolates through the perforated distributor, D. The steam is thereby nearly all condensed and falls to the conical diaphragm, E, the residue escaping through the exhaust, F, on the left of the engraving. The water now descends the vertical pipe, G, to the lower section of the apparatus. At the bottom of the pipe it encounters the cup, H, over the sides of which it flows into the mud well, where it deposits such foreign matter as it may hold in suspension, the accumulated sediment being afterwards drawn off through the valve, I. The water next rises through the filters, J J, to the upper chamber, K, whence it emerges in a clear and pure condition through the pipe pipe, L. At M is shown the overflow pipe, at N the glass water gage, and at O the man holes.

It is hardly necessary to dwell upon the advantage of using the purest attainable fluid for the feeding of steam boilers, or the general benefits of filtering water that is in anywise turbid, previous to employing it for the ordinary purposes of life.

The apparatus above described seems, so far as its principle and construction are concerned, an efficient and useful device. The inventors state that careful analysis has proved that it removes from water over three quarters of the lime which forms boiler scale, and probably five sixths of the suspended impurities.

Patented through the Scientific American Patent Agency, February 27, 1872. Further information may be obtained by addressing Messrs. Kennedy, Berkshire & Co., Muscatine, Iowa.

The Million Dollar Telescope.

"An Old Mechanic" writes to suggest the formation of a stock company, with shares of ten dollars each, to construct the proposed large telescope, and states that he, for one, would gladly pay \$25 for a peep at Mars or the moon through such an instrument, and would go to any part of the United States for such a privilege. He points out that it is of no use to look to Government for such a telescope, as it has no money for such a purpose, although plenty is forthcoming for European shows and big guns; and he asserts that the money, according to his plan, would be easily obtained; and, if such a telescope were placed in Philadelphia in 1876, that it would pay the stockholders 200 per cent, besides benefiting science.

LYNN'S ANTI-FREEZING RAILROAD TANK VALVE AND FEEDER.

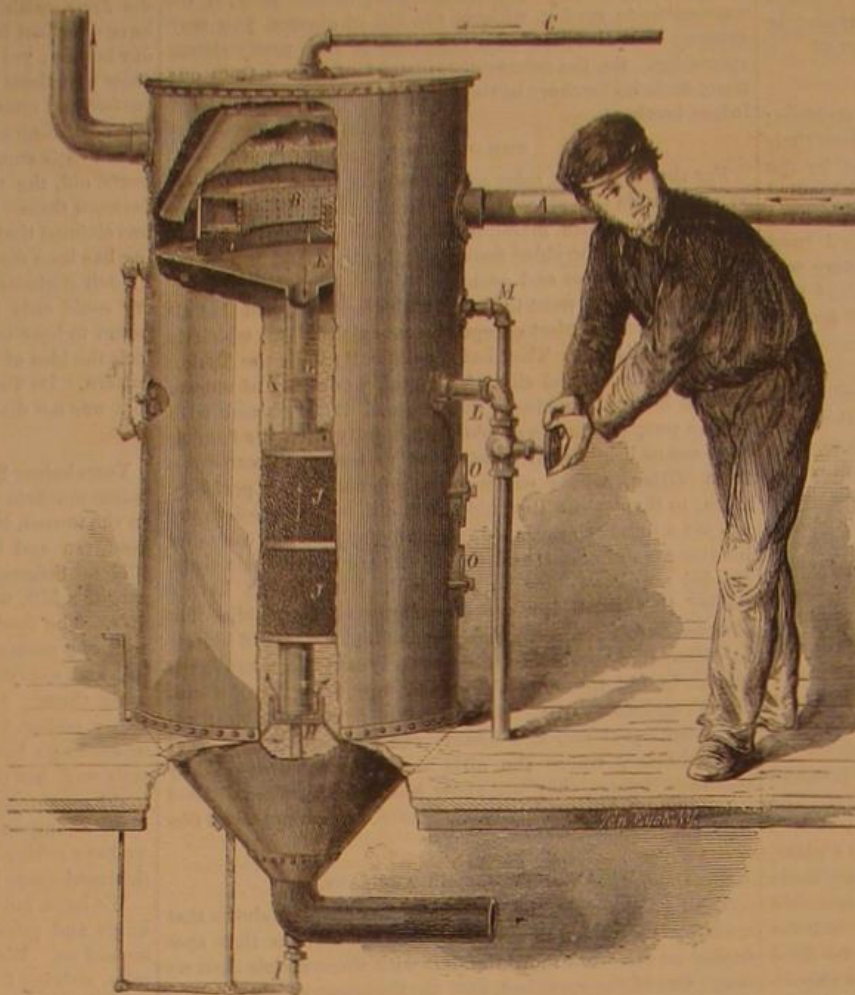
The invention herewith illustrated is an arrangement of the parts of a railroad tank whereby water may be delivered to an engine without requiring the latter to be located at any precise spot near the reservoir, and also an ingenious combination of devices which prevent the flow of the liquid being stopped by freezing.

The outer portion of the spout, Fig. 1, is connected to the part, A, attached to the tank by means of the horizontal hinge, as shown, which allows of its motion in a vertical plane. This outer portion is in two parts, B and C, which are connected by the india rubber bellows, D. Within the flexible joint, and shown through its cut away portion, is a vertical hinge, E, which attaches a double rod, represented in dotted lines in the spout, to the part, C. On this rod the outer section, B, of the spout moves, this motion being allowed by the inner extremity of the latter being attached to the rubber connection. A clearer idea of this arrangement may be obtained from the similarly lettered portions in the horizontal section, Fig. 2. By means of the two hinges and the bellows attachment, it will be seen that the spout may be placed at any angle to suit the location of the engine. The special advantage of the flexible connection and double interior rods is that the portion, B, of the spout may be slightly drawn out, sliding on the rods, in order to adapt it to whatever distance the locomotive may be from the tank.

F is the valve seat on the lower side of the inner end of the pipe, A, which extends into the tank; G is the valve, the rod of which continues up through the tube, H, to the top of the reservoir where it is connected with the lever, as shown. By pushing the valve downwards the water passes with force into the spout, and the latter, acting as a siphon, does not

ascend the tube, H. This device, it is claimed, effectually prevents the valve from becoming clogged or inoperative from freezing, its rod being always free to act. When the valve is closed, whatever may be contained in the box and spout, A, escapes from the exterior open end of the latter.

In order to avoid the stoppage of the flow from a freezing over of the surface of the water, and a consequent shutting

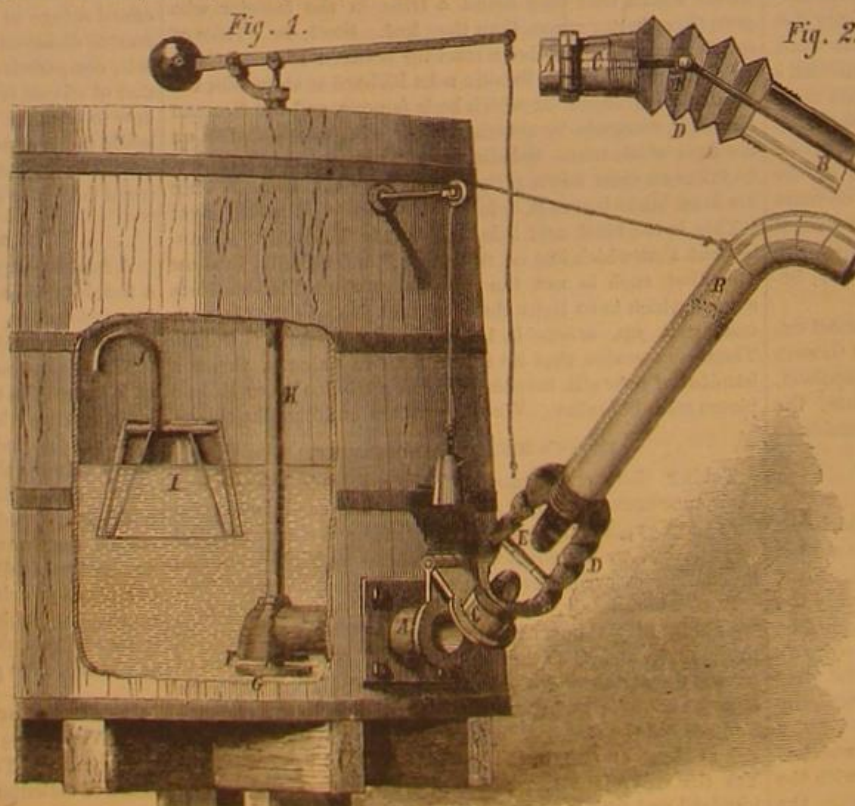


STEAM FILTER AND CONDENSER.

off of access of the air, a float, I, is arranged. The liquid inclosed within the inverted tub is thereby protected and kept from solidifying while air is supplied through the bent tube, J. Further particulars may be obtained of Messrs. M. N. Lynn & Co., New Albany, Ind.

Medical Phosphorus Oils.

According to M. Méhu, sweet almond, olive or poppy seed oils will dissolve easily one eightieth of their weight of phosphorus. He therefore proposes that only one part of phosphorus to 100 parts of oil, instead of two parts as in the French Codex, should be used. Phosphorated oil of this strength is strongly luminous in the dark; but this luminosity may be entirely destroyed by the addition of a small quantity of



ANTI-FREEZING RAILROAD TANK VALVE AND FEEDER.

ether, or of any of the essential oils not containing oxygen, such as bergamot, citron, copaiba, lavender, mace, mustard, rosemary, turpentine, etc. Colza, rape, beechnut, linseed, and brown cod liver oils each dissolve one seventieth of their weight of phosphorus. Castor oil dissolves one part in one hundred and five. Cacao butter dissolves one per cent;

but if a colorless product be required, it should be treated as recommended for the oil of sweet almonds.

Recognition of Vegetable Fibers in Mixed Fabrics

Silk and wool are dissolved by boiling in a 10 per cent solution of caustic soda, while vegetable fibers remain unattacked. When wool is dissolved in caustic alkali, the solution blackens on adding sugar of lead, sulphide of lead being thrown down. The undissolved vegetable fiber is bleached, if colored, with hydrochloric acid and a little chlorine water. It then shows the characteristic property of dissolving in an ammoniacal solution of oxide of copper. If the fabric contains a large quantity of dye stuff, it is better to put it into a mixture of 2 volumes strong sulphuric acid and 1 volume nitric acid, whereby the wool, silk, and dye are all dissolved, and the vegetable fiber converted into gun cotton, which after washing and drying is recognized by its explosive character.

In testing white fabrics, a solution of fuchsin can be employed, which will dye the silk and wool but not the vegetable fiber. Before this test is used, the dressing must be removed by boiling in a dilute solution of sal soda and soap. Enough caustic soda must be added to the boiling fuchsin solution to partially destroy its color and leave it of a light rose red.

To detect wool in silk, a solution of oxide of lead in caustic soda is used, as this will blacken the wool but not the silk. If, on the contrary, you wish to detect an admixture of silk in a woolen fabric, you employ a cold ammoniacal solution of oxide of copper, which dissolves the silk but not the wool. Acids precipitate white flakes from this solution. Wool is also soluble in this solvent when warm, hence the necessity of using the solution cold when separating wool and silk.

Concentrated acids can also be employed, hydrochloric being the best; for they too dissolve the silk while cold, but do not act perceptibly on the wool. The vegetable fibers also remain undissolved. The insoluble fibers are bleached and tested as above given.

The Premature Decay of Timber.

Mr. Hector Orr, in a paper on the above topic, communicated to the *Journal of the Franklin Institute*, gives conclusions drawn from an examination of the timbers of the U. S. ship *Chatanooga*. This vessel was built in Philadelphia, but never left the Delaware. Last winter she was injured by the ice and partially sunk off League Island. Her keel was laid less than eight years ago, but at the present day her timbers are so rotten that they fairly crumble under the touch. Near the forward bends the timbers were doubled. The writer noted one or more instances in which a pine log and a oak log were thus coupled, and the decay had evidently begun at the inner surfaces, which were in direct contact with each other; but even where both logs were of the same wood, the same inward decay appeared. Whether in the undisturbed mass or where pierced with iron or copper fastenings or even with the trenail, the fiber was completely broken up.

The fleet of Commodore Perry, which was built in haste from timber cut on the lake shore for service in the war of 1812, suffered from early rot, so that the vessels were pronounced unseaworthy soon after the peace of 1815. In some vessels a strange tendency to decay has been noticed, indicating a sort of triennial crisis in their early life, which, if passed without injury to the wood, predicted some twenty-five years of wear. Marked instances have been observed in large pieces of timber, such as pillars, girders, and even rafters, that were cased with light boards to improve the appearance of the room, the inner mass being found dangerously rotten. Another important fact is that in portions of the "lining" of vessels covered with zinc or tin, as in provision closets, etc., the decay followed exactly the surface covered by the metal, indicating the action of "dead" air in contrast with that of a free atmosphere on the surrounding parts which remain sound. The hygienic condition of a decaying structure is worthy of consideration. It has been determined that in all well ascertained centers of production and diffusion of yellow fever, three conditions were always present, namely, heat, moisture, and decayed wood. The danger in such a vessel as the *Chatanooga* is obvious. As to moisture, her mere bilge water would furnish this, even without the drippings from tanks and boilers; the heat is insured by her furnaces, which a cruise in the tropics would aggravate, and the rotten wood, as was evident, existed at once in profusion and perfection.

G. W. T. of Mason City, Ill., writes that he observed large numbers of meteors on the evening of November 27. In 55 minutes, 251 were counted.

The Kallistochrome.

This is a new and ingenious form of chromatic top, to which the above name has been given, and is the invention of Mr. J. Beverley Fenby, of Birmingham, England, and although nominally a toy, it is worthy of notice on account of the brilliant chromatic effects it produces. The instrument consists of a well balanced top, which, when spun in the glass cup provided for the purpose, will run from six to eight minutes. On the top of this top can be dropped paper disks variously colored, these disks resembling those used with an ordinary chromatic top. Above the colored disk is placed what is termed a mask, this being a black disk having two triangular openings cut in it. The mask has an india rubber ring on its under side, which rests upon a collar on the spindle of the top while the mask itself is slightly "buckled," so that its surface is not flat. When the top revolves, the mask is carried round also, but the resistance of the air causes the mask to slip slightly on the collar, it thus revolving at a less speed than the top. The effect of this is to produce automatic changes in color of the top as seen through the openings in the rapidly revolving mask. These changes of color are very beautiful, the appearance of the top with some of the disks resembling a mass of brilliantly tinted vapor, which wells up at the center, and gradually changes color as it passes outwards towards the edge of the disk. Other disks produce brilliant rings, ever changing in their tints, and altogether the instrument is one which serves to illustrate some exceedingly interesting optical effects.

Butter Making.

It requires both attention and experience to produce butter in the shortest time. If the cream be too warm, it froths a great deal and a thin liquid appears in the vessel, especially at high temperatures; when the cream is too cold, it froths too, but appears thick, like freshly fallen snow. In the latter case, the cream ought to be warmed, and in the former, cooled. The appearance of the butter globules also serves to indicate whether the cream is too warm or too cool. In the former case, the globules are soft and melting, in the latter, hard; in both cases a slower churning is advisable. Old cream produces butter sooner than fresh. A temperature between 70° and 80° is best in churning, and the cream should be skimmed off. Fresh air and strict cleanliness of the vessels are indispensable.

Telegraphy in the United States.

An interesting report on the subject of telegraphing in the United States, and with special reference to the proposed Government telegraph system, has been lately made by the Hon. David A. Wells. According to the statistics given by him, there are at present \$60,000,000 invested in the business, 80,000 miles of line, and 180,000 miles of wire. This valuable and increasing property it is now proposed to transfer to the National Government.

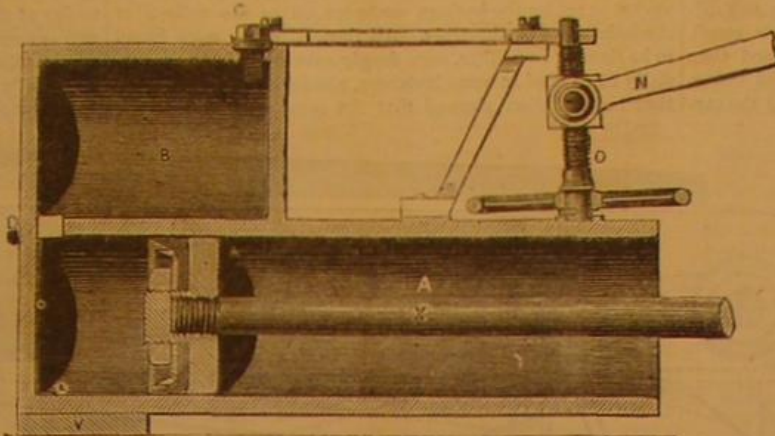
The cost of the British lines was \$40,000,000, and to buy the lines in the United States, not less than \$75,000,000 would be needed. To meet this expense a new national loan would have to be issued. The charge for transmission of messages, which is fixed at twenty-five cents for twenty words in the Washburn bill, and at one cent a word in the Hubbard proposition, would be entirely insufficient to meet expenses. Moreover, as the cheap telegraphing must be counterbalanced by an additional tax upon the people, it is difficult to see where the advantage lies.

In Europe, the government system has been unsuccessful. In 1870, North Germany, Bavaria, Denmark, Spain, and Austria, all had deficits, while the expenses in Great Britain were about \$3,000,000 in excess of the receipts.

With regard to government efficiency, Mr. Wells calls attention to the fact that the post office of the United States is very much inferior to those of foreign nations. We have neither cheap postage nor a strictly honest service, and it is not supposable that any change would be made in these respects when the postal department was charged with the care of the telegraph. In addition, he repeats the arguments which have been so often advanced to show that all steps of this kind are inconsistent with the theory of republican institutions, because they tend toward imperialism.

Statistics of Joint Stock Companies in England.

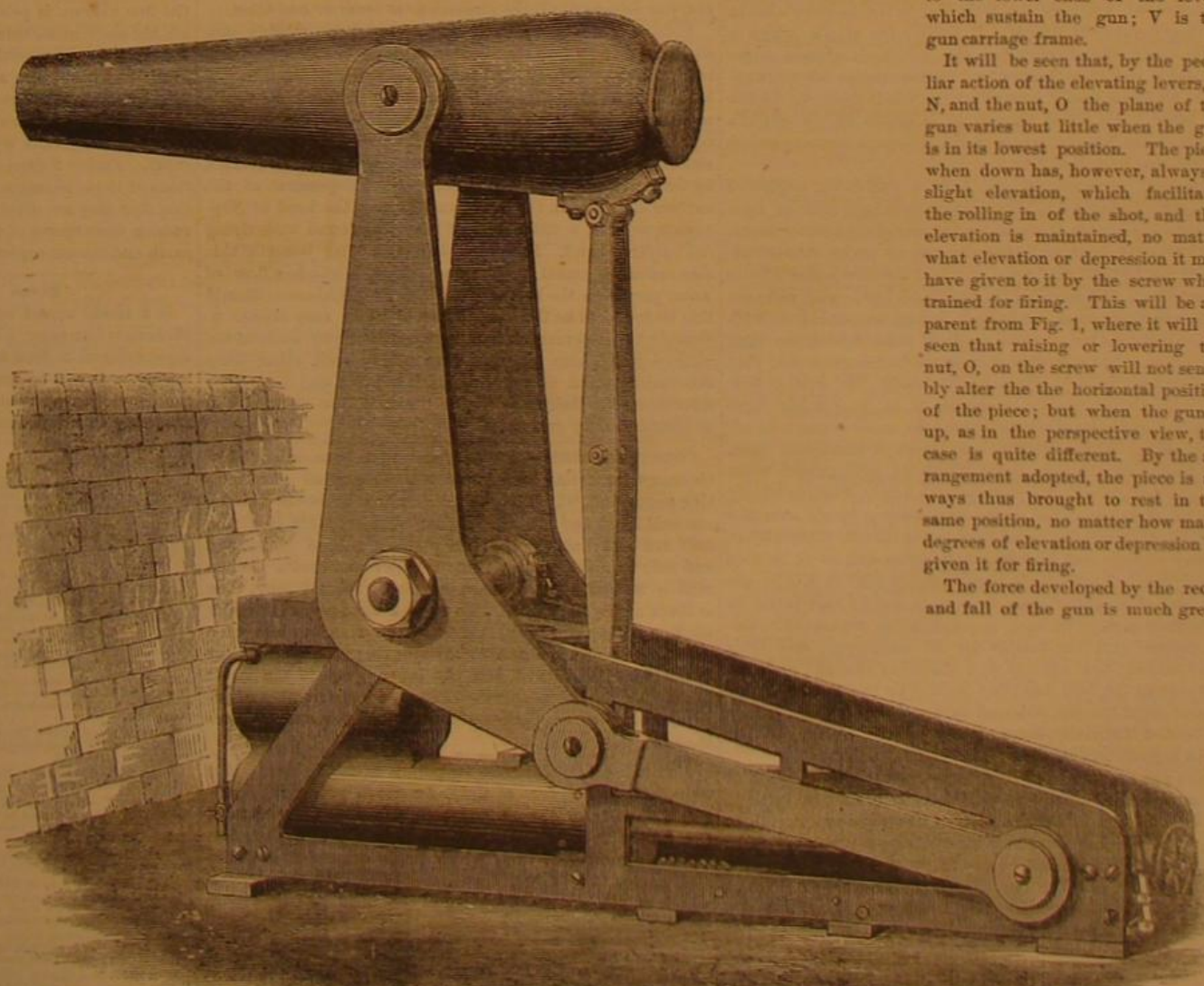
The "Joint Stock Companies Directory" for the year 1873 has just appeared, containing 1,500 pages, embracing the names of all the joint stock companies in England. From this we get some idea of the immense number of stock companies in that one kingdom. First, we find the different railroad companies, such as the Midland Railway Company, which has 15,000 stockholders. The same company has at least as many more employees, making 30,000 persons to whom the welfare of a single company is a vital question.

**PNEUMATIC GUN CARRIAGE AND ELEVATOR.—Fig. 2.**

After the railroads, follow long lists of insurance, banking, contracting, navigation, dock, hotel, mining, water, gas, and general companies. The *Echo* has counted the names of all the directors and finds them to number 10,500! If we suppose that each of these directors draws but \$750, then the total sum paid them equals \$7,875,000, which represents a capital of \$150,000,000 at 5 per cent. Besides, as a rule, the directors draw \$1,000 to \$1,500, and railroad directors draw a salary of \$2,500. In this way an idea may be formed of the immense extent of stock enterprises in England.

A Gigantic Barometer.

A huge barometer, the face of which is four feet in diameter, is now being erected on the facade of the Paris Bourse. The instrument proper is an ordinary sized aneroid, the movements of which are transmitted, by ingenious mechanism, to a train of clockwork which is wound up monthly. The clockwork actuates the great needle on the exposed face. *Les Mondes* suggests that it would be an excellent idea to place such barometers at the entrances of harbors, so that masters of vessels leaving the port might be able to determine, with reasonable probability, the coming weather.

**PNEUMATIC GUN CARRIAGE AND ELEVATOR.—Fig. 1.—[Designed by Captain James B. Eads, St. Louis, Mo.]****PNEUMATIC GUN CARRIAGE AND ELEVATOR.**

Captain James B. Eads, whose name is best known in connection with the great engineering work he is now successfully bringing to a conclusion—the railway and road bridge over the Mississippi at St. Louis—has recently designed a gun carriage for working guns *en barbette*, in which the force of recoil and the weight of the gun are employed to compress air in a suitably designed receiver, where it is stored up and used when the gun is to be elevated. Working models of this carriage have been tested at Washington with success,

both as to their efficiency in rising and falling, and also as to their capacity for remaining depressed for prolonged periods without losing the power necessary again to raise the gun. The engravings, for which we are indebted to *Engineering*, are taken from a working model for a 15 inch United States army gun, and made one twelfth of the full size; the total fall of the gun in the model is 10 inches, representing a depression of 10 feet in the actual piece.

The action of the carriage is dependent simply upon the compression of air in a receiver, effected by the downward motion of the gun, transferred to a piston rod and leather-packed piston, which works to and fro in a cylinder open at one end. Water or glycerin is admitted behind the piston in order to maintain a tight joint, and in sufficient quantity to fill the space between the end of the cylinder and the piston when the gun is in its lowest position. The quantity of water would be varied with the powder charges employed; with heavy charges the quantity of

water is increased, in order to produce a greater degree of compression in the air.

The chief features in the details of the carriage are the elevating and depressing gear for training the gun, the arrangement for locking and retaining the gun, when down, against the force of the air compressed in the reservoir, and the friction gear.

The engravings annexed will fully explain the construction of the carriage. Fig. 1 shows the gun above the parapet ready for discharging. Fig. 2 shows the air pump and cylinder for elevating the gun; and Fig. 3 shows the gun after recoil, in loading position beneath the parapet. A is the cylinder to receive water to assist in increasing the air pressure when necessary; B is the air chamber; C is an inlet closed with a screw plug for introducing water; K is a lever for working a ratchet arrangement or lock, by which the gun is locked in loading position when thrown down by the recoil; N N are connecting rods for elevating and depressing the gun before firing, and also for preserving its horizontal position when in the act of descent; O is a nut on the elevating screw, jointed to the rods, N N; P is a friction plug fitting into a wood-lined socket in the crosshead, which is attached to the piston rod and connecting straps, U; these straps are jointed to the lower ends of the levers which sustain the gun; V is the gun carriage frame.

It will be seen that, by the peculiar action of the elevating levers, N N, and the nut, O the plane of the gun varies but little when the gun is in its lowest position. The piece when down has, however, always a slight elevation, which facilitates the rolling in of the shot, and this elevation is maintained, no matter what elevation or depression it may have given to it by the screw when trained for firing. This will be apparent from Fig. 1, where it will be seen that raising or lowering the nut, O, on the screw will not sensibly alter the horizontal position of the piece; but when the gun is up, as in the perspective view, the case is quite different. By the arrangement adopted, the piece is always thus brought to rest in the same position, no matter how many degrees of elevation or depression be given it for firing.

The force developed by the recoil and fall of the gun is much great

er than is required to bring it back to the elevation from which it falls. A part of this force is, however, given off by the cylinder and piston in the form of heat, otherwise the gun would be thrown up with great force; part of the force is also converted into heat in compressing the air in the cylinder, and as this heat is quickly absorbed, the latter is incapable of expanding to its original volume when the gun is thrown up. Hence the latter part of the stroke of the piston is made against an external atmospheric pressure, and tends to bring the gun gradually to rest as it rises above the parapet. If the gun is not down long enough for this heat to be lost, it comes up with greater energy. To equalize any differences of air pressure and also to prevent counter recoil, which would ensue if elastic buffers were used, and thus probably cause the gun to fall after it came up and before firing, the friction plug, P, is secured to the rear of the carriage, and enters a corresponding socket in the crosshead. This socket is lined with wood, and the plug can be advanced or withdrawn by the screw and wheel, Q, according to the amount of resistance found desirable to check the gun. When the plug enters the socket, the gun is securely retained until it is loaded and ready to be raised. This insures the cylinder being filled with air, and prevents the possibility of a vacuum after the gun is up.

The gun, when thrown down, is held against the reactive force of the air by a peculiarly arranged pawl and ratchet gear. The ratchet is fastened to the underside of the crosshead, with teeth inverted, and the pawl is retained in its upward position by a spring.

The Money Value of Intelligence.

Every thoughtful man recognizes the money value of intelligence in a community. It is for this, in part, says the *Country Gentleman*, that the State builds school houses and furnishes free education to the masses. "Knowledge is power," even the ignorant respect it, and pay it many an involuntary compliment. The power consists in the ability to better one's condition more rapidly; and in doing that—such are the relations of men to each other—they usually benefit all around them. The improvements on a piece of real estate do not affect the owner alone, but indirectly extend to the neighborhood, and next find their way to the assessor's books and thus benefit the nation. It is like the ripple which a pebble starts when thrown into the water—it spreads wider and wider, and though after awhile the visible effect disappears, we know that it does affect the whole body, no matter how large. So when something is added to the world's wealth, it benefits the whole world, although we may not be able to trace its full effects.

When an enterprising man buys a run down, neglected farm, with rickety and dilapidated buildings, and at once proceeds to improve it, clears up the unsightly fence corners, drains the wet land, pulls out stumps or rocks, moves the barn to the back of the house, and sets the new house a little distance back of the highway, lays out a lawn with pleasant walks and shade trees and hedges; brings blooded stock with him, and causes his acres to produce three fold more than ever before, what man so stupid as not to recognize that that is a pecuniary gain to the neighborhood? No matter how selfish the owner may be at heart, if he makes his farm more valuable, he does the same, to some extent, to all around him. The neighbors like to see a handsome farm near them even if they never think of selling, and when they do try to sell, the prospective buyer will invariably have his attention called to the handsome property over the way, or which adjoins, or at least is not far off. Speculators holding unimproved land like nothing so well as to be able to say (because nothing is more potent) that it lies in the very best of neighborhoods, is surrounded by rich farms in the highest state of culture, in a delightful region of walks and drives; that the people are all intelligent, and their tastes refined; that schools and churches abound; and that the value of the land has been proved by the extraordinary yield of crops on the adjacent farms. When these things can be said truthfully, sales are comparatively easy, and that at the highest prices.

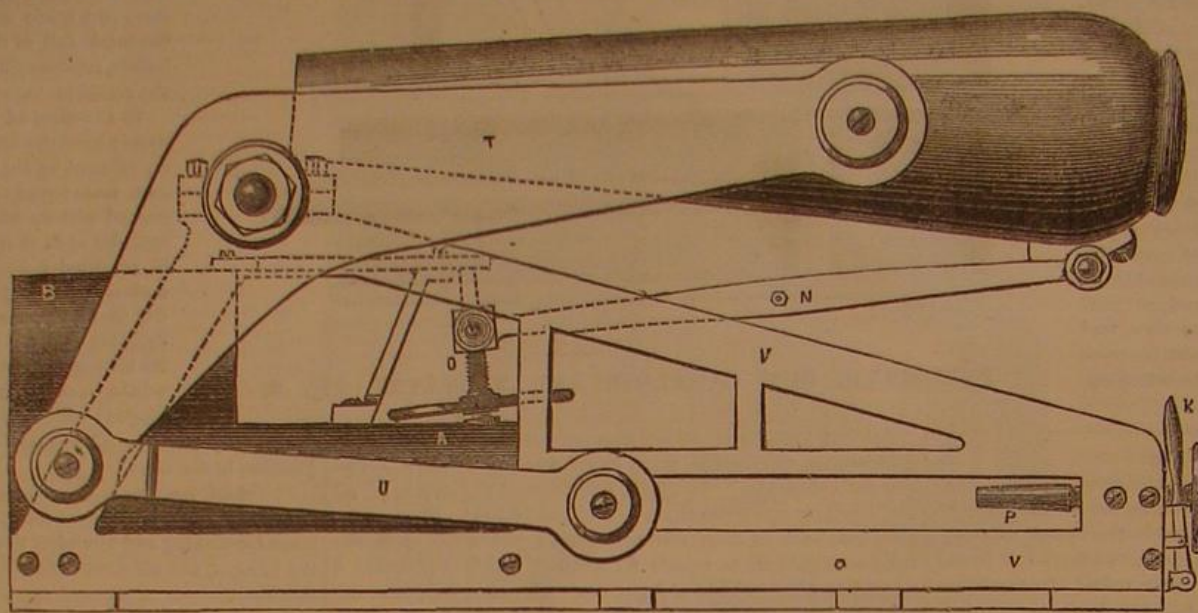
Does not every enterprising farmer see then—as well as those who are not farmers—that there is a money value in intelligence, and that the rapidity of its spread concerns them very closely? Improvements on one's own place are well, wise and admirable; but so are improvements around you. There should be, then, no neglect of the means. Every agency which will promote farm intelligence should be employed and kept up.

Submarine Water Supplies.

Yonkers is an enterprising city, just north of New York, on the Hudson river, and the municipal authorities have lately been exercised upon the question of a water supply. Through Yonkers runs a small river called the Nepperhan,

which empties into the Hudson. Professor Newberry, of Columbia College, has been consulted in the matter, and in his report he gives the following interesting information:

Before any plan is adopted for supplying the city of Yonkers with water, I would strongly recommend that a thorough exploration be made of the materials which occupy the bottom of the rocky valley of the Nepperhan, and underlie, perhaps very deeply, the present stream. It is probably known to you that most of the draining streams of all the region between the Mississippi and the Atlantic are now running far above their ancient beds. This fact was first revealed to me by the borings made for oil in the valleys of the tributaries of the Ohio. All these streams were found to be flowing in valleys, once deeply excavated, but now partially filled, and in some instances, almost obliterated. Further investigation showed that the same was true of the



PNEUMATIC GUN CARRIAGE AND ELEVATOR.—Fig. 3.

draining streams of New York and the Atlantic slope. For example, the valley of the Mohawk, for a large part of its course, is filled with sand and gravel to the depth of over two hundred feet. In the Hudson the water surface stands now probably five hundred feet above its ancient level—the old mouth of the Hudson and the channel which leads to it being distinctly traceable on the bottom nearly eighty miles south and east of New York. The excavation of these deep channels could only have been effected when the continent was much higher than now. Subsequently it was depressed so far that the ocean waters stood on the Atlantic coast from one hundred to five hundred feet higher than they now do. During this period of submergence the blue clays in the valley of the Hudson—the Champlain clays—were deposited, and the valleys of all the streams were more or less filled.

Following the general rule, the Nepperhan probably once discharged itself into the Hudson at least one hundred feet below its present level, and the old valley in which it flowed is perhaps filled to this depth for some distance above its mouth. It is also probable that a portion of the material occupying the bottom of the old valley will be found to consist of sand and gravel, saturated with water and traversed by drainage currents which are quite independent of the surface stream. In the boring made near the head of Nepperhan avenue, a thick bed of clay was found underlying the surface gravel. It is almost certain that beneath this clay are sand, gravel, or boulders, through which a flow of water passes on the bed rock toward the Hudson. Should this be found to be the case, it would be an easy matter to construct a subterranean dam between the rocky walls of the valley—which here approach very near to each other—stop this underground flow and pump it out for city use, either directly by the Holly process, or throw it into reservoirs to be distributed by gravity.

COLOR BLINDNESS.—An instrument has been invented in Germany for testing color blindness. It consists of a rotating apparatus, which moves a disk whose center is a circle, one half black and the other white; outside of this is a ring half red and half green, then another ring of violet and red, then the outside ring of violet and green. When rapidly rotated, the center appears to be colored gray, then is black and white mixed. To a green blind person the middle line will appear gray, that being the result to him of a mixture of violet and red. The outer ring will appear gray to the red blind patient, and the inner, gray to the violet blind. By the use of this instrument, a large number of patients may be simultaneously examined for one or more kinds of color blindness.

A BILL is before Congress to permit scientific institutions to import alcohol, free of duty, for use in preserving specimens. Professor Agassiz appeared before the Congressional Committee to advocate the measure, and stated that, last year, the institution with which he is connected, Harvard University, Cambridge, Mass., used five thousand dollars' worth of alcohol, and he thought that about as much more was annually used by other institutions.

SIR G. C. COWELL states that he witnessed the explosion of a fire ball, which seemed to be about twelve feet in diameter, near the Great Western railway at Slough, England, on November 30, 1872, at 2.30 P. M. The report made was similar to that of a heavy gun, and the ball burst, on reaching the ground, like a well timed shell.

Meteorological Phenomena.

Father Sanna Solaro, in a communication to the French Academy of Sciences, takes an interesting and comprehensive view of meteorological phenomena. He says that if we consider the sun as the principal source of terrestrial and atmospheric electricity, we can consistently explain the most difficult phenomena of meteorology. The sun being the cause, we can account for the extreme violence of electrical phenomena in the tropics and especially at the time of the equinoxes. Hence the terrible cyclones, which mere differences of temperature cannot explain. The excess of electricity of those regions, striving to re-establish its equilibrium, causes the air to flow towards the temperate zones. The whole column of air over the tropical zone being more powerfully electric than the balance of our atmosphere, it is but natural that the electricity in the higher and more rarefied regions should flow off towards the poles and manifest itself under a luminous form. Hence auroras are most frequent too at the time of the equinoxes.

When electricity is developed in an electrical machine, it accumulates in the prime conductors and pushes away the air from them in order to escape. What then must be the effect of the immense oceans of electricity accumulated above our heads? It is here that we must look for the cause of barometric variations, and we will then understand why the barometer falls rapidly at the approach of the center of a cyclone, and why it sometimes rises suddenly after a clap of thunder. The daily and the yearly variations of the barometer, like those of the compass, are small at the equator, much more sensible at mean latitudes and almost zero in winter at high latitudes.

It has been known for some time that when the barometer rises considerably, the thermometer falls a few days after. On the supposition that the depression of the barometer is due to an accumulation of electricity, it will be easily understood that the electricity, escaping by puffs, cools the air in proportion to its own tension; the barometer will rise at once, while several days will be necessary to transmit the lower temperature to the thermometer.

Earthquakes are of two kinds; one of them originates in the interior of the earth, while the other, and by no means the less violent, is produced upon the surface. The latter are the more numerous. They are frequently preceded by noises in the air resembling rumblings of thunder or the unloading of pebbles on a stony road; they are often accompanied by luminous phenomena, and, for the most part, nothing can be heard below the surface of the earth. On one occasion, the shocks were not perceptible in the cellars and caves. Father Solaro states that frequent personal observations of these phenomena have forced upon him the conclusion that they are often due to atmospheric waves caused by sudden disturbance of the electrical equilibrium between the earth and the atmosphere.

Fires and their Causes.

In a recent report of the Boston Manufacturers' Mutual Insurance Company, a list of the fires by which that corporation suffered in 1872 is given, from which we take the following. It will be found interesting as showing the many causes which may produce fires, and shows the great care necessary in all manufacturing establishments to prevent combustion.

- 1872.
- January 1.—Lyman Mills, Holyoke, Mass., picker No. 1. Fire was discovered in a pocket or bin in cotton from a Kitson willow at about 9 o'clock A. M., attributed to foreign matter in the cotton. Loss \$450.
- January 8.—Glasgow Co., So. Hadley Falls, Mass. Fire in the gas house, from an escape of gas. It was caused by one of the workmen entering the gas house with a lighted lamp, there being no ventilator. Loss about \$3,300.
- January 9.—Woonsocket Co., Woonsocket, R. I. Fire in the office and store building, supposed to have been the result of thieving in the store, the thieves firing the store, accidentally or otherwise. Loss total.
- January 9.—Utica Steam Cotton Company, Utica, N. Y. Fire in No. 2 picker room. On opening the room in the morning, fire was discovered running over two laps which were in contact with a steam pipe. There seems to be no doubt that we have here a clear case of ignition of what is usually clean cotton by the heat of ordinary steam pipes.
- January 17.—Methuen Company, Methuen, Mass. Fire in jute card room, discovered on the apron of a picker, and as the stock had not entered the machine, it was attributed to matches. Extinguished by sprinklers. Loss moderate.
- January 19.—Stevens Linen Works, Dudley, Mass. Fire in a jute card room, caused by a boy bringing some stock into a gas flame. Extinguished by steam. Loss \$250.
- January 31.—Salsbury Mills, Salsbury, Mass. Fire in a wool dry room, at about 7.40 P. M., attributed to spontaneous combustion. Loss about \$21,000.
- February 27.—Harmony Mills, Cohoes, N. Y. Fire in a store house; discovered by the watchman at 1.30 A. M. In the center of a pile of 2,000 rolls of jute cotton bagging. Caused by spontaneous combustion, probably from oil used in working the jute. Loss to the office, \$1,900.
- March 11.—Kearsarge Mills, Portsmouth, N. H. Fire in the picker room from foreign matter in cotton. No claim made.
- March 13.—Whittenton Mills, Taunton, Mass. Fire in a Kitson compound opener in picker No. 2, at the 3d beater, and supposed to be caused by winding of cotton around feed rolls, the same being ignited by the beater. Sprinklers, steam, and extinguishers used in putting out the fire. Loss \$350.
- March 18.—Newton Mills, Newton U. Falls, Mass. Fire in a section of cards not at work, attributed to friction of loose pulleys. Extinguished by buckets and hose. Loss, chiefly on card clothing, \$230.
- March 22.—N. Andover Mills, N. Andover, Mass. Fire was discovered by the watchman, at about 4.30 A. M., in the attic, and about half an hour after delay in giving an alarm was caused by the burning off of the bell rope, and the alarm when given was mistaken for the burning of the mill and help was slow in coming. Result, the burning out of the three upper floors of the mill and spontaneous combustion in wool, or the carelessness of the watchman. Loss about \$100,000.

March 29.—Steam Woolen Mill, Catskill, N. Y. Fire in picker room, originating in a wool picker, probably from foreign matter in the wool. Loss about \$1,500.

April 22.—Amoskeag Mills, Manchester, N. H. Fire in No. 5 picker, discovered by a fireman, probably from foreign matter in the cotton. Extinguished by the sprinklers. In pulling over the cotton the fire broke out anew, and the sprinklers were applied again. There were 21 bales of cotton in the room. Loss only \$460.

April 29.—Southwick Mill, Milford, N. H. Fire was discovered by the watchman, in the basement, at about 1:30 A. M. The watchman changed at 12:30, and the fresh man says he passed through the basement about 1 o'clock when all was right; about 2 1/2 minutes later he saw the fire from the boiler house, and went for the agent. When the latter reached the mill, he found so much smoke in the next room above the basement that he could not get at the pump fixtures, and the fire was so located in the basement as to prevent reaching the pump in that room, and it was not started at all. At this time the fire was among about one hundred sets of nearly new harnesses hanging in the usual manner overhead in the basement. Whether the fire originated in these harnesses, or was kindled accidentally by the watchman, or was the work of incendiaries, may never be determined. Loss total, or \$100,000.

May 2.—Fall River Print Works Mills, Fall River, Mass. Fire broke out in the center of a sharp & Roberts mule carriage, about one hour after starting work in the morning, probably from a dry step on an upright shaft, and ran both ways. After ineffectual efforts with buckets, the pumps were started and the mill pretty thoroughly drenched. The damage was considerable, both from fire and water, the latter chiefly on cards, etc. In the lower room, one pair of mules destroyed, all rollers uncovered, etc., besides the loss of most of the window glass and sash, and the whole amounted to \$3,485.95.

May 6.—Chas. Wilds, Valatie, N. Y. Fire in an English opener at 6:15 A. M., supposed to have been from foreign matter in cotton. Loss small.

May 17.—Cocheco Mills, Dover, N. H. Fire in a mule carriage from friction. Put out by buckets of water. No claim.

May 18.—Greenwoods Company, New Hartford, Conn. Fire in a first picker at second beater, from foreign matter in cotton. Beater blade roughed up, but nothing found. Put out by pails of water. No claim.

June 23.—Stillwater Woolen Mill, Smithfield, R. I.—Fire was discovered at about 10:30 A. M. of Sunday. The mill was nominally watched on Sunday, but on this day the watchman was permitted to leave his charge to attend church, and the fire was seen from a dwelling (about half an hour after the man had reported all safe), and in the second story of the wing, and as the day was warm, the doors of the mill above the first story were all open, and the doors to the elevator open also, and the fire after getting headway rushed up and through the mill without hindrance. There was a good organization connected with the force pumps, and the fire fixtures were esteemed better than an average, but all the men who belonged to this organization were out of the village at the time of the discovery of the fire, as was the agent also. The efforts of the men not used to the pumps resulted in breaking the main gear of the wheel, and the mill was totally destroyed in about 45 minutes. Cause, spontaneous combustion in bags of shoddy stored in lower story of wing. Loss to Mutual Companies, \$100,000.

June 25.—Slater's Mills, Jewett City, Conn. The superintendent reports two fires in the picker room on a Saturday night, within an hour of each other. An examination of the cotton delivered from the opener resulted in finding matches, which they thought had passed through without ignition. Put out by "extinguishers" without loss.

July 20.—Stark Mills, Manchester, N. H. Fire in picker of No. 2 mill, in a bin which received the cotton from a willow, and attributed to foreign matter in the cotton. The alarm being given, an effort was made to let water into the sprinklers by turning the valve which the wrong way, and persisted in until the valve stem twisted off. The fire was subdued by streams from the hose after getting well advanced. Loss made up at \$1,940.

August 21.—Dodgeville Mill, Attleborough, Mass. Fire was discovered about 5:30 A. M., in the gauge room of the picker house, supposed to have been caused by a spark from the chimney alighting on the ventilator of gauge room and working its way downwards into the cotton. Extinguished by steam. Loss moderate.

August 21.—Cocheco Print Works, Dover, N. H. Fire in dust house of singeing department, caused by a spark from the singeing machine. No claim made.

August 29.—Wamsutta Mills, New Bedford, Mass. Fire in the picker room of No. 3 mill, first seen on the floor under an apron, and spread soon all over the room. Extinguished by steam, sprinklers, and hose. Cause not ascertained. Damage, \$1,000 to \$1,200.

September 11.—Stevens Linen Works, Dudley, Mass. Fire in lute card room, supposed to have been caused by matches. Extinguished by sprinklers and hose. Loss about \$711.

September 11.—Lonsdale Mills, Lonsdale, R. I. Fire in No. 3 picker house, cause not known. Loss about \$1,000.

October 17.—John S. Brown, Fisherville, N. H. Fire found in the gauge room of east picker, attributed to foreign matter in cotton. Extinguished chiefly by "chemical fire engine," sprinklers and hose were also used, but probably unnecessary. Loss \$450.

October 18.—Lancaster Mills, Clinton, Mass. Fire in opening machine, caused by matches. Extinguished in season to prevent loss.

October 24.—Washington Mills, Lawrence, Mass. Fire in cotton picker, caused by a piece of flint stone passing through the opener. Extinguished by sprinklers and hose. Loss \$446.

October 24.—Bates Mills, Lewiston, Me. Fire in No. 2 picker in a Creighton opener, caused by winding up of roving waste which fired by friction. Extinguished by sprinklers. Loss \$723.

November 4.—U. S. Flax Company, Lincoln, R. I. Fire in cotton picker room in stock passing through a Wilson whizzer, and caused by matches. Extinguished by steam and sprinklers. Loss about \$1,000.

November 4.—Cocheco Print Works, Dover, N. H. Fire in engraving shop by spontaneous combustion in a heap of dirty neglected rags. Put out by watchman with a pail of water. No claim made.

December 7.—Greenwoods Company, New Hartford, Conn. Fire in picker room of warp mill, caused by the friction of a belt on its enclosing box. The fire being out of sight, much water was thrown in and the stock damaged thereby. Loss not large.

It will be observed that the pickers still keep up their reputation as the most frequent originators of fires, 18 out of 35 having been in that department. There are also several cases of spontaneous combustion, and woolen manufacturers should be warned by the case at Stillwater. The attention of all is directed to the case of firing of cotton laps by steam pipes in the Utica mills, as one to which very many concerns are liable, from the practice of allowing combustible matters to remain in contact with steam pipes. The sprinklers alluded to consist of perforated pipes placed on the ceilings, through which water is sent in case of fire.

Facts for the Ladies.—Mrs. Rev. W. V. Milligan, Cambridge, Ohio, has saved with her Wheeler & Wilson Lock-Stitch Machine hundreds of dollars in the last ten years without a cent for repairs. See the new Improvements and Woods' Lock-Stitch Ripper.

PATENT OFFICE DECISIONS.

IMPROVEMENT IN INDEX LAMPS.—HENRY H. BLAKE.—FORFEITED APPLICATION.

TRACHEE, Acting Commissioner:

The only date that can be regarded by the Office as entirely reliable is that of filing, as indicated by the official stamp upon the paper. As this was more than two years subsequent to the last official action on the application, and no explanation of the delay is offered, the Commissioner is left by the law without discretion in the matter. The application must be treated as abandoned under the provisions of section 32, act of 1870.

IMPROVEMENT IN HORSE RAKES.—GRANTED TO HARVEY W. BARN, DECEMBER 3, 1870.—CALISTA E. COX, EXECUTRIX.—PRACTICE UNDER RULE 41.—REISSUES.

TRACHEE, Acting Commissioner:

It has been urged that the practice should be relaxed in this instance, as the claims, or at least some of them, have been sustained by United States Courts. I do not think this position is tenable. The law makes no exception whatever in reissue applications. Section 54 of 1870, relating to reissues, provides that "the specification and claim in every such case shall be subject to revision and restriction in the same manner as original applications are." Now the claims have been sustained by constraining them as claims for devices, and although under a former more lax practice they were granted without objection, now that they are before the Office again, in an application for reissue, they are undoubtedly subject to revision, and should be amended to conform to the decisions of the courts and the present practice of the Office. This objection of the Examiner is therefore sustained.

[TOOL HANDLE OR HOLDER.—WM. W. DRAPER.—EXTENSION.

TRACHEE, Acting Commissioner:

This case, although very well presented before the Office, does not appear to be a strong one in the essential facts requisite to warrant the grant of an extension. The invention consists of a tool holder intended to center, clamp, and secure the tang of a file or other tool, and is adapted to apply to tools of varying sizes.

I am not favorably impressed with the contract by which it is proposed that the inventor is to obtain the adequate remuneration which it is alleged he has thus far failed to receive. The assignees or licensees engage to supply the market, but there is no evidence that there is any demand in the market for this particular tool holder. On the other hand, there is evidence that the main reliance for profit is upon suits for infringement of the "prior claim" of construction embraced in the first claim, which would avail the inventor nothing. Twenty-five per cent of the net profits of manufacture, after deducting the expenses of extension, do not, under the circumstances of this case, promise the inventor adequate compensation. Altogether the case does not seem to me to be one in which, upon the evidence adduced, as a proper one, having due regard to the intent of the law and the interests of the public, to warrant the grant of the extension sought and it is therefore refused.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

METHOD OF PRESERVING FISH.—ENOCH PIPER vs. GEORGE T. MOON et al.

BLATCHFORD, Judge:

The patent to the plaintiff, granted March 18, 1861, is for an "Improvement in Method of Preserving Fish."

The claim is for "preserving" fish or other articles in a close chamber by means of a freezing mixture, having no contact with the atmosphere of the "preserving" chamber, substantially as set forth.

The specification of the patent, in describing the process claimed, describes the process previously used for preserving frozen ice cream. All that the patentee has done, according to his claim, is to take the frozen ice cream out of the vessel and put into it a fish or other article, frozen or unfrozen. That is no patentable invention. If the process of preserving the frozen ice cream had not existed previously, the use of such process, in the manner stated, would be within the claim of the patent, and would be an infringement of it. The prior use of such process must, therefore, be an anticipation of the claim of the patent at least in a case like this.

The patentee may be the first person who has practically succeeded in introducing into the market, at all seasons, salmon as fresh as when first caught, and may thus have supplied a great desideratum and have established a business that is commercially profitable. He may have invented something, in that connection, which is capable of being protected by a patent, and he may have described in this specification, or shown in the model or drawings accompanying it, something which may be claimed, and well claimed as an invention, and which may be secured to him by a reissue. But the difficulty with the present claim is that it is too broad, and that it covers nothing but a process, and that a process practiced before, substantially in the same manner set forth in the specification.

For these reasons the bill must be dismissed with costs.

M. E. Andrus and Broome & Holmes, for complainant.
W. C. Witter and George Gifford, for defendants.

Recent American and Foreign Patents.

Improved Vapor Stove for Heating Soldering Irons.

David Berkey, Huntington, Ind.—This invention has for its object to furnish an improved vapor stove or fire pot for tinners' use for heating their soldering irons. The body of the stove is made of any sheet metal in the form of an inverted frustrum of a cone. The body is provided with a conical cover, terminating in a neck to receive the smoke pipe. The reservoir to contain the kerosene or other light hydrocarbon is supported by rods. From the reservoir a pipe leads downward, and is then curved to enter the lower part of the stove. To the end of the pipe is attached a semicircular piece of pipe. To the other end of the semicircular pipe is attached a short piece of pipe, which is bent into such a shape that its other end, to which the burner is attached, may be directly beneath the center of the curved pipe so that the flame from the said burner may strike the said pipe and vaporize the liquid before it passes to the burner. The burner is made in the form of a short tube, and with a number of small holes in its closed upper end. A disk fits into the stove and has a slot with flanged side edges formed in it. It is so adjusted that the slot may be longitudinal with the semicircular pipe, the flanges of said disk overlapping the sides of the said pipe so as to collect the heat from the burner and guide it through the slot in the said disk so that it may come into direct contact with the copper tubes placed above and upon the disk; and its open ends communicate with holes in the side of the stove through which the irons are inserted to be heated.

Improved Corn Husker.

John M. Carlisle, Sumter, S. C.—This invention has for its object to furnish an improved machine for separating ears of corn from their husks, enabling the work to be done faster than it can be by hand, saving the hands of the operator from injury, and leaving the husks in fine condition for being fed to stock. In using the machine the ear to be husked is laid upon the rest with its stem forward, and is pushed forward till stopped by the stop claw. The spring lever holder is then lowered to hold the ear, and the sash is forced downward. By the downward movement of the sash the stop claw is withdrawn, the knife cuts the ear from its stem, and the husks are slit longitudinally, by the points as they are drawn back along the ear by the rearward movement of the head block, and drop from the ear, which is then removed from the rest and placed in a basket or other receptacle. The sash is then raised and the machine is ready for another ear.

Improved Spectacle Frame.

Julius King, Warren, O.—A difficulty has heretofore been experienced in joining the bow to the bridge, or nose piece, in manufacturing steel frame spectacles. By making the bridge of silver, gold or other non-oxidizing metal, the soldering of such metal to the steel is done at much lower temperature, and prevents burning, which renders ordinary steel frames very brittle. By the use of a combination of metals, greater strength is obtained, and the liability of the bridge to oxidation is prevented. Mr. King is a practical optician, and author of a chart by the use of which persons are enabled to determine the focus of their sight, and thus be readily fitted with glasses of the number they require.

Improved Cartridge Loader.

Joel S. Warner, Ogdensburg, N. Y.—The object of this invention is to produce a portable device but little larger than the cartridge shell for placing the wads therein, and the invention consists in a tube counterbored to fit over cartridge shell and provided with a spring plunger very effectively applied.

Improved Glove.

James F. Mason, Johnstown, N. Y.—This invention relates to that class of gloves which are made partly of leather and partly of cloth, and known as "combination gloves," and consists in the patterns and in the glove made therefrom.

Improved Steam Boiler.

Atwood Wigzell, Halifax, England.—This invention relates to the construction and general arrangement of steam boilers, having particular reference to the class known as "sectional steam boilers," and consists in a series of conical tubes attached to or forming a part of horizontal parallel tubes upon the sides of the boiler, the said conical tubes being so arranged that the tubes of one part fit between the tubes of the other part, thus forming one or more horizontal tiers of these conical tubes, two or more such tiers being contained and operating in combination with a steam chamber.

Improved Adjustable Pipe Tongs.

William Kearney, Belleville, N. J.—This invention relates to improvement in pipe tongs, of the class in which one jaw is made adjustable by means of a screw, but is more particularly a modification of a device described in the patent of H. N. Smade, dated August 29, 1871. The object of this invention is to provide an adjustable jaw which shall be capable of adapting itself, within moderate limits, to the object to be seized or held, and of being readily adjusted to various positions.

Improved Awl.

Godfrey K. Mellor, Woonsocket, R. I.—The lower part of the awl is made with two or more sides, each side being grooved. The grooves extend to the pointed end. By being thus grooved, the awl forms several sharp edges at its sides which cut easily through the leather, and which, therefore, make it easier to use the improved awl than the awls in common use.

Improved Slide Valve.

Peter Feartree, Lansingburg, N. Y.—This invention has for its object to furnish an improved device for operating the valve of a steam engine, which shall be so constructed as to enable the steam to be cut off at any desired part of the stroke, and which will operate the valve so as to give a lead, which may also be regulated at will.

Improved Pruning Shears.

Oscar Chase, Rutland, Ohio.—This invention has for its object to furnish an improved pruning shears, so constructed as to cut the bows with a circular or drawing cut, so as to do its work easier than when the cut is made in the ordinary manner, and which may also be used with equal advantage for cutting bolts and other articles of iron or other metal; and it consists in the continuation of the handles, one of which is provided with a hook, guide arm, and stop, and the cutter and the link slotted in its inner end and provided with a finger or cam.

Improved Boots and Shoes.

Robert Somerville, Sandusky, O.—This invention consists in the use of wire gauze cloth for the uppers of boots and shoes. The principal advantage of this shoe is that it gives the foot free ventilation, and it is sufficiently pliable to allow free action to the foot.

Improved Picket Fence.

Joseph White, Pilot Point, Texas.—This invention has for its object to furnish an improved picket fence, which shall require a comparatively small amount of timber, can be easily repaired, and cannot be rubbed down by the stock, and it consists in the construction and combination of the various parts of the fence, so that all may incline laterally, and the timber may be made light, and at the same time the fence will be strong and substantial. With this construction, also, when any of the pickets rot off they may be driven down into the ground or replaced with new pickets, without disturbing the wire, rails, or posts, which cannot be done when the wire passes through the pickets.

Improved Ore Crusher.

William P. Hammond, Napa city, Cal., assignor to himself and Henry Mygatt, same place.—This invention has for its object to furnish an improved device for operating the stamp of a stamp mill or ore crusher, enabling the stamp to be raised with a less expenditure of power than when the stamp is operated in the ordinary manner, and it consists in the tappet, in combination with the stamp shaft, cam, and driving shaft. By suitable construction and arrangement of the tappet the friction will be lessened, the cam will rotate the stamp more surely, and the power required to raise the stamp will be diminished, the point of contact being directly above the driving shaft.

Apparatus for Filling, Polishing, and Varnishing Moldings.

Max Hamburger, Isaac J. Skind, and Achille Klein, New York city.—This invention has for its object to furnish an improved machine for filling, French polishing, finishing, varnishing, and sand papering wood moldings, etc. In using the machine, the molding or other work to be operated upon is secured to the table, which table is then raised to bring the work against the brushes or rubbers with the necessary pressure. A lever is then operated to bring a clutch in contact with a wheel that will carry the brushes or rubbers in the proper direction. The motion of the brushes or rubbers may be reversed at any time, and as often as desired, so that a short strip of molding or a part of a long strip may be operated upon, as required.

Improved Balanced Slide Valve.

Hubbard Hendrickson, Red Bank, N. J.—This invention relates to a new means of balancing the slide valves of steam engines with such exactness and regularity that the motion of the valve will be made easy, its wear prevented, and friction avoided. The invention consists, first, in connecting a pivoted yoke with the slide valve, said yoke having a vertical stem that swings at its upper end on a horizontal pivot. This pivot is supported in a tube or cylinder, which is held balanced by the steam, so that the actual support is supplied to the valve by the steam, but indirectly under said cylinder, and thence to the pivot at the upper end of the rod.

Improved Pole Clamp.

Henry Haering, New York city, assignor to himself and Hermann Allie, of same place.—This invention consists of a U-shaped yoke with bearings in the bars near the open ends, an eccentric clamp with a hand lever, and journals for working in the aforesaid bearings, and a fastening chain or rope, all combined or arranged so that a couple of scaffold or other poles lapping each other may be embraced between the bottom of the yoke and the eccentric clamp by placing the yoke around them and then putting the clamp in its bearings, and thus be bound together very firmly and in a simple manner. The clamp is designed for splicing scaffold, tent, and other poles.

Improved Plow.

Edwin Reese, Estaw, Ala.—The invention consists in a self sharpening plow having the landside of such peculiar construction that the point and edge of share are allowed in a uniform and certain manner to wear upon both upper and lower side so as to retain the same edge until completely worn out.

Improved Butt Hinge.

Isaac L. Thompson, Sardis, Ohio.—This invention relates to an improvement in the class of butt hinges provided with supporting arms or straps, and consists in constructing such arms or straps with lugs for taking into the wood and relieving the screws from strain.

Improved Chair Seat and Back.

William T. Doremus, New York city.—This invention has for its object to furnish chairs, provided with elastic seats and backs, which shall be simple in construction, strong and durable, and at the same time convenient in application and comfortable in use; and it consists in the arrangement of alternate rigid and elastic blocks, having flexible connections.

Improved Lubricator.

John McLure Power, Port Discovery, Washington Territory.—The neck of the lubricator is screwed into the cylinder head. A pipe is connected with the branch from the neck of the lubricator and with the condenser, through which steam is admitted from the cylinder. This pipe enters the condenser and is closed at its end. It has a short vertical branch pipe screwed into it. A valve spindle is attached near the bottom of the reservoir, for drawing off the surplus water of condensation. A spindle valve is located in the cup or receiver, by which the flow of oil is controlled, and the condensing surface increased or diminished. A solid plug, made of any non-conducting material, closes the top of the neck tube. Steam will pass up through the branch and pipe from the cylinder into the condenser, which steam will be condensed in whole or in part, and the water of condensation will fall by its own gravity into the reservoir. The water, being of greater specific gravity than the oil, will settle at the bottom of the reservoir, and when it accumulates in too great quantity, it is drawn off through the valve. The lubricating oil flows over into the pipe, and reaches the cylinder by virtue of its own gravity. The flow of steam upward, as well as of oil, may be shut off by means of the valve spindle.

Improved Tool Holder.

James S. Ettenborough, Easton, Pa.—This invention consists of a relief bar or plate pivoted to the end of the shank by which the tool is attached to the reciprocating bar of the machine at right angles to the line of motion, with a tool post similar to the tool post of a turning lathe, for holding the tool, the relief bar being arranged to swing and free the point of the tool from the work when it moves back, to prevent it from rubbing on the work and being worn thereby or broken when escaping from the end of the work, the said bar being provided with a spring to throw it back into the working position before beginning to cut, and the tool post being arranged to shift the tool sidewise for under cutting, slotting, and other purposes.

Improved Door Check.

George Rohrbaker, Penn Station, Pa.—The object of this invention is to provide means for holding swinging doors in any desired position; and it consists in one or more circular plates forming part of a frame attached to the casing and arranged concentric with the door hinges, and in an elastic friction block connected with the door and working in contact with said circular plates, thereby causing friction, by means of which the door is held.

Improved Farm Gate.

Cyrus E. Gillespie, Edwardville, Ill.—This invention relates to an improved mechanism for operating gates on roadways at a distance therefrom so as to make it convenient for persons on horseback or in carriages to open such gates before reaching them, and to reclose them after they are passed, all without dismounting. The invention consists mainly in connecting the latch of the gate with a crank on a pinion that hangs on its lower pivot, so that as said pivot is moved to one side or the other, the pinion will be turned and the latch opened to permit the opening of the gate.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From January 8 to January 9, 1873, inclusive.

CAR SPRING.—P. G. Gardner, New York city.
DRYING PRAT, ETC.—L. W. Boynton, N. Y. city, J. E. Holmes, London, Eng.
ELECTRIC SIGNAL.—W. Robinson, Brooklyn, N. Y.
EXTRACTING NAILS.—G. J. Capwell, Cheshire, Conn.
HAT.—R. Eickemeyer, Tonkers, N. Y.
HOSPITAL BED.—I. Waller, Cleveland, O.; H. Fowler, Detroit, Mich.
PRINTING TELEGRAPH.—G. L. Anders, E. B. Welch, Cambridge, Mass.
PUDDLING FURNACE.—L. S. Goodrich, Waverly, Tenn.; I. H. Hillman, G. W. Goodrich, Trigg Furnace, Ky.
TOY.—W. W. Rose, New York city.

Business and Personal.

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Water Front, also Stores or Lots to Rent, Delaney St., E. River. Address Bro. 64 Water St., N.Y.

Covering for Boilers and Pipes. The most economical and durable article in use. Took first prize at American Institute Fair. Van Teyl Manufacturing Company, 728 Water Street, New York.

Indispensable to every Manufacturer and Machinist—Custom Journal of Commerce; send for a specimen copy. \$1 per year.

Buy Iron Working Machinery of Gear, Boston, Mass.

Spiral and Bevel Wheels and Spindles, of great durability, cast to order by Pittsburgh Steel Casting Co. All work warranted.

Carpenters—For Sale, a Sash Factory, run by water power, at a lumber landing, with a profitable run of trade. For particulars, address P. O. Box No. 2, Charlestown, Jefferson County, West Virginia.

Chucks—Fairman & Co., Baltimore, Md.

I have some capital and a practical knowledge of the manufacture of Tubs and Pails, and want to put them both to use. Address H. J. Rowe, Pittsburgh, Pa.

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

Needle and Clock Machinery of every description of the most improved styles. Hendey Bro's, Welcottville, Ct.

Wanted—A lot of Second-hand Machinery for a Cotton Mill, consisting of Looms, Spinning Frame, Dressing Frame, Bobbin Winders, Reamer, Cards and Picker. Address P. O. Box 5283, New York.

For best Process, Dies and Fruit Can Tools, Biles & Williams, 115 to 120 Plymouth St., Brooklyn, N.Y.

E. P. Peacock, Patent article manufacturer in light metal work of all kinds, 115 S. Clinton St., Chicago.

Wanted—A situation by a first class Machinist and Toolmaker. Best reference given. Address T. Albert, 102 E. 7th St., New York.

Send to H. Moore, 41 Centre St., New York, for Catalogue of "Broughams" (the best) Lubricators, Oil Cups, Gauge Cocks, Oilers, Faucets, &c.

For Sale—Rights to a popular and recently patented Toy. Can be sold for 10 cents and leave a good margin. Address J. H. Layman, 223 Baymiller Street Cincinnati, Ohio.

Buy Gear's Improved Automatic Dovetailing Machine, Boston, Mass.

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

A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1872, for "Best Telegraph Instrument for private use"—is offered for sale by the Merchants' Mfg. and Construction Co., 50 Broad St., New York. P. O. Box 6835.

Diamonds and Carbon turned and shaped for Philosophical and Mechanical purposes, also Glazier's Diamonds, manufactured and reset by J. Dickinson, 64 Seneca St., New York.

Patent Gearing—Great Strength, Durable, Noiseless, Cheap. J. Conly, 148 Ten Eyck St., Williamsburgh, N. Y.

Steam Boiler and Pipe Covering—Economy, Safety, and Durability. Saves from ten to twenty per cent. Chalmers Spence Company, foot East 9th St., New York—132 N. 2d St., St. Louis, Mo.

For Sale, Machine Shop and Foundry. Address, Wagoner & Matthews, Westminster, Md.

Sperm Oil—No lubricator like it. See Kellogg's advertisement on another page.

Iron Roofing, Scott & Co., Cincinnati, Ohio.

Shafting and Pulleys a specialty. Small orders filled on as good terms as large. D. Frisbie & Co., New Haven, Conn.

Wanted, a Machine to make a flat flour barrel hoop out of black ash timber; also, any Machinery that will decrease the cost of making Flour, Fruit, or Lime Barrels; also, a Machine to shave a flat hoop ready for the barrel. Address P. O. Box 2533, Buffalo, N. Y.

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

Foot Lathe for \$22. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Wanted, reliable and responsible parties to Sell Engines, Saw Mills, and other machinery manufactured by the Mansfield Machine Works, Mansfield, Ohio.

For the Best Circular Saw Mills and Steam Engines, Stationary and Portable, of all Sizes, apply to the Mansfield Machine Works, Mansfield, Ohio.

For Wait's Improved Turbine Water Wheels, Improved Malt, Gang, and Circular Saw Mills, Paper Engines, Rope Cutters, &c. &c., address Marlow & Van Wormer, Successors to P. H. Wait, Sandy Hill, N. Y.

Circular Saw Mills, with Lane's Patent Sets; more than 120 in operation. Send for descriptive pamphlet and price list. Lane, Pitkin & Brock, Montpelier, Vermont.

Machinists—Price List of small Tools free; Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

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

Nickel Salts and Ammonia, especially manufactured for Nickel Plating, also "Anodes," by L. & J. W. Feuchtwaenger, 55 Cedar Street, New York.

English Patent—The Proprietors of the "Heald & Clegg Centrifugal Pump" (triumphant at the recent Fair), having their hands full at home, will sell their Patent for Great Britain, just obtained. A great chance for business in England. Address Heald, Sisco & Co., Baldwinville, N. Y.

Read the article on "The Machinists," now being published in the Boston Journal of Commerce. Send for Specimen Copy.

American Boiler Powder, for certainty, safety, and cheapness. "The Standard Anti-Incandescent." Am. B. P. Co., Box 77, Pittsburgh, Pa.

Scale in Boilers. I will remove and prevent Scale in any Steam Boiler, or make no charge. Send for circular. Geo. W. Lord, Philadelphia, Pa.

Gauges, for Locomotives, Steam, Vacuum, Air, and Testing purposes—Time and Automatic Recording Gauges—Engine Counters, Rate Gauges, and Test Pumps. All kinds brass work done by The Recording Steam Gauge Company, 91 Liberty Street, New York.

Boynton's Lightning Saws. The genuine 400 challenge. Will cut five times as fast as an ax. A six foot cross cut and buck saw, \$6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Boilers. L. B. Davis & Co., Hartford, Conn.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

Steel Castings "To Pattern," from ten lbs. upward, can be forged and tempered. Address Collins & Co., No. 212 Water St., N. Y.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address L. B. Davis & Co., Hartford, Conn.

All Blacksmith Shops need a Holding Vise to upset bolts by hand. For such address J. R. Abbe, Manchester, N. H.

Williamson's Road Steamer and Steam Plow, with rubber Tires, Address D. D. Williamson, 22 Broadway, N. Y., or Box 180.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

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

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

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

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. L. B. Davis & Co.

Always right side up—The Olmsted Oilier, enlarged and improved. Sold everywhere.

Gatling guns, that fire 400 shots per minute, with a range of over 1,000 yards, and which weigh only 125 pounds, are now being made at Colt's Armory, Hartford, Conn.

Notes & Queries

1.—A. F. P. asks: How can I tan a sheep's hide with the wool on it, and then color it pink?

2.—E. M. K. would like to have a recipe for tanning both sides of a deer skin.

3.—J. T. would like to know what is the easiest method to brighten cylinder heads, and other smooth cast iron?

4.—G. R. C. wants directions for making a spectroscopic for stellar observations, with dimensions and other details.

5.—J. P. wishes to know how to color tanned deer, sheep, and dog skins the different shades of brown, purple, orange, black, etc. He has six or eight hundred to color.

6.—G. D. Y. says: I will wager G. B. D. one year's subscription to the SCIENTIFIC AMERICAN that he cannot make a box at an angle of 45° from the perpendicular, by his own rule as given on page 24 of this volume.

7.—A. B. asks if one will explain the mathematical process of ascertaining the distance between two chords of a circle, the area of circle and the area of that portion of circle included between chords only being given.

8.—S. T. W. asks: Will S. L. D., who asked on page 314 of volume XXVII, for a simpler method of transferring prints to glass than removing the paper from the back of the picture, state his method, also what varnish is used and how it is made?

9.—E. M. H. asks: Will some one please inform me how to make a good emery wheel for finishing tools? I use sole leather for covering, but it is too hard. I want to make a grease, or finish wheel. What kind of leather shall I use? What number of emery is best to set with, to finish after a 90°?

10.—P. E. F. asks: What is the best rule for making coffins? The one in use is not applicable to all sizes. 2. Is it true that there is a preparation made that will cause one's moustache to grow? If so, what are its ingredients? 3. How can I make hair oil that will cause the hair to curl, and not be injurious to hair or scalp? 4. Is there a dip for polished iron to keep it from rusting, and what is it that manufacturers of sewing machines use on their polished steel and iron to prevent rust?

M. McD. asks for (1) a rule to find the distance from fulcrum to weight on a safety valve lever, to keep in a given pressure, when the size of valve, distance from fulcrum to valve, and weight are known; and also a rule, when the diameter of a valve is given, to find the area. 2. Which is to be taken, the inside diameter of valve seat, or the whole diameter of valve that rests on the seat? Answer: To find the total length of a safety valve lever for a required maximum pressure: Multiply the effective area of the valve by the distance from the center line of its stem to the pin on which the lever is hinged, and divide by the weight of the suspended weight. 2. Where the valve is well fitted, the inner diameter of its seat is to be taken. When leaky, the effective area is likely to be that whose diameter is the outside diameter of the seat.

J. M. G. asks: How long should two boilers (42 inch shell with 37 three inch flues) be for an engine 150 x 30 inches, running at 65 revolutions a minute with 65 to 70 lbs. of steam, using very hard water? Answer: If the engine is well built and well taken care of and is of good design, we should be inclined to make the boilers 16 feet long. Sixteen feet is long enough, in our opinion, for three inch tubes. Were it necessary to give more heating surface and to use longer boilers, we should put in larger tubes.

A. B. C. says: I wish to enquire in regard to lighting my house with manufactured portable gas. It is claimed by some that this portable arrangement is cheaper than any other mode. Answer: By portable gas we presume you mean the apparatus now so commonly used for lighting churches and dwellings in the country, which consists of a device for driving air through light coal oil and thence through gas pipes to the place of combustion. The air on passing through the oil absorbs some of the liquid, and the carbon thus taken up burns, just as oil carried up by a wick burns. The air serves the place of the wick. If properly made and carefully used, these portable gas machines are safe and afford a first rate light at a cheap cost. The oil used, termed here gasoline, is very explosive, and the utmost care should be taken to keep fire and lights far away from the machine.

A. B. says: The heating pipes of a greenhouse are common sewer tiles, composed of lime and gravel, the end of each joint slipping into the next one. I find the heat or cold expands and contracts them, breaking the cement that I put them together with, consequently permitting the smoke to escape and fill the greenhouse, to the no small detriment of the plants. How can I obviate this evil, and is there any kind of spring cement with which I could join them? 2. What is the force per square inch of freezing water? 3. The news dealer charges me 5 cents for the SCIENTIFIC AMERICAN, that is \$4.15 per year. Does \$5.00 sent to you include postage; if not, what would the postage be? Answer: 1. As an expedient, we suggest that you cover the joints with a band of thin sheet tin, the ends of which you can lap and bend over with your fingers with sufficient tightness. 2. The expansive force of water in freezing has been estimated at thirty thousand pounds per square inch. 3. The postage on the SCIENTIFIC AMERICAN is 5 cents a quarter or 20 cents a year, payable by the subscriber.

G. W. D. says: The water backs in the radiators and stoves in this city become clogged up with a deposit of lime, the hot circulating pipes stopping up first. I wish to know if, supposing I can get a preparation that can be put in the boiler and circulate through the pipes and back, it will cut the lime from the pipes or back and leave it in the form of sediment, so that it can be washed out. Answer: Try chloride of barium. It may do the work in time. It is always more difficult to remove scale once formed than to prevent its formation. For such situations, water backs should be constructed with special provision for cleaning out scale mechanically. There is a chance for some one in the trade to make a useful improvement.

N. B. J. asks: 1. How can I find out the law in regard to inspecting steam boilers, and who is the inspector? I know of several engines which have been running for years, which have never been inspected. 2. Will you inform me how I can find the rule for setting an eccentric? 3. Can an engine be built with the cylinder moving on guides in one direction, connected to a crank while the piston moves in the other direction, thus utilizing the power always exerted on the cylinder head, and also answering the purpose of the valve? Answer: 1. If the boilers are stationary, apply to the police department for information; if they are steamboat boilers, write to Supervising Inspector J. S. Devenny, Pittsburgh, Pa., or to Supervising Inspector General Nimmo, United States Treasury Department, Washington, D. C. 2. Consult back numbers of the SCIENTIFIC AMERICAN, or purchase a copy of Professor McCord's book on valve gearing, which may be had of any New York bookseller. 3. It has been thought of before and has been tried, but without success. You do not lose power in consequence of the pressure of steam acting against the stationary cylinder head, any more than from the engine itself pressing upon its stationary foundation. Motion is necessary to either the use or the loss of effective pressure developing power.

E. W., of R. I., asks: If I take an iron box containing 1 cubic foot of space, fill it with steam at 212° Fahr., raise the temperature to 500° Fahr., what pressure would an ordinary steam gage indicate on this box? 2. Fill the same box with air at the temperature of say 60° Fahr., and raise this temperature likewise to 500° Fahr.; what pressure would the gage indicate upon this? Answer: See reply to J. P. L. 1. $(500^3 - 60^3) \div (212^3 - 60^3) \times 14.7 = 20\frac{1}{2}$ pounds. 2. $(500^3 - 60^3) \div (212^3 - 60^3) \times 14.7 = 27\frac{1}{2}$ pounds.

D. F. W. writes for information as to repairing a church bell. The bell is split up 14 inches, a straight split; it is about 1,400 lbs. in weight, and is about 35 inches thick along one portion of the split. My plan is to make a true circle of light Russia iron (such as is used for stores and stove pipes), place it on a shaft and run it at about 5,000 revolutions per minute, moving the bell slowly up to the circle as it makes its way into the bell, which I think it will do. What is your idea? Will it do it, and if so, would more than one day be required to do the cutting; and after the cutting was done, would the bell be likely to have a good tone? Answer: You have proposed the only practical method of getting out of your difficulty. We should expect your plan to succeed if properly carried out, but should be somewhat apprehensive that very thin iron might not work as well as iron of, say, No. 12 or No. 14 gage. "Soft iron saws without teeth are in use for cutting off iron beams, and even steel."—SCIENTIFIC AMERICAN.—The unpleasant sound of a cracked bell is due to the jarring against each other of the two sides of the rift, thus breaking up the regular vibrations producing musical tones. Cut the two sides clear of each other and the note will be again heard. We should try the experiment as proposed if a good steel saw could neither be found or made. Knowing nothing of your facilities for doing work, we cannot tell about the time required.

J. F. L. asks: If a steam boiler of 1,711 cubic feet internal measurement have one cubic foot of water in it, which is heated to 212° Fahr., the gage indicating 14 lbs. pressure, and if then the heat be raised 20° what will be the additional pressure for each twenty degrees above the boiling point? Does steam expand or contract by being superheated? Which is the most dense, steam or superheated steam? What is the actual cohesion of best cast iron heated to 750° Fahr., also of cast steel, unwrought, in pounds, the materials being one inch square, two or three feet long? What is the effect of alloying iron or steel with copper, especially if it be used hot? Answer: Steam, if perfectly dry and not in contact with water, behaves precisely like any other gas, expanding $\frac{1}{47}$ of its volume at 82° Fahr. for each degree that its temperature rises, the pressure being proportional to the temperature, measured from the absolute zero of heat, 60° below Fahrenheit's zero. In the case given, the pressure will be $(212 + 461^3) \div (212^3 - 60^3) \times 14 = 14\frac{1}{2}$ pounds per square inch. Steam, superheated, is five eighths as heavy as air. No reliable experiments have been made upon the other points of your inquiries.

H. D. says: I have seen in the SCIENTIFIC AMERICAN a statement in regard to using oxyhydrogen gas for illumination, and that the hydrogen gas was made very cheap. I would like to know how it is made so cheap, or the cheapest way to make it for balloon purposes. Answer: There is no really cheap way of making hydrogen gas. One of the methods that went the round of the journals a few years since, is to heat damp coals and slaked lime, absorb the carbonic acid by soda, and collect the hydrogen in gasometers. Where the resulting bicarbonate can be sold to advantage, and the alkaline earth can be obtained in quantity, it has been maintained by Du Motay that the above method is the cheapest yet proposed. The economy of the operation has not been fairly tested.

A. W. D. asks: Will it be necessary for me to make the entire model of a machine, or only the improvement to be patented? Answer: The model only needs to be complete enough to illustrate the working of your improvement.

A correspondent asks: How can the work necessary to overcome the friction of a body on rollers be calculated? Take for example, a house weighing 100,000 pounds, moving on 20 oak rollers 8 inches in diameter the rollers running on oak planks. There is no lack of data concerning sliding friction, and that of axes, but apparently very little concerning the common expedient of moving heavy bodies, as guns, by mounting them on cradles and placing the rollers under in succession. Answer: The earliest experiments on rolling friction were made by Coulomb, and later experiments were made by Morin. The laws deduced are the following: 1. Rolling resistance is nearly proportional to the pressure. 2. Such resistance is inversely proportional to the diameter of the rollers. Where the rollers are smooth and no crushing occurs, the rule for determining the resistance, with oak rollers running on hard wood, as determined by experiments on a small set of rollers, is: Multiply the pressure or load, in pounds, by seven, and divide by 1000 times the radius of the rollers used in feet, or $R = \frac{7P}{1000r}$. Thus, for a load of 100,000 pounds and 20 rollers of 8 inches diameter, $R = (7 \times 100000) \div (1000 \times 1) = 165$ pounds for each roller, or $165 \times 20 = 3300$ pounds total. Results will vary greatly in different kinds of material for rollers and for different kinds of road bed.

J. R. asks: Will some one give me the solution of the following problem? What are the contents of a stick of timber, length 40 feet, diameter of larger end 24 inches, of smaller end 12 inches. 73½ feet, nearly, is the answer. Answer: The mathematical formula is as follows: $\frac{\pi h}{3} (R^2 + Rr + r^2) =$ contents in cubic feet or inches. $\pi = 3.1415$ or $\frac{22}{7}$, a constant factor. R is the larger radius, r, the minor radius, and h the length of cone. This formula holds good for any truncated cone.

P. S. says: In your book "For Inventors and Mechanics," you give a receipt for making marine glue. I have tried your receipt and failed. I took sulphuric ether and put in pure rubber; it has now been standing some three weeks and there is no sign of its dissolving. Answer: Why do you try sulphuric ether? The recipe says "ether," simply.

J. T. writes as follows: Bourne's "Hand book of the Steam Engine" says that a cylinder 64 inches diameter and 8 feet stroke, working with 12 pounds pressure, should have the neck of its cast iron crank shaft 17-01 inches in diameter, and, by another rule, it should be 17-59 inches. Bourne's "Calculator" gives the latter figure. Again, Bourne says 296 pounds acting at a foot radius will twist off a cast iron bar one inch in diameter, and that 123 pounds will be safe. Bourne says 11,945 pounds is the ultimate strength of 14, and that 3,981, or one third of it, will work with safety, but he does not say at what radius. Who is right? Bourne also says if you multiply the force applied in pounds by the length of lever in inches, and divide the product by one third of the ultimate strength of an inch bar, or 3,981, the cube root of the quotient will be the diameter of the shaft in inches; therefore, according to this rule, we have: force acting on the piston mentioned, 3600 x 988 pounds, which, multiplied by 48 inches, the length of crank or lever, will give an 8 feet stroke, which equals 1852991-0784, which, divided by one third of the ultimate strength of an inch bar or 3981 = 465-4587, of which the cube root is 7-74, the answer, or diameter, a big difference between 17-59 and 7-74. How comes this? Please give the name of a reliable work on the strength of shafts. I also notice in your last issue that 7-65 inches is the area of the steam ports of 9 horse power compound engine, which is not according to the old theory of 4 square inches for every horse power. How is this? Answer: The strength of cast iron is somewhat variable. Some specimens twist off under the action of far less force than do others. The most reliable experiments thus far published are those of Major Wade of the United States Ordnance Corps. Using bars one inch in diameter and a leverage of one foot, he found some specimens that gave way with a force of less than 600 pounds, while others bore nearly 900. The average was 733, with American cast gun irons. Basing a rule on the mean result, we have the following: To determine the least force, in pounds, which will break a crank shaft of good cast iron: Multiply 733 by the cube of diameter, in inches, and divide by the radius, or length of crank in feet; that is, $P = 733 \times d^3 \div L$. (1.) To determine the diameter required to resist torsion we have: $d =$ the cube root of $(PL \div 733) = \frac{1}{3}$ the cube root of $(PL \div 733)$, and this is the algebraic expression of the following rule: Multiply the twisting force, in pounds, by its leverage or the length of crank in feet, and take one ninth the cube root of the product, for the diameter of a shaft which will just break under this torsional strain. The principal cause of variation among authorities treating on this subject is the fact that they use different factors of safety. One writer considers three sufficiently high, while another is unwilling to subject a shaft to a twisting force greater than one tenth of that which will break it. It thus happens that one writer recommends a size which would be utterly condemned by another. The best authorities, such as are accepted by our leading engineers, recommend that, in machinery, all important parts be made strong enough to bear six times the force to which it is proposed to subject them. Introducing a factor of safety of six, we construct, for shafts of cast iron, the following rules for safe working sizes: To determine the proper working torsional stress on a given shaft: Multiply 120 by the cube of the diameter, in inches, and divide by the length of crank, in feet, expressed algebraically, $P = 120 \times (d^3 \div L)$. (2.) To determine the diameter required to be safe for a given working torsional stress: Multiply the twisting force, in pounds, by the length of crank, in feet, divide by 120, and the cube root of the product will be the diameter in inches, that is: $d =$ the cube root of $(PL \div 120)$. (3.) Using rule (1) we find the breaking strength of a shaft 17½ inches diameter, with crank 4 feet long, to be $733 \times (17\frac{1}{2})^3 \div 4 = 982,037$ pounds. Using rule (2) to determine the size of shaft just capable of sustaining 35,000 pounds on an arm 4 feet long, we get, $d = \frac{1}{3}$ the cube root of $(35000 \times 4) = 6$ inches. But determining the safe figures by rules (3) and (4), we get $P = 120(17\frac{1}{2})^3 \div 4 = 160,770$ pounds, and $d =$ the cube root of $(35000 \times 4 \div 120) = 11$ inches. The rules given in Bourne are frequently very defective. Professor J. D. Van Buren's work on "Strength of Steam Machinery" is the most concise and accurate yet published, on that subject, of which we have knowledge. For more general purposes we use, often, the work of Professor D. V. Wood on "Resistance of Materials" and, for more obscure investigation, consult Rankine, Mooney and Morin. The last named are too mathematical for the general reader, however. 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J. A. S. finds the alum and sulphur method of preserving eggs to be a failure, and enquires for some other means of keeping eggs fresh in hot weather. Answer: The theory of egg preservation is that the closing of the pores in the shells prevents the oxidation and consequent destruction of their contents, and so various substances for coating them have been recommended. Drying varnishes have been used, and collodion has been recommended; but the expense of these means would justify an experiment with the Chinese method, which is to coat the eggs with wet clay, and let it dry on.

B. asks how the number of yards of carpet required to cover a room is ascertained. Answer: Your room, 15x15 feet, contains 225 square feet, or 25 square yards. Your carpet being 21 inches wide, you will need 14 yards of it to make a square yard, or 31 yards 4 inches in all.

W. N. asks for a recipe for pasting paper to iron, so that it will not be affected by oil or water. Answer: Paint the iron first with oil paint and let it dry. Glue or paste will then adhere to the iron, but the paper will not be oil or water proof. Try a quick drying varnish.

R. D. S. wants elaborate details for making an Eolian harp. Answer: Make a long flat box (20 x 6 x 2 are very good dimensions) of very thin sound pine board, and make every joint perfectly air tight. Cut a round hole in the center of the lid, and stretch by screws several strings of fine catgut, lengthwise over the hole, strained over two bridges. Tune all the strings to the same note, and stand your box upright in the wind. E violon strings will do for the purpose.

G. F. of Mo: When there are two assignments of record covering the same interest, the Office does not regard the second assignment.

J. D. M. of Texas: Your remarks censuring the acts of the Patent Office are not well founded, although your sentiments accord with those of many others who have obtained patents which they could not sustain. If you will consider for a moment, you will see that it is not in the province of the Patent Office to determine matters of infringement: it is for the Courts only to adjudicate in such cases. The Patent Office examines your claims, and, if your invention possesses novelty, it is bound to give you a patent; should it go further and decide as to its conflicting with previous patents, it would exceed its jurisdiction.

N. B. H. writes: I would say to your enquirer H. C. K., who asked for a rule for laying off wooden axes, that the old rule, one third off front, two thirds behind, one third off bottom and two thirds off top of the axle is not a bad one, but the only scientific way of making a wooden axle is to set the bottom of wheels 4 feet 10 inches apart from inside to inside. Set the tops 4 feet 11 inches, the front one inch nearer together than the back. Then take a straight edge and run through the hubs. Just what it lacks of touching the boxes, take that much off the axle at that point. Try the straight edge bottom and front, and work the back and top off to it; and no matter what the shape of the wheel may be, no matter about the length of hub or the size of boxes, the wheels will track and run precisely right. From shoulder to shoulder, between the hubs of course, is the length of the axle, which you get on the straight edge.

D. M. S. asks: How can I plate, with silver or nickel, small brass polished articles—telescope instruments, for instance? How is the metal applied, and what is the best preparation to remove the coating or varnish on the articles to be plated, if it is necessary to remove it before plating or washing? Answer: Before plating with metal, it is necessary to remove all paint and varnish; this can be accomplished by a solution of bichromate of potash made acid by a little sulphuric acid. The surfaces of the metal must be thoroughly cleaned. To plate with nickel, use the double sulphate of nickel and ammonia, and make the positive electrode of a bar of nickel.

W. C. W. says: I was running a saw mill at summer and the water failed. I went to digging and struck a vein that rose to the top of the hole at once. My boiler was very badly scaled; but since using this water, the inside of my boiler is as clean as if new. Enclosed is a sample; please tell me what is in the water, and if it will injure my boiler. Answer: The water has been examined by an expert chemist. It contains considerable chlorine and organic matter, not much magnesium, but too much lime for good drinking water. It would be better to blow off the boiler more frequently when using such water.

E. P. W. says: In a recent number of the SCIENTIFIC AMERICAN there is an article on the metal vanadium, in which you speak of a Mr. Apjohn, who has been investigating the subject. Will you oblige me by giving me the address of this gentleman? Is the article in your paper a synopsis of a fuller article in some other, and if so, what? Answer: The article on vanadium was prepared expressly for this journal from the literature of the subject found floating through foreign periodicals, and was not the synopsis of a longer article from another journal. The latest information on the subject, accessible to American readers, is contained in the Supplement to Watt's "Dictionary of Chemistry."

E. H. R. says: I presume that most people have noticed the circles of smoke, frequently caused by the puffing of a locomotive. A few weeks since I noticed some uncommonly fine circles of the kind, one of which continued revolving rapidly for fully fifteen minutes, and until it had floated out of sight. If it is a centrifugal force that keeps a revolving body or substance in its orbit, where is the centrifugal force that held this circle of smoke from dissolution during the time referred to, or in fact for any appreciable time? Do not such phenomena indicate that there is a force inherent in matter, besides centrifugal and centrifugal forces, that may be denominated circular force or a natural tendency to revolve in circles? Answer: Any force acting suddenly upon the air from a center, imparts to it a rotary motion. Smoke and steam render the motion visible. The whole circumference of each circle is in a state of rapid rotation, as is shown by the arrows in the figure. The rapid rotation, in short, confines the smoke within the narrow limits of a circle and causes the rings to be well defined. Professor Tyndall, in one of his experiments, made wave motions visible by blowing tobacco smoke into the apparatus.

C. F. asks which would make the best table for a sewing machine, a plain black walnut, well seasoned, or 6 thin white wood boards, glued together diagonally and veneered with black walnut. Which would be the most liable to warp or split, and which would hold screws the best? Answer: We should prefer the black walnut made of thin boards, glued together diagonally as you propose. The white wood made in the way you describe would make a good table.

O. N. McK. asks (1) who it was who observed the lifting of the lid of a tea kettle by steam, and fastened the cover to the kettle; and was afterwards surprised to find the cover was thrown off violently? 2. Who first applied steam as a motor? Answer: 1. A somewhat similar story is told of James Watt, the legend stating that his attention was first called to the power of steam by the lifting of the lid of a kettle. 2. Heron, in his work on pneumatics (230 B. C.), mentions three simple contrivances for using steam as a motor; this is, we believe, the oldest record on the subject, but the power of steam was probably recognized many centuries before the time of Heron, by the Egyptians.

D. J. T. says: Please let me know the effect of mixing creosote and nitro-glycerin. Answer: We give it up.

A. L. asks what will destroy or neutralize the narcotic effect of tobacco while being smoked in a pipe. Answer: Fill your pipe about one third full of pine chips, cut as you would cut your tobacco; put your tobacco on the top of the chips and draw the smoke through them, changing the wood two or three times a day, and use the best light navy tobacco.—J. A. S.

S. H. wants to know if a coil of pipe in his kitchen range will not be a good water back or heater. Yes, it will be, none better. I have used it for years in my stove, and never any other. At first I had an iron 3/4 inch gas pipe, but the water became rusty; I then had a brass pipe put in, and the action is perfect. There ought not to be any steam generated, and will not be, if the circulation is good. An inch pipe is better than any smaller size. One end, projecting from the stove, should be 1/2 inch higher than the other, more would be better, to establish the circulation. My pipe comes in at the back of the stove, passes around the fire box, on the fire brick (touching it) and passes out again, the two legs being parallel. Two or three inches outside the stove, the lead pipe is connected by screw joints. At the angles of the brass pipe, brass elbows are used, the pipe being screwed in, like common gas pipe. My copper tank is in the bath room and water closet, in second story, directly over the kitchen, keeping it warm in winter.—N. D.

E. E. S. says that J. C. J., who enquired how to prepare canvas for painting on, will find little economy in preparing his own canvas. He can make a very cheap substitute for canvas by mounting a sheet of well dampened drawing paper on a pane of glass; when partially dry, paste over it four or five thicknesses of thin muslin, each piece being allowed to dry thoroughly before another is put on. All must be stretched very tight and rubbed smooth. Cover it with paint, spreading it with a knife, and using as little as possible; when dry, paint it and stipple it with a blender to give it a "tooth." It is better to use isinglass than flour paste, as it does not absorb moisture as soon as the latter; and old muslin or lawn is better than new. If before any paste is put on, it is saturated with drying oil and allowed to dry a year before it is used, it will not warp; if not, it should be left until the picture is dry enough to lay in a portfolio. Some painters make canvas by tacking cloth on a stretcher, sponging it with a strong solution of glue and spreading white lead on with a knife, but it lacks that roughness which is technically called "the tooth," and it is liable to crack if too much glue has been used. Should J. C. J. ever attempt to sell his painting on this material to a professional picture dealer, he will be inclined to think that it is the canvas, not the painting on it, which the Shylock wishes to buy.

In answer to C. D., who asked for a mode of fixing pearl coatings on various articles, S. F. says: Pearl articles are made from the shells of the pearl oyster, known as mother of pearl. They are found round the islands of Manila and Ceylon, in the East Indies. The shells are cut with saws and ground to the various shapes on grindstones running in water, and are afterward filed and carved into various patterns.

A. G. C., who asked how to temper taps, should draw the temper in hot sand; he will then have no trouble in getting an even temper and will not be troubled with smoke.—W. H. W.

J. H. W. says, in answer to C. R. M., who wants a receipt for cement that will stick flannel on iron rollers: I have used the following for over 25 years with success: I dissolve common glue in good clear vinegar and cook it at a slow heat until it is all dissolved; I then add 1 quart glue, so dissolved, two or three liquid ounces Venice turpentine or white pine pitch direct from the tree.

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 Method of Utilizing the Waste Heat of Street Gas Lamps. By R. B. M.

On the Proper Ventilation of Apartments. By E. M.

On Steam Boiler Pressure. By C. P. E.

On Marine Canals for the Bar of the Mississippi. By W. K.

On Steam and Air Engines. By E. L. B.

On a Telescope to cost One Million Dollars. By L. L.

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On Polar Mutations. By J. E. H.

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On the Austrian Show. By J. M. B.

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6,581.—SHOW CARD.—Thomas Hall, Jersey City, N. J.

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VALUE OF PATENTS

And How to Obtain Them.

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HOW TO OBTAIN PATENTS. This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct: Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

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To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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The patent may be taken out either for five years (government fee \$30), or for ten years (government fee \$60) or for fifteen years (government fee \$90). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

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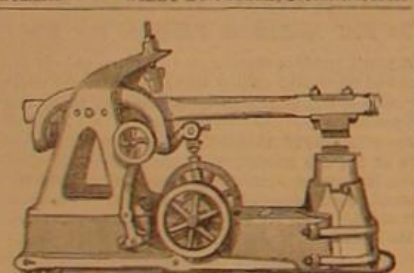
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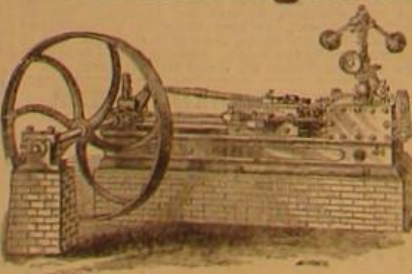
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Vol. XXVIII.--No. 8.
[NEW SERIES.]

NEW YORK, FEBRUARY 22, 1873.

\$3 per Annum,
IN ADVANCE.

THE SNAP FLASK.

We are not aware to whom is due the credit of the invention of the useful contrivance which our artist has so graphically depicted in the hands of the brawny workman in the engraving. It is simple, handy, as we shall presently show, and, withal, a convenience which iron foundries, or more especially molders in green sand, can ill afford to be without. We have therefore prepared the accompanying illustration, and to make matters more clear, we add a few words of description, in the hope that the suggestion may prove of practical value to those who are unacquainted with its uses, construction, and merits.

The snap flask, as it is commonly termed, differs from an ordinary two part flask in having its portions hinged together by a butt at one corner and closed by a latch at the corner diagonally opposite. It is without those troublesome cross pieces which are always half charred, generally of the wrong shape and in the wrong place, nor are its various parts filled with numberless bristling rusty nails. Its interior sides, being smoothly scooped out, hold the firmly rammed sand during the removal of the cope. In constructing small moldings, the flask is best located on a rude table, so that in using his two wooden hand rammers (such as are represented in the cut) to pack the sand home, the molder can stand erect. After the work is finished in the ordinary way, it only remains to unlatch the corner and swing the flask when it is ready for immediate re-use. The sand mold is removed from the table to the floor and weighted with a plate of cast iron, made with lifting ears on two sides and pierced with a square aperture in the center, through which the molten metal is poured.

We think there are few workmen who will not agree with us in the opinion that, after a hard day's work, it is no slight labor to shake out, fit together, and pile up in the yard a score or more of small flasks, and that any contrivance which, like that above described, will save them such toil is well worthy of their attention and employment.

Practical Notes on the Steam Engine.

The comparison of the different systems of construction of steam engines, old and new, says *Dingler's Polytechnisches Journal*, with reference to the speed of the piston, steam pressure, duration of admission of steam to the cylinder, and the regular and even motion of the machine, shows that the rapidity of the piston and the pressure of steam augments with the duration of expansion. The following classification then may be established: 1st. Low pressure engines which work with but a feeble or low tension of steam (35 to 40 pounds per square inch) with a small speed of piston and without or nearly without expansion; under these conditions the motion is regular but the expenses of setting up and keeping in repair are large. This system is represented by Watts old beam engine. 2. Engines which work quicker than the preceding, but still with a moderate speed, the steam pressure and expansion remaining as above. Motion irregular. Expense of establishing light, but of repairs, heavy. To this category belong what are termed good ordi-

nary machines. 3. Engines of which the pistons move moderately quickly, of which the steam works at a medium pressure and in which steam is admitted to the cylinder during half or three quarters the stroke. These have a sufficiently regular motion and their cost of establishment and repair is relatively low. They are usually constructed with a single horizontal cylinder and are in very extended use. 4. Engines which work with the same rapidity and pressure as to the preceding system but with large expan-

ently quite as much. Even the fifth was considerably stained. From this it follows that the collodion film, as ordinarily used, absorbs only a fractional part of the rays that can affect it. Could it be made to absorb the whole, its sensitiveness would be correspondingly increased.

Sounds of the Body.

At a recent meeting of the Clinical Society of London, Dr. Poore exhibited an adaptation of a well known philosophical experiment to medical purposes. A patient with a remarkably loud aortic regurgitant murmur, accompanied by intense thrill, was made to lie on his back upon a common mahogany table. Dr. Poore then took an ordinary walking stick, placing it vertically upon the sternum at the level of the third costal cartilages, and upon the upper end he poised the sounding board of a guitar, with the orifice downwards. When this arrangement was completed, and after complete silence had been obtained, the murmur became distinctly audible to the bystanders. Dr. Poore remarked that he regarded the case merely as a clinical curiosity. His apparatus was very rough, but it served to exhibit a novel application of acoustic principles, and probably, with a specially constructed and more delicate instrument, it would be possible to render the sounds and murmurs of the heart audible for the purposes of clinical demonstration. Sounds and probes with sounding boards at one end were used in some of the clinical lecture theaters in Germany; and Dr. Poore exhibited an iron probe with a circular sounding board at its extremity, by means



MOLDING WITH THE SNAP FLASK.

sion, very usually provided with a specially devised cylinder. Motion irregular. More expensive than the engines in the preceding paragraph. To this category belong the Woolf compound engines, which have two cylinders placed side by side, in a horizontal position but not on the same plane.

With these four classes of machines, the above results have been determined and confirmed by long experience. One more system remains to be noticed: 5. The engines which work with high velocity, high pressure and great expansion. These are regular in motion and low in first cost and expense of repairs. But little experience has been had with these machines. It is considered, however, that they possess a decided advantage in having speed together with a horizontal position. They may be advantageously substituted for the old forms of cumbersome and slow beam engines.

Absorption of Light by Photo Film.

Professor J. W. Draper says: The silver compounds of collodion absorb the radiations falling on them, which are capable of producing a photographic effect. Yet sensitive as it is, collodion is very far from having its maximum sensitiveness, as is shown by the following experiment, which is of no small interest to photographers: I took five dry collodion plates, prepared by what is known as the tannin process; and having made a pile of them, I caused the rays of a gas flame to pass through them all at the same time. On developing, it was found that the first plate was strongly impressed, and the second, which had been behind it, appar-

of which all vibrations communicated to the probe were greatly intensified.

Mr. De Morgan remarked that Dr. Corfe had suggested the converse of this. He demonstrated that, when a person placed his head on the chest, the sound of his voice, when speaking, was affected by the condition of the patient's chest.

Dr. Anstie remarked that Mr. Brooke used to demonstrate stone in the bladder to his class at the Westminster Hospital by means of a sounding board attached to the staff.

The application of this well known phenomenon of the transmission of sound to the diagnosis of chest diseases may possibly lead to a material improvement upon the stethoscope. A walking stick is, of course, not the most suitable connecting rod for conducting the sound.

TOMATOES IN IRON POTS.—There are a thousand and one things I would like to know (and probably shall, in time, unless I have to learn how to vote); but this I do know, that tomatoes must not be cooked in an iron pot. Some beneficent housekeeper, following in the footsteps of the illustrious "scrapple" maker, gives a recipe in last week's *Rural* for a cheap soup, in which she directs the ingredients to be put in an iron pot. I sometimes, at good tables, taste tomatoes which have been made bitter by this process. If the intention is to medicate them, the result will satisfy the design.—*Rural Yorker*. [It might be added that vegetables should never be cooked in iron pots, unless the latter are enameled or otherwise coated internally.]

Scientific American.

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ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

The annual report of the Commissioner of Patents to Congress, for 1872, has just been sent in, from which it appears that the affairs of the Patent Office are in good order and flourishing condition. 3,090 caveats were filed last year, being a slight decrease over the previous year. 18,246 applications for patents were made, of which 13,590 were granted. A slight increase in the number of patents granted is shown, and a considerable decrease in the number of applications made, which the Commissioner explains in a curious way. The decrease of applications and increase of the number of patents granted, is due, he says, to the circulation of the office publications, giving to inventors, manufacturers, and attorneys reliable information as to what inventions are already patented, thereby securing better applications but fewer in number.

Now, if this is so, if the effect of the office publications has been thus quickly and noticeably, during the first year, to reduce the number of applications, and yet to increase the number of patents granted, may we not expect similar results, in greater ratio, a few years hence, when the aforesaid publications are more extensively circulated? Let us look at the results for the next five years, allowing that the ratio remains only the same:—Number of applications made in 1871, 19,472; in 1872, 18,246; decrease, 1,226. Number of patents granted in 1871, 13,033; number granted in 1872, 13,590; increase, 557.—Allowing the same ratio each year for the next five years, we should have the following results for the year 1878:—Number of applications made, 12,160, and number of applications granted, 16,375. Evidently it will not do to carry forward the Commissioner's deductions.

A much more probable explanation for the discrepancies in the figures for 1871 and 1872 would be this:

In 1871 the Office was overcrowded with business and delays ensued, and the examiners doubtless rejected many cases for the first time which, on revision in 1872, they decided to allow. The falling off of 1,226 applications in 1872 is probably due to the discouraging effects upon inventors of the official delays during the year preceding.

The Commissioner informs us that the expenses of the Patent Office have been increased during 1872; but we are satisfied that the money has been well spent in providing room, and in reproducing copies of back patents.

The various official publications of diagrams, claims, bound volumes of reduced copies, and full size copies of patents have been admirably produced, and reflect the highest credit upon the Commissioner. This department of publication has become one of the most important branches of labor at the Patent Office, and is of inestimable value to the country. The publication of a general Index to the patents, and a Digest of the inventions, are highly important works which ought to be proceeded with, and we hope that Congress will give to the Commissioner the necessary authority. The Commissioner recommends that a law to authorize the extension of patents granted subsequent to 1861 should be enacted. We trust it may be.

In urging Congress to adopt his scheme for the "reorganization" of the Patent Office, the Commissioner makes the following statement:—"After careful and extended enquiry, I am convinced that considerably more than one half of the capital employed in manufacturing in the United States is thus invested because of the security to specialties obtained from patents." "For this reason," he says, "the demand for better examinations and more care as to the wording of specifications and claims before issuing patents or rejecting applications, is increasing every day. The business of the Office is being done under a plan of organization adopted in

its infancy—a plan adequate to its wants at that time, but which has been outgrown by its enormous increase of business." The italics are ours.

The Commissioner's plan for "reorganization" is simply to place a set of nine bosses over the present examiners, to be called "chiefs of division," who are to supervise the work of the examiners and decide whether their decisions are to stand, and whether a patent shall be granted or refused. We deprecate the addition of any new forms and ceremonies, with their attendant delays, red tapeism and expenses, to the business of obtaining patents. We prefer the *infantile* system as it now exists, which works so well, gives such general satisfaction, and affords such ample securities that, according to the Commissioner's own showing, it now employs one half of all the capital invested in manufacturing in the United States.

It is a good old adage: "Let well enough alone." It would be hard to find a system that works better than the present, and we say, *let it alone*. The simpler the forms and the more prompt the official action in the grant of patents, the more will the inventive genius of the country be fostered and encouraged.

A BLOW TO THE TRADES' UNIONS.

The last volume of the Massachusetts Law Reports contains the ruling of Chief Justice Chapman, in a case which involves the question of whether trade organizations have any right to exact fines, or use other means of extortion to compel employers to accede to their demands. The plaintiff, Mr. John Carew, had contracted to supply a certain quantity of hewn stone; certain members of a society called the Journeymen Freestone Cutters' Association of Boston obtained from him the sum, or fine, as they called it, of \$500, by threatening to deprive him of laborers necessary to him for the fulfilment of his contract, and by actually inducing some of his employees to leave. The action was brought to recover. The court ruled that the plaintiff might regain not only \$500 but any damage to his business caused by the acts of the conspirators. Chief Justice Chapman says, in his opinion: "The acts alleged and proved in this case are peculiarly offensive to the principles which prevail in this country; and if such practices could enjoy impunity, they would tend to establish a tyranny of irresponsible persons over labor and mechanical business which would be extremely injurious to both."

There is not an employer or a right minded workman in the country who will not rejoice at the placing upon record of so clear, resolute and unequivocal a condemnation of the whole system of trades' unionism as it is now practiced. One or two such decisions in this State are greatly needed, and would do more to prevent such uprisings as that of last summer than years of discussion between the contending parties. We have plenty of laws on our statute books militating against conspiracy; and, if none of them cover such cases as that above cited, let some of the employers who suffered by the great strike see that the proper steps be taken to have suitable enactments framed by the Legislature, that will effectually remedy all existing evils.

THE VIENNA EXPOSITION.

The buildings of the Vienna Exposition are now completed and in readiness for the reception of the articles to be exhibited. Several changes have, we learn, been made in the general plan. The center space of the Palace of Industry, instead of being divided up, has been converted into one colossal rotunda, the largest roofed building in existence, measuring 426½ feet in diameter and 300 feet in height. The iron work of the roof weighs 40,000 tons, and it may be imagined that it required no small effort of engineering skill to raise this enormous load to a height of nearly 300 feet. The work was accomplished by 240 men in three months. The central structure is iron, covered with an outer coating of masonry connected with the interior by girders. Some idea of the dimensions of the vast fabric may be gained from the fact that a regiment of infantry numbering 1,400 men could conveniently be paraded on the architectural cornice which runs round the inside where the roof joins the columns.

The materials of which the buildings are composed are mainly iron, wood and glass, but the walls, where not clear-storied, are filled in with brick. The outward decorations, which are very imposing and of a solidity apparently sufficient to last for ages, are made of canvas steeped in fluid plaster of Paris and hardened in molds. With admirable taste, a blue texture of jute spangled with golden ornaments has been selected as a wall covering, which contrasts agreeably with the dark red of the supporting columns.

The machinery hall is a simple brick building with no pretension to architectural display. The motive powers, cranes, boilers and engines are all themselves exhibits. All engines under seventy-five horse power and cranes lifting less than twelve tons are excluded. Borsig's engine factory in Berlin, which turned out its two thousandth locomotive for the Paris Exposition, in 1867, will exhibit its three thousandth in Vienna.

The supplementary structures will consist of edifices for the accommodation of distinguished visitors, and annexes to hold the excess of exhibits not finding room in the great galleries. The Austrian Emperor is to have a magnificently fitted up pavilion, and it is stated that the French and German buildings will vie with it in grandeur. Krupp, of cast steel renown, will stock a special edifice with his own inventions, and the *New Free Press* boldly aspires to out-do the London Times, whose machinery was last year exhibited in London, by erecting a pavilion of its own. One space of 1,600 square meters is appointed to hold German educational apparatus and appliances.

Danger from fire is put almost beyond the reach of possibility. There is a large basin of water in the grounds, filled conveniently from the adjoining Danube, which might at any moment convert the whole area into a lake. The basin was constructed at a cost of \$12,000, and in addition thereto, fire engines and hydrants are provided in sufficient numbers to inundate every gallery in the buildings.

THE SCIENCE RECORD FOR 1873.

In reply to various enquiries we would state that Science Record for 1873 is now almost through the press and will be issued either next week or the week after, when all to whom copies are due will be immediately supplied. A large edition has been ordered. It is a handsome octavo volume of six hundred pages, illustrated with many engravings. The Engineering department contains views of several of the most important railway bridges in this country, the great Suspension Bridge between New York and Brooklyn, Steam Street Cars, improvements in engines, injectors, mills, and machinery of all descriptions.

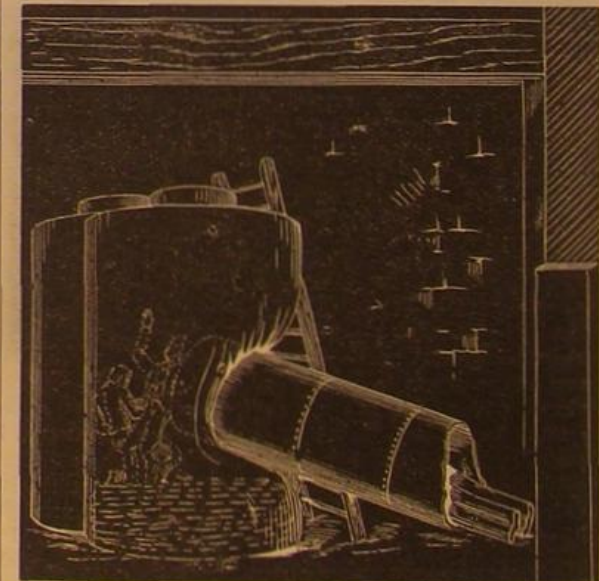
The department of Geography contains illustrations from the Yellowstone region, showing the wonderful pools, hot springs and other extraordinary formations, which are among the wonders of the world.

The department of Biography is rich in portraiture, containing steel and wood engravings of distinguished men of science, including Professor Joseph Henry, Professor Tyndall, Professor Dana, Professor Peirce, Professor Bunsen, Professor Kirchhoff and Professor Morse. The portrait of the latter is engraved from a painting from life taken some years ago, soon after Professor Morse had completed the first line of telegraph, between Baltimore and Washington, when he was in the vigor of his life.

The book is one of interest and value for lovers of progressive, practical science. The advertisement on another page shows the general scope of the contents.

THREE FEARFUL BOILER EXPLOSIONS IN ONE DAY.

Three terrible boiler explosions have recently occurred on the same day, February 2d, one resulting in the death of nineteen persons and the wounding of nearly two score more. One of these explosions took place at Pittsburgh, Pa., another at Syracuse, N. Y., and the third near Norristown, Pa. To an esteemed correspondent, Mr. W. B. Le Van, of Philadelphia, we are indebted for the accompanying diagrams and details of the casualty at the rolling mill of Messrs. J. Wood & Bro. at Conshohocken, near Norristown, Pa., which destroyed about one half of the establishment. The exploded boiler was 18 feet long and 4½ feet in diameter, and had been in constant use in the mill for twenty years. It had two flues, each 18 inches in diameter, which, with the shell, were originally of No. 4 iron, calculated to withstand 80 pounds working pressure to the square inch. At the ruptured point, the iron had become but three sixteenths of an inch in thickness, and was besides much crystallized. When the explosion took place a portion of the boiler was hurled, end first, across a canal and a railway track into a building known as the Albion Print Works. There it encountered a girder of an arched doorway, shattered it (with the adjacent wall) and finally lodged in a large iron tier, used for steam-



ing pieces of muslin, in the manner shown in our diagram. Two boys were engaged within the tier, distributing the warp for bleaching, both of whom were instantly killed. The tier was 8 feet wide and 12 feet high.

Ten minutes before the accident the steam gage showed a pressure of 53 pounds. The close flattening together of the flues indicates that they collapsed from force externally applied. There is little doubt as to the cause of the disaster. The boiler was simply used up, and the thinness of the iron and the clean, smooth rupture show that it had become inadequate to withstand the required pressure. Eleven persons were killed outright and a similar number, more or less, badly wounded. The responsibility of this awful disaster appears to rest upon the proprietors, and forms another link in the long chain of similar horrors due to a negligence of reasonable precautions for the safety of human life.

The Pittsburgh explosion occurred in the extensive American Iron Works of Messrs. Jones & Laughlins. These works are among the largest in the country, covering fifteen acres of ground and employing three thousand workmen. It is here that the celebrated cold rolled shafting is made. The explosion involved a battery of four boilers located in the central part of the numerous workshops. The spike and nail

factories together with the sheet mill were demolished, at a loss of some \$75,000 and seven persons killed and thirty wounded. The boilers had been five years in use. It is stated that the iron was good and that the gages showed plenty of water just before the accident. Portions of metal were thrown for distances of three blocks, crashing through the roofs of neighboring buildings.

Among the incidents of the disaster, it is mentioned that Mrs. Clarke, wife of one of the employees, hearing the noise of the explosion, fell upon her knees and commenced to pray; while in the attitude of supplication, a piece of the boiler weighing 700 pounds struck the house, and went crashing through the room on the line where her head would have been had she remained standing. Another mass of the boiler iron, weighing nearly eighty pounds, went lumbering through the air for a distance of 200 yards, and, descending upon a door of a bakery on Carson Street, crashed through it as it might through a house of straw, and fell upon the middle of the floor. Fortunately, however, though much destruction of property was occasioned, no loss of life here ensued. A blacksmith, named Jacob Broonsinger, who was working in a shop in the vicinity of the explosion, had been standing at a certain place fixing a horseshoe. He stepped over where the horse was, and had just begun to put the shoe on when an immense piece of iron, weighing fully 200 pounds, came crashing through the roof, and fell on the spot where he had been standing a moment before.

We trust that some of our engineering correspondents will send us diagrams and particulars of these boilers for publication.

The third explosion to which we have alluded took place at Geddes' rolling mill, in Syracuse, N. Y. In the latter case, one workman was killed and seven injured. The boiler was new and considered in prime condition. The buildings and machinery were damaged to the extent of \$5,000.

MATTHEW F. MAURY.

Matthew Fontaine Maury, formerly an officer in the United States Navy, afterwards of the Confederate Navy, died recently at his residence at Lexington, Virginia, aged 67. He was formerly superintendent of the Government Hydrographic Office, where he elaborated investigations in regard to winds and ocean currents. The discovery of the telegraphic ocean plateau and the indication of good whaling ground is attributed to him. At the time of his death, he was Professor of Physics in the Virginia Military Institute.

AN OLD FRIEND GONE.

The London *Mechanics' Magazine*, after an existence of fifty years, has, as a distinctive publication, disappeared from public view. It has recently been incorporated with a new weekly periodical, of more pretentious form and larger dimensions, entitled *IRON, THE JOURNAL OF SCIENCE, METALS AND MANUFACTURES*.

We shall greatly miss the familiar face and the regular visits of our excellent cotemporary, which flourished for nearly a generation before the *SCIENTIFIC AMERICAN* was conceived. The assurance that the new comer, which is to stand in its place, will be more sprightly and occupy a wider field have, for us, no comfort. For over twenty-five years the *Mechanics' Magazine* has been to us a valued friend and counselor in things scientific, and we deeply regret the exigencies that have compelled its final suspension.

We have before us, as we write, the first number of the *Mechanics' Magazine*, which is graced by a prospectus commencing as follows:

"FELLOW COUNTRYMEN:—Almost every class of people in this enlightened country has now a journal or magazine, which attends to its peculiar interests," etc. It then goes on to say that no publication has yet appeared suited for mechanics and artisans. "But the publishers now undertake such a work under the title of the *MECHANICS' MAGAZINE*, which shall be so cheap that all may buy, and of such value that no one ought to be without it." The price was fixed at 3d. per copy. It was printed in book form, sixteen pages in each issue, and published weekly. The first number was issued on Saturday, August 30, 1823. How vast has been the progress of science and invention since that day!

The front page of the first number of our venerable cotemporary was adorned by a portrait of James Watt, who had then been buried four years. An excellent biographical sketch of the great inventor then follows. The diving bell is next described and illustrated. Then comes a picture of a man flying in the air, with mechanical wings. A list of the new patents granted during the preceding month is then given, six in number, one of which was issued to Steven Fairbanks, of the United States of America, for certain improvements in locks. How to boil potatoes, and choose a carpet, are explained; also an old wife's notions about tea and teapots. How to detect cotton mixed with wool; How to avoid the effects of foul air in wells, and How a philosopher was outwitted, are explained. The latter states that a little girl came to a learned doctor who was busy in his study, and asked for some fire. [This was before the day of matches.] She had nothing wherewith to carry the coals, and the doctor started to fetch something for that purpose. But the little girl, stooping down, scooped some ashes on one hand and placed thereon with the other some live embers and departed. The astonished doctor threw down his books, saying: "with all my learning I should never have found out that expedient."

Jacob Perkins, the American inventor, was at that time in London, and some of his inventions attracted great attention. Among others noticed in an early number of the *Mechanics' Magazine* was a steam engine and generator, worked at what

was then considered an enormous, a fearful pressure, namely, 75 pounds to the inch. His assertions that such engines could be safely worked, and with greater economy, were scarcely credited by the scientific people, notwithstanding that he had a ten horse power engine in actual operation.

The successful removal of a brick house to a considerable distance back from the street, in Maiden Lane, forms the subject of a letter from New York. The job was done by a Mr. Brown by means of screws, and his mechanical genius is highly praised.

Brunel's device for tunneling under the Thames is also illustrated and described, and notice is made of the fact that Sir Humphrey Davy had just discovered the application to mechanism of a certain gas, fifteen times heavier than air, which will produce a power fully equal to that of steam. The great obstacle to the immediate use and introduction of the gas is stated to be the difficulty of confining it. But Sir Humphrey expected to be able to overcome the obstacle.

In the number for January 3, 1823, a correspondent, who is so far in advance of the age that he does not venture to give his name, but signs himself T. G., gives drawings and descriptions of a locomotive engine, cars and railway. His article is entitled "Proposition for a General Iron Railway, with Steam Engines, to Supersede the Necessity of Horses in all Public Vehicles." He says:—"The intention of the present scheme is to introduce a more economical and expeditious mode of conveyance than is now in use, for vehicles of every kind, whether employed in the transport of persons or merchandise. It is proposed to supersede entirely the necessity of horse power in all public wagons, stage and mail coaches, post chaises, etc., and to employ in its stead the more potent agency of steam. A careful examination of the drawings now presented to the public, as a plan of a general iron railway, will, it is hoped, clearly demonstrate the ease, safety, and celerity with which vehicles of every denomination, for the conveyance of goods and persons, may be propelled by mechanic power. The six parallel railways which extend the whole length of our inner plate, form a general iron railway, which might run in a direct line from London to Edinburgh, and from London to Falmouth." This proposed railway had three tracks with devices for the lateral transfer of the cars from one track to the other. Each rail was provided with cogs, set below the face of the rail, and cogged wheels on the locomotive were made to mesh with the rail cogs; the engine and train were thus propelled. It had not then been ascertained that the adhesion of the wheels on the smooth faces of the rails would be sufficient, without the use of cog teeth.

DEPARTURE OF PROFESSOR TYNDALL.

We have before us Professor Tyndall's parting words to his many friends in the United States, delivered at a dinner recently given in his honor by many prominent citizens of New York. Through all the lightness characteristic of a post-prandial speech, we recognize the same earnest efforts in behalf of original research, the same powerful appeal to all classes of educated men to aid in the cultivation of science, that were so eloquently maintained in the able discourses now familiar to us all.

It is difficult to take exception to arguments emanating from so distinguished a source, but, while concurring in the belief that men who are willing to devote their lives to the advancement of our scientific knowledge should be supported, free from other cares, we do not fully acquiesce in the opinion that original research would be very materially forwarded by the establishment of an institute on the same basis as the Royal Institution of Great Britain. Records of the past point to the fact that successful discoverers in the great field of science have toiled, not with costly accessories or assisted by abundant means, but have carried out their labors after struggling against the most adverse of circumstances and with the humblest aids.

We are led to infer from the remarks of the learned author that he regards with a shadow of dissatisfaction the position he has taken upon the lyceum stage. He says "look jealously upon the man who is fond of wandering from his true vocation to appear on public platforms. Now and then the discoverer, when he has anything important to tell, may appear with benefit to himself and the world, but as a general rule he must leave the work of public lecturing to others. If our premise be correct, Professor Tyndall, with characteristic modesty, underrates the magnitude of the service he has rendered to science by his public lectures. Great as he is as an investigator, and valuable as the discoveries attained through his instrumentality are, we consider that as a teacher, as an apostle of science sent to awaken a new interest in its truths in the minds of others, he fulfils his true mission; and that, had he secluded himself as he suggests the inquirer into Nature should do, the value of his contributions to our knowledge published by other means would fall far short of the benefits he has already conferred by his matchless elucidation of truths already known.

Did our space permit, we should be glad to present the whole of Professor Tyndall's admirable speech. As it is, we cannot refrain from quoting the following lines, addressed to those who apply themselves to science as a vocation. After alluding to his mode of life and study in Germany, he says:

"For a good portion of the time I rose an hour and a half earlier, working by lamplight at the differential calculus when the world was slumbering round me. And I risked this breach in my pursuits and this expenditure of time and money, not because I had any definite prospect of material profit in view, but because I thought the cultivation of the intellect important—because, moreover, I loved my work, and entertained the sure and certain hope that, armed with

knowledge, one can successfully fight one's way through the world. It is with the view of giving others the chance that I then enjoyed that I propose to devote the surplus of the money which you have so generously poured in upon me, to the education of young philosophers in Germany. I ought not, for their sake, to omit one additional motive by which I was upheld at the time here referred to—that was a sense of duty. Every young man of high aims must, I think, have a spice of this principle within him. There are sure to be hours in his life when his outlook will be dark, his work difficult, and his intellectual future uncertain. Over such periods, when the stimulus of success is absent, he must be carried by his sense of duty. It may not be so quick an incentive as glory, but it is a nobler one, and gives a tone to character which glory cannot impart. That unflinching devotion to work, without which no real eminence in science is now attainable, implies the writing at certain times of the stern resolve upon the student's character: 'I work not because I like to work, but because I ought to work.' In science, however, love and duty are sure to be rendered identical in the end."

We feel assured that the regrets expressed by our parting guest at the circumstances which necessitate his early farewell will be shared by all. That he has succeeded in arousing a new interest in science among us is unmistakable; and that by his personal presence he has, if such be possible, increased the respect and admiration we had formed for him through his writings, is equally true. He carries away with him the expression of our cordial goodwill, coupled with the sincere hope that his return to our shores will be delayed to no distant day.

AN ELECTRICAL TOWER.

Mr. William H. Ward, of Auburn, N. Y., has suggested an electrical tower for accumulating natural electricity for telegraphic purposes. The structure which is to be placed on high mountain peaks or other elevated stations is to be made in three sections. The lower portion is a mere shell containing a door. Above this and insulated from it by a diaphragm is the middle part in which are openings or windows having slats pivoted in them, so that, by means of raising or lowering rods suitably connected to such shutters, the openings may be shut or opened. A projecting roof extends over the windows, serving to protect them from the weather and also for receiving the aerial electricity which may be drawn from it by wires for land line purposes. Above this roof is another insulating diaphragm. The highest portion of the tower is surmounted by a bent ventilating tube and vane, so arranged and connected with the rods acting upon the shutters that the revolution of the vane by the wind will open the windward and close the leeward slats. The wind therefore assists in driving an aerial current of electricity into the insulated middle portion of the tower, which current passes upward through the upper portion of the tower and out through the ventilator, thus forming a draft by means of which the electrical current is forced out at the vane. Insulated wires leading from the top portion of the tower allow a supply of electricity to be drawn therefrom.

By the use of the aerial electricity which surrounds the earth in the upper strata of the atmosphere, the inventor considers that artificial batteries may be entirely dispensed with, and a circuit formed merely by connecting the aerial current with the earth current. For instance, to bring Buenos Ayres, in South America, in direct connection with New York the following plan would be pursued: one electrical tower is erected on Pike's Peak or any other suitable high mountain in North America, and another similar tower on some suitable peak of the Andes in South America. The former would, by means of land lines, be connected directly with Denver, which place is again connected with all the prominent cities of the States. In a similar manner the southern tower is connected by land lines with prominent cities *via* Quito. New York telegraphs to the tower on Pike's Peak, and the operator having connected the land line with the aerial current, the signals are transmitted through the aerial current to the town in South America, and thence—the land lines being suitably connected—to Quito and Buenos Ayres.

A Velocipede Race.

A fifty mile race on bicycle velocipedes recently took place at Wolverhampton, Eng., between two experienced riders, Moore and Johnson. Moore, the smaller man of the two, agreed to allow his opponent an advantage of two miles in the fifty. The first fourteen miles were run in 59 minutes and 23 seconds, the advantage being in favor of Moore. At the end of the twentieth mile the race seemed to be over, as Johnson was evidently suffering from having repeatedly to force his high wheel with short crank up hill against the wind. Moore, on the other hand, with small wheel and long crank, had no difficulty in making the ascent. On the twenty-seventh mile, Moore passed Johnson for the sixth time, who could now scarcely move his vehicle up the short hill, and, on the twenty-eighth mile, Johnson gave up the race. Moore finished the remainder alone, making the fifty miles in three hours 56 minutes and 40 seconds, and running the last mile quite as quickly as the first. At starting, in view of the odds given to Johnson, bets of three to one were offered that he would come off victor.

THE Leyden jar was discovered by Von Kleist in 1745. Chemical decomposition by voltaic electricity, was discovered by Nicholson and Carlisle, London, in 1800.

THE height of thunder clouds from the earth has been observed, in India, to be from three to five miles.

FLOATING STATION FOR FLOATING FIRE ENGINES.

We herewith illustrate a floating station or dock for floating fire engines, which has been designed and lately patented by Mr. William H. Maw, and which is being introduced by Messrs. Merryweather & Sons, a firm who have been remarkably successful in the construction of small floating fire engines of the class which the station is especially designed to accommodate.

The object of the arrangement we illustrate is to afford shelter and protection to floating fire engines, and to enable

being placed in telegraphic communication with the land stations, they enable the floats to be brought into action without any delay. 4. They afford better accommodation for the men than can be given in the present large floats, while they also afford ample stowage for coals and stores.

The Proposed Million Dollar Telescope.

Some of our correspondents are determined to push this matter. W. L. L. says that the people of the United States ought to promote the scheme at once, and he suggests that ev-

temperature being regulated at will by a globe valve in feed pipe.

This evaporator is no untried experiment, but can be seen in daily use at the works of the Rahway Glue Manufacturing Company, Rahway, N. J. The company claim to have evaporated 600 gallons an hour, and they invite all interested to visit the factory and see for themselves the actual working.

This evaporator is adapted for sugar, salt, dyes, wood and bark extracts, etc. For further information, address the sod

**FLOATING STATION FOR FLOATING FIRE ENGINES.**

floating fire engine vessels of comparatively small dimensions to be employed to greater advantage than is possible under ordinary circumstances. For this purpose it is proposed, by Mr. W. H. Maw, that the floating fire engine, when not at work, should be kept in readiness, under cover, within a suitable floating station or dock, which is permanently moored in the required situation, and may be placed in telegraphic communication with the shore and other fire stations of the district in which the floating station is situated. The floating station is constructed so as to carry firemen's quarters, coal and other stores, and apparatus for containing supplies of water, heated or otherwise, in readiness for feeding the boiler of the floating fire engine.

The floating station is constructed with two hulls connected together below the water level by cross girders as well as by a roof overhead, the hulls being placed sufficiently far apart to accommodate the steamers between them. The cross girders must, of course, be sufficiently immersed to clear the keel of the floating fire engine under all circumstances, unless it be desired that the floating fire engine or engines should be capable of leaving the dock at one end only, in which case some of the girders may be placed at a higher level.

In the cases of some harbors where vessels, lying at moorings, are liable to have their bottoms rapidly coated or fouled by marine vegetation, or otherwise injured by constant immersion, the floating fire engine station or dock is constructed to keep the floating fire engine out of the water, for which purpose the hull of the station is built in compartments divided from each other by suitable watertight partitions, some of these compartments being capable of having water admitted into them. These compartments are made of such size that, when filled with water, they will cause the draft of the floating station or dock to be increased by an amount exceeding the draft of the floating fire engine, and the cross girders connecting the two sides of the floating station at the bottom are formed with cradles capable of supporting the float without injury, and so placed that, when the hull of the station is thus deeply immersed, there shall be sufficient water over them to allow of the floating fire engine entering the dock. When the float has been thus brought into position, the water is pumped out of the compartments by connecting the latter to the suction pipes of the pumps carried by the float, the dock rising as the water is thus pumped out, and carrying the float with it. On the float being required for service, water is at once admitted to the compartments above referred to, and the dock sufficiently immersed to allow the vessel to float off the cradle.

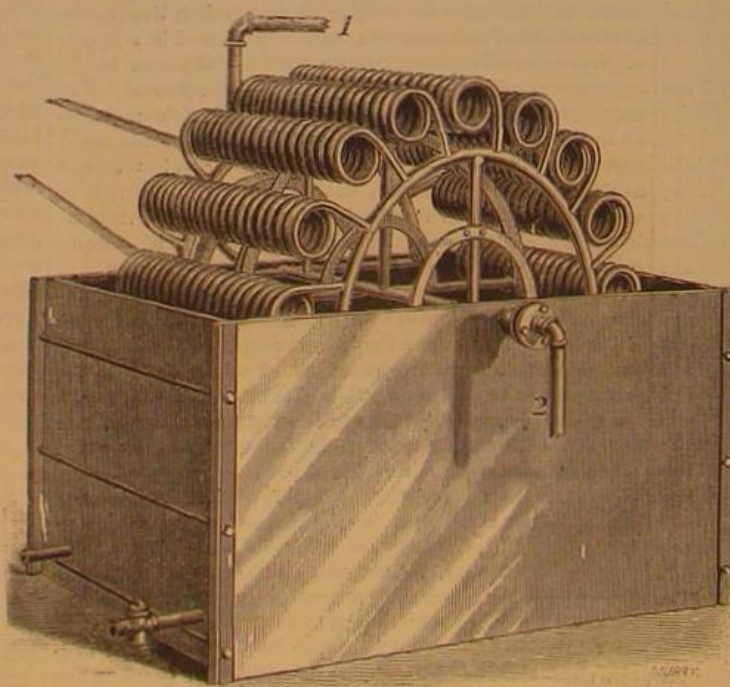
The construction of the station will be readily understood from the engraving, which we take from *Engineering*.

The floating fire engine stations are designed to obtain the following advantages: 1. They enable a small and handy class of floating fire engines to be used in the most effectual manner, by placing them at all times under the immediate attendance of their crews. 2. They afford complete protection for the floating fire engines, both from the effects of the weather and from chance damage from passing vessels. 3. By

every one of our readers should contribute to the object, and an appeal for assistance be made to Congress. He concurs with a previous writer that a charge for the use of such an instrument would amply remunerate the investors, and he offers \$25 to help make a beginning. By similar liberality among all classes, the necessary funds could be raised; but the help of Congress to any such object should not be expected. There is no personal greed to satisfy, as there is in such cases as the Vienna exhibition, and no adventurer who will "lobby" the scheme through the two Houses; so the telescope must be constructed, if at all, by public spirit shown in voluntary contributions.

IMPROVED EVAPORATOR.

This machine meets one of the great requirements of the age, namely, a process of evaporation which, combining sim-

**BADOUX'S RAPID EVAPORATOR.**

plicity with cheapness, is within the reach of all; and as no mechanical knowledge is needed to run it, it is peculiarly adapted to out-of-town factories, plantations, etc.

The evaporator is a strong wheel with hollow shaft, rims, and coils. 1 represents the feed pipe for introducing hot air or live or exhaust steam, which, meeting a check in the shaft, passes up through the arms into the rim, and is there distributed through the coils. 2 represents the discharge pipe for the air or condensed steam, which can be again utilized for heating feeding boilers, etc.

The tank can be made of wood or metal, and to hold such quantity as is desired. The wheel is rotated by hand, horse, or steam power, and it is said that it does not whip or froth the liquid, but lifts and evaporates it from the surface. When started, it can be left to do its work alone, the

agents, the Rahway Glue Manufacturing Company, P. O. Box 351, Rahway, N. J.

The Silk Worm in Japan.

The Italian silkworm breeder, Chiapello, who was lately enabled to travel in Japan, and visit the silk districts of Boshio, seldom entered by Europeans, publishes some interesting particulars in the *Moniteur des Soies*. Chiapello was greatly surprised by the almost complete want of mulberry trees. All mulberry plantations in that silk-producing province are hedges formed along irrigation canals, from twenty to twenty-five inches distant from each other; the single bushes are separated by a distance of from fifteen to seventeen inches. Great care is taken in properly manuring and watering these bushes till the fifth year. The Japanese consider the leaves from bushes four or five years old the best food for worms which are preserved for propagation, especially for those coming from the region watered by the rivers F'squama and Sirotaz. Besides the usual manure for the land generally, they give to each bush, from time to time, a few spoonfuls of finer compost, especially one prepared from a fish guano. The color of the eggs is said to be influenced by the kind of manure used; the latter, as well as the degree of manuring, is also stated to affect the produce.

This extreme care as to the food of the silkworm is a striking feature in the silkworm culture of the Japanese, which contrasts sharply with the carelessness practiced in this respect by European growers. The same care is observed in choosing animals for propagation, and a peculiar method is employed for selecting the strongest, consisting in temporarily exposing the cocoons to the influence of cold, whereby the weaker ones naturally die off. Another characteristic in Japanese silkworm breeding is that twice the room is given to each worm which is allowed for it in Europe. The detection of diseased animals is also worthy of notice. If a reddish point appears on the head, the worm is killed. Some districts have for centuries been famous for the excellence of their silkworms, and their eggs are largely used in Japan for propagation.

Longevity of Elephants.

It is stated by Sir Henry Stisted, who had a command in India during the Sepoy rebellion, in 1857, that some of the elephants employed by him had inscriptions upon their trunks showing their capture by the British forces at the celebrated battle of Plassy, nearly one hundred years previous. Pliny quotes Aristotle to the effect that elephants live from 200 to 300 years. In a vegetable-feeding quadruped, says Mr. Buckland, the duration of the teeth offers a fair criterion by which to judge of the probable extent of life, and we think that Sir Everard Home is the physiologist who has observed that the teeth of the deer and sheep are worn in much less than fifteen years; those of the ox tribe in about twenty years; those in the horse in about forty or fifty years; while those of the elephant will last for a century. The longevity of the last mentioned animal must be, therefore, in all probability, very considerable, although falling far short of the ancient estimate.

IMPROVED PAIL PUMP.

Our engraving shows a little pump introduced by Messrs. A. Paget & Co., of Loughborough, England. The apparatus is placed on a light cast iron stand, to which the bucket, holding five gallons, is bolted. A perforated screen covers one end of the passage in the cast iron stand, which, as shown, forms the inlet to the pump; the other end is closed with a flap valve.

The pump consists of an elastic circular chamber, the sides of which are made of rubber, while the top and bottom are formed of cast iron plates, with an opening and valve in each. The form and dimensions of the air vessel are clearly shown in the engraving, as well as the position of the outlet and connection with the hose. Cast in a piece with the lower

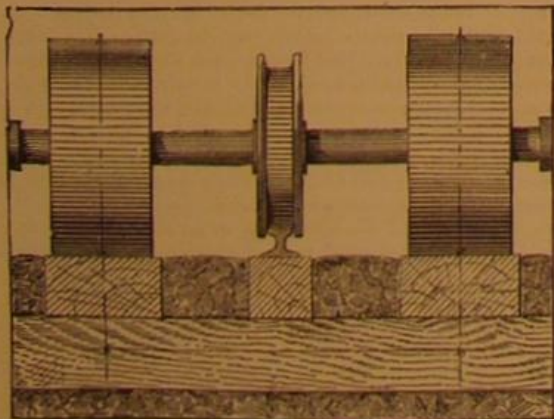


part of the air vessel is a bracket terminating in a pedal. A spiral spring, attached at one end to the top of the bucket and at the other to the pedal, by a short length of cord, serves to keep the pedal always in its normal position.

The alternate pressure of the foot upon the pedal, and the contraction of the spiral spring when that pressure is relieved, compress and distend the elastic or bellows-like chamber, actuating the inlet and outlet valves and forcing the water into the air chamber and thence through the outlet. The whole apparatus, complete, weighs twenty pounds, and with it a jet of water can be easily discharged to a height of from 30 to 35 feet, at the rate of two and one quarter gallons a minute. If desired, the jet may be distributed in spray, by the spreader shown in the illustration.

NOVEL AND CHEAP RAILWAYS IN PORTUGAL.

The question of working tramways by means of locomotive engines and light rolling stock is at present in course of receiving a practical solution in the kingdom of Portugal, where two lines of considerable length are now being made. One line runs from Lisbon to Cintra, a distance of 17 miles, whilst the route of the other is from Lisbon to Torres Vedras, about 60 miles. The first line is nearly completed, whilst the works of the second have progressed for about two thirds of its length. Both the tramways and the rolling stock, however, are of peculiar construction, says *Engineering*, and neither a railway nor an ordinary tramway, nor the two combined, will afford even an approximate idea of the principle adopted on these lines. The tramway consists of a central 42 lbs. rail of the Vignoles section, flanked on either side at a distance of about 20 inches with timber longitudinal sleepers, the three being secured to traverse sleepers, which are also of timber. Upon this triple



line run engines and carriages having one pair of broad wheels placed central to their length, and running on the timber sleepers, and at either end a bogie frame carrying for the engine two, and for the carriages one, double flanged wheel, placed centrally to the width of the carriage and working on the iron rail. In the locomotive the pair of broad wheels are the drivers, the small central wheels acting as guides. In the carriages, however, the exact reverse of

this arrangement is observed, the bearing being taken by the bogie wheels, whilst the outer broad wheels act simply as guides. They are allowed a very wide margin of vertical play by means of American springs made with an india rubber core surrounded by a spiral steel spring. The bogie wheels are also carried by six springs of the same character. The carriages, in fact, are therefore, it will be seen, steadied and prevented from overturning laterally by the outer wheels. The gage of the line is determined by the outer wheels, which are 4 feet 2 inches from center to center of tyres, the longitudinal timber on which they run being of sufficient width to carry the engine wheels, which are 14 inches broad, the breadth of those on the carriages being 4 1/2 inches.

The engines have 11 inch cylinders, and weigh when empty a little more than eleven tons, and loaded, 13 tons 5 cwt., the tanks carrying 200 gallons of water. The locomotives are fitted with an ingenious hydraulic arrangement, by means of which the body of the engine is preserved in a horizontal position when it is either ascending or descending an incline, so that the tubes are not uncovered by the water, the level of which is indicated outside. The power of each of the engines already made has been tested up to 300 tons, which has been drawn by them on the level. The carriages are of three classes, those of the first class carry 16 passengers, the second class 20, and the third class 24. The carriages are 14 feet 6 inches long, and are divided down the center by a partition extending just above the heads of the passengers when seated, so that a means of communication is left open. The passengers enter the carriages from the sides, and are seated back to back. There are also first and second class composite carriages which carry 18 passengers; for merchandise, substantial goods wagons are provided.

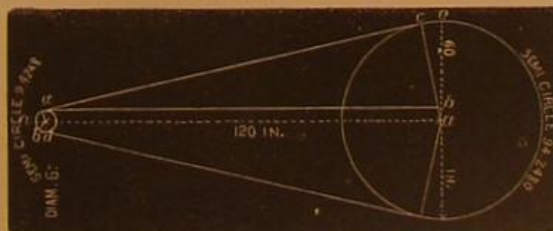
In order to test the system a strip of land has been obtained in Epping Forest, at Buckhurst Hill, where a piece of tramway road, 1,710 feet long, has been laid, with a short siding at right angles to it. The junction between the main length and the siding is formed by a curve 39 feet 4 inches radius, laid at an incline of 1 in 17. The main line—if we may so term it—is on an incline for nearly its whole length, the steepest gradient being 1 in 18 1/2 and the average in 22 1/2. Up and down this line and round these curves, a number of runs were made, both with full and empty carriages, at good speeds and with perfect success, at the rate of about 20 miles an hour, starting and stopping included. This corresponds with the results of a great number of runs which had previously been made over the same road, time being accurately taken. The system has been developed to its present degree of perfection by Mr. F. H. Trevethick, the engineer to the Lisbon Tramways Company, who has bestowed the greatest care upon every detail of construction; and we feel sure that under his care the system has been developed to the utmost, whilst the commercial success of the enterprise appears to be guaranteed by the large amount of both passenger and goods traffic between the localities which the tramways will connect.

Correspondence.

Finding the Length of Belts.

To the Editor of the Scientific American:

Your correspondent, J. B. Doolittle, gives a very nearly correct plan for finding the length of pieces to be put in or taken out of belting. I wish to know the best plan for finding the length of the entire belt. I send you a sketch of mine which is nearly correct enough, as I have proven both



by practice and by laying down the full size on a floor. It is calculated, as you see, by similar triangles, but I want a shorter way if there is one. A SAWYER.
Chester county, Pa.

Polar Mutation.

To the Editor of the Scientific American:

Mr. J. Arnett, C. E., in the *SCIENTIFIC AMERICAN* of January 25, accounts for the terrestrial changes in past ages (which have been made manifest by the geological survey of Ohio) by polar mutation, or, in other words, by supposing a change of position of the earth's axis with respect to its surface.

We learn, from a study of celestial mechanics, that the earth's axis is continually changing its position with respect to a fixed point in space; but we have no evidence that it is changing, or ever has changed, its position with respect to the surface of the earth. On the contrary, it may be demonstrated that such polar mutation could not result from any known cause. Laplace says: "The momentary axis of the earth coincides with its third principal axis, and its poles of rotation always correspond very nearly to the same point of its surface." (See *Mécanique Céleste*, volume ii., page 859.)

Before assuming that polar mutations are the cause of observed physical changes in the structure of the earth, it should be shown that such polar mutations are mechanically possible. But this can only be done by assuming some external, accidental, and transitory force, about which we know absolutely nothing.

Des Moines, Iowa.

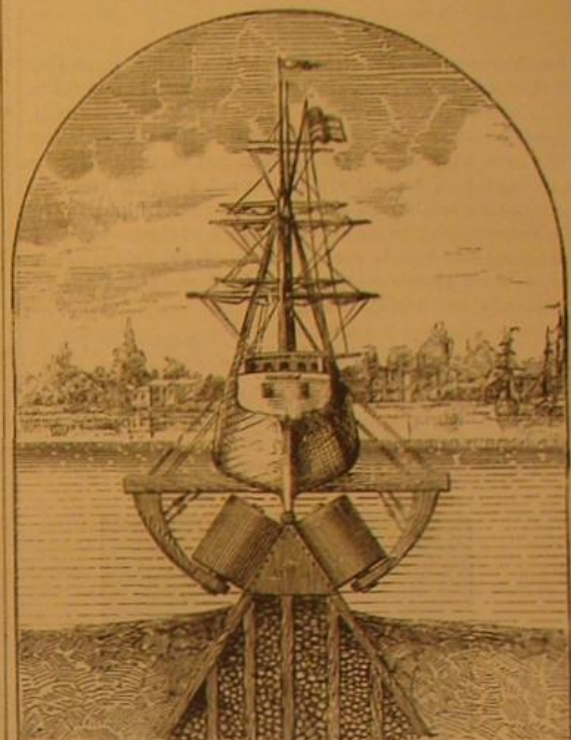
J. E. HENDRICKS.

A Marine Camel.

To the Editor of the Scientific American:

I send you a plan for a marine camel, as suggested by the article by Mr. C. W. Stewart, in the *SCIENTIFIC AMERICAN* of January 18, 1873, for carrying full laden vessels across the bar at the mouth of the Mississippi river.

The back of this marine camel may be partly, or the whole of its entire length, submerged; each end would have to be submerged to a depth sufficient to allow the vessel to float into, and out of, a receiver, already mounted upon the track. The entire weight, when out of water, would be pivoted on the crown of the prism, this prism being composed of wood and stone, and the crest surmounted by a huge iron rail of



circular form, running the entire length of the prism. The equilibrium of the load is to be preserved by means of two revolving flanges for each burthen wheel; the flanges are to lap on the central wheel, and extend down each side of the prism to its base. This locks the carriage to the prism, so that the action of the waves could in no way interfere or displace the carriage from the prism.

I submit this plan for a marine camel, first, because its form admits of extending to any dimensions, without necessitating changes in carriage; and, secondly, because the form is the best calculated to withstand the action of the elements, and to give the greatest amount of strength, vertically and laterally, with the least amount of material; and, thirdly, no long axles are used, and, moreover, the strain and motion imparted to the vessel while in transit would be something similar to that when riding upon the waves. E. CREW,
Inventor and Patentee of Prismatic Railway.

Opelika, Ala.

Iron Supports to Brick Arches.

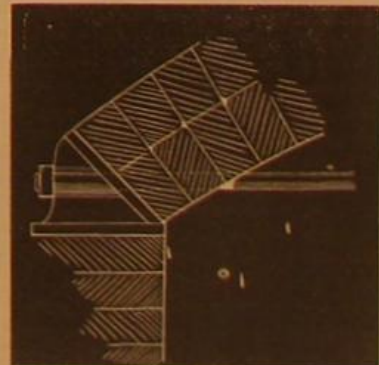
To the Editor of the Scientific American:

I want to build an arch of brick, of 16 feet span, 20 feet length, and 9 inches thickness, with a rise or crown of about 3 feet. The walls on which it rests are light, and I want to support it with iron cross rods at spring of arch. Of what strength should the rods be, and how many will I need? Is there any rule to compute the outward strain of arches?

Millville, N. J.

A. E. B.

REMARKS BY THE EDITOR.—If the arch has only its own weight to carry, it will need four tie rods of one inch diameter, one placed at 30 inches from each end of the arch, and the other two at equal distances between. At each springing of the arch there should be a skewback laid upon the wall to commence the arch upon, and the tie rods should pass through these skewbacks (see engraving), the axis of



the rod passing through the center of the depth of the arch at the face of the skewback. This skewback may be made of cast iron, the plates one inch thick, the angle brackets set at each end and at every 30 inches in the 20 feet. One of these brackets will occur at each rod, and is to have the hole for the rod pass through it, the metal being swelled out around the rod so as to afford a flat bearing for the head and nut of the rod. If the arch is to be levelled up with sand, concrete, or other filling, or is to carry any other load, then the rods should be larger.

There is a rule for finding the horizontal thrust of arches, but it is too complicated for insertion here in all its generality. For this particular case, however, the following rule approximates near enough for all practical purposes:

Approximate rule: Multiply the cubical contents in feet of the semi-arch, by the weight per cubic foot of the brick work and by the horizontal distance in feet of the center of gravity of the semi-arch from the springing, and divide the product by 7,000 times the height in feet from the springing to the top of the arch at the crown, and the quotient will be the area in inches of the cross section of the tie rod. This area should be the area of the rod at its smallest part, for example, the bottom of the thread of the screw at the end.

Algebraically, the rule may be stated thus

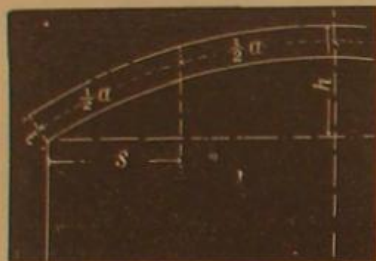
$$A = \frac{a t l w s}{7000 h}$$

where A = area of the cross section of the tie rod, a = length in feet of semi-arch from springing to crown; t = the thickness in feet of the arch; l = the length in feet along the wall, supported by one rod; w = the weight in lbs. per cubic foot of the brick work; s = the distance in feet horizontally from the springing to a vertical line dropped from the center of gravity of the semi-arch; and h = the vertical height in feet from the springing to the top of the arch at the crown.

Applying this rule to the case in hand, the values are as follows: $a = 9$ approximately, $t = \frac{1}{2}$, $l = 5$, $w = 110$, $s = 3\frac{1}{2}$ approximately, and $h = 3\frac{1}{2}$. Hence

$$A = \frac{9 \times \frac{1}{2} \times 5 \times 110 \times 3\frac{1}{2}}{7,000 \times 3\frac{1}{2}} = 0.495$$

This is the area of the cross section of the tie rod, the diameter of which is about 0.795 inch. This is the diameter at the bottom of the thread of the screw. Hence the diameter of the rod before the screw is cut ought to be about one inch.



The rule here given is based upon the conditions that the arch is not required to carry any load, the metal used is to be of fair average quality, and the work well done. The cast skewbacks may be made in two lengths of 10 feet each for each wall, and bolted together endwise by bolts through ears or lugs.

The Mount Auburn Incline Railway of Cincinnati.

To the Editor of the Scientific American:

Few quick transit railway enterprises have been so productive in final results as the Cincinnati inclined railway, which is known as the Mount Auburn Incline Railway of Cincinnati. It was commenced on May 11, 1872, and its construction is due to the skill and energy of a few of Cincinnati's best citizens, such as G. A. Smith, Stacy Hill and James Dougherty. It should be described to show the West Hoboken and Hudson City people that, had they a few such men, they would never put up with the slow, tedious, and dangerous transportation, by which they now travel and will travel till a horse railway is laid direct from the ferry to Palisade Avenue, running straight across the flats and then ascending the hill, not by the hundred steps but by an inclined railway at an angle of forty-five degrees, or even steeper.

Heretofore all the communication between the city of Cincinnati and Mount Auburn has been by a roundabout way by horse cars or by a rather more direct route by stage, both of which were long and tedious. The stage route was much more tiresome, for it was necessary to employ four horses to a stage, and the car was obliged to stop several times to rest the exhausted beasts. And when, in the winter time, the roads are covered with ice, it was the next thing to impossible to get up at all. Under such circumstances, it was not, perhaps, a brilliant idea to conceive the plan of an incline railway. But, when carried into practical operation as we find it to-day, it is a credit to its designers. The incline, which is situated at the head of Main Street, is 857 feet 6 inches from bumper to bumper, and there are two grades; from the bottom up about two hundred feet the ascent is 32 feet in 100, and the rest of the grade is about 26 feet in 100, making about 275 feet rise on the whole line. At the top of the incline is situated all the machinery for working the cars. This machinery, which is quite extensive, was designed and built by John Cooper and Co., of Mount Vernon, O. There are two flue boilers, about 47 inches diameter by 22 feet long, arranged to work together or singly. These are stationed about twenty feet from the head of the incline, and further on, in the rear of the boilers, are placed two engines of 30 horse power each. The engines are connected together at quarters on the same shaft, with a pinion between them which works into the wooden cogs of the elevating drum. This drum is about ten feet in diameter and about eight feet in length on each side of the cogs. These cogs are about 3 or 3½ inches pitch, and are stepped, or staggered, so that, when the engines are running up to full speed, there is not the least jar or jerk to the car or to any part of the machinery. At the head of the incline, there is a very ingenious automatic brake for stopping the cars should one of the hoisting ropes break. If it would not take up so much space I would describe it more minutely; but I will only say now

that it is considered perfect in its working and has beautifully stood the tests to which it has been put.

There are two cars, one going up while the other goes down, and nearly balancing each other. To each car there is attached two ropes of 1½ inches steel wire; one is used for the hoist rope, while the other merely runs idly over the safety wheel and is only brought into play if the hoist rope breaks on either one of the cars. Directly over the safety apparatus the engineer has his room; and from this position he can see the entire length of the incline. From this room the whole working machinery is operated by one man standing in full view of the cars and track. To his right he has his reverse lever which works the links on the engines 60 feet to the rear of him, and to his left he has his throttle lever, which is connected with the throttle valves on the engines by long light rods running on rollers or sheaves; and with his right foot he controls the brake on the elevating drum, by which he is enabled to bring the cars up easily against the bumpers. It is surprising to see how easily the engineer can stop the car without causing any bumping. I have seen him stop the cars time after time, so easily and at the same time so quickly that it seemed as if it would be impossible to draw a sheet of paper through between the bumpers on the end of the car and those at the head of the incline. In the engineer's room there is also a telltale to show the exact motion of the engines while running, and also a long lever attached to the aforesaid safety brake. This is used only in case of accident, to enable the engineer to have full control of every part of the machinery, although, as I have already stated, the safety brake is automatic in its operation; but the lever makes the brake doubly safe, which is of great importance where so many people are constantly going up and down.

There was a little timidity felt at first by some who were obliged to go up the hill and had for many years used the stage coach, but it did not take long for them to banish all fear. The cars can easily carry sixty passengers in a load; and at one time last summer, during the hot season, they carried nine thousand people in the course of six hours. One feature of the road is the accommodation; the managers will run up a car for one passenger as willingly as for sixty.

Their system of signals by bells is perfect. The time taken in making a trip from top to bottom is about thirty-five seconds, which is found to be much better than fifteen minutes by the stage or horse cars, especially when the thermometer stands at 25° below zero. There is some talk of erecting two more incline railways in the spring, for the accommodation of people in other parts of the city, for they will go back upon the high land to live, railway or not. The builders of the machinery which is already running will probably be consulted in relation to the new roads, for their experience on the first incline has brought out a great many points which will give an immense advantage, not to them only, but to the company putting up the road.

Mount Vernon, O.

O. C. WOOLSON.

Timed Turbines.

To the Editor of the Scientific American:

The following view of the turbine may be interesting to many of your readers:

It is believed that the final solution of that hardworked problem, as to how the water propels the turbine, relates simply to time, thus: Moving water is a strict observer of time; it falls, flows, curves, bends, etc., in a certain time. Man demands that the turbine shall make certain time (speed), discharging the water at a certain time; but he forgets that the water, and not he, fixes the time in which it will be moving as demanded; hence,

"Nature, and not man,
Has fixed the law, then change it if you can."

As the above only specifies that nature, not man, fixes the issues, the information given falls short of practical value; but this is as intended, leaving to others to fix, philosophically or experimentally, the exact point. The question would be simply this: As the greatest attainable pressure of the head water upon the buckets, as the propelling force, is desirable, how long or through what distance can this pressure be allowed to act before it will have deflected the water from its forward motion to that proper for the discharge, as here, of course, is the point for the issue?

Fair Grove, Mo.

J. B. REYMAN.

REMARKS BY THE EDITOR:—We suspect that our readers will feel more confidence in the facts deduced from experiment than in conclusions based upon metaphysics, however ingenious and interesting. In the present case, experiment has well determined the laws governing the action of turbines, and our correspondent will be better satisfied with the work of Wiesbach, Rankine and other authorities than with his own.

A Meteor in Nova Scotia.

To the Editor of the Scientific American:

A very brilliant meteor was observed here on January 25, about 7 P. M., and the circumstances are worthy of note.

About the time mentioned, I was walking along the street when suddenly my attention was arrested by a very bright light, which illuminated the surrounding scene; at the same time I heard a whirring noise overhead, and, on looking up, I beheld a meteor of large size moving along the sky. In a few seconds from the time I first observed it, an explosion occurred and fragments of the meteor, of varied colors, were scattered in all directions about the sky.

I have on many occasions observed meteors of rare brilliancy and great magnitude, but I do not remember any accompanied by such rare phenomena.

Halifax, N. S.

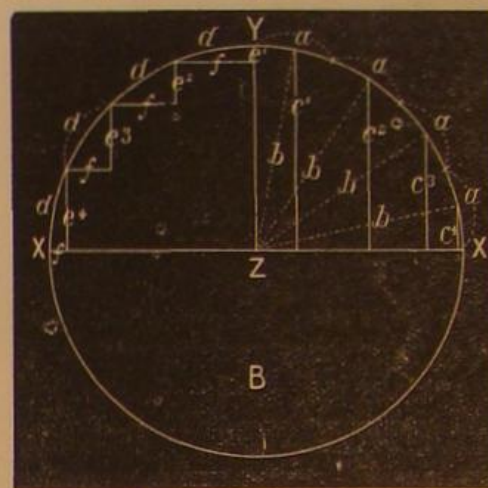
J. R. S.

Bursting Cylindrical Boilers.

To the Editor of the Scientific American:

It is to be regretted that this subject is still being discussed in your widely read journal as a matter still in doubt; and that the authority of Professor Henry and other "eminent scientists, both of England and this country," is claimed as endorsing the fallacy still adhered to by Mr. Bakewell. He claims that, in a boiler B, of a diameter 1, and with an internal collective pressure represented by 3.14 acting upon its whole circumference, the half circumference X, Y, X, measuring 1.57, would represent the measure of force tending to separate the upper half of the boiler from the lower half at X, X. On page 83 in the SCIENTIFIC AMERICAN of February 8, Mr. Bakewell gives an illustrated intended proof of his proposition, which is as hopeless of being conclusive as that of the student, who, with diploma in his pocket and brimfull of science, returned to his dotting parents, and, sitting down to a cosy supper of which two birds formed a main dish, to illustrate his learning, remarked: "I will prove to you that these two doves are three." "Glad of that, my son, mother and I will take these two; you take the third." The student's chance for the third was not a bit worse than Mr. Bakewell's for the extra force he claims as tending to burst a boiler. I hope I may be more fortunate in giving a convincing illustration.

The half circle X, Y, X, being divided into, say, eight parts, each arc, a or d , would have a pressure upon it of $\frac{1.57}{8}$. To



use two different illustrations, let the pressure upon arcs a, a, c, a , be represented by the four dotted radial lines b, b, b, b , bisecting the arcs centrally. The vertically acting forces will then be represented by the vertical lines c^1, c^2, c^3, c^4 ; and no other vertical forces can be shown to exist. Thus the vertical pressure tending to tear the boiler at X is to the pressure upon the $\frac{1}{2}$ circle X, Y, as the sum of the lines c^1, c^2, c^3, c^4 , is to the sum of the radial lines b, b, b, b , or as 1 to 1.57, nearly, (the result is as 1 to 1.562, the approximation becoming closer as the number of subdivisions a, a , is increased). Or, taking the left hand illustration, the pressure upon each arc d, d, d, d , being $\frac{1.57}{8}$, the resultant vertical pressures will be c^1, c^2, c^3, c^4 , which equal radius Y, Z, and are, when added up, $\frac{1}{2}$; while the horizontal forces are represented by the lines f, f, f, f , equal to radius X, Z, or to a force of $\frac{1}{2}$, which tends to tear the boiler at Y. Let the question be examined in still another way. Suppose the upper half circumference removed, and a rectangular shell put in its place, or a straight plate across along the diameter X, X; what then becomes of the tearing pressure at X, X, claimed to be measured by 1.57? And yet it is a fundamental law which cannot be questioned that the tearing pressure at X, X, so long as these points remain the same distance apart, is the same, no matter what the configuration of the vessel above it may be, whether it be spread out to thrice the width of X, X, or thrice as high, convex, concave, undulating or any other shape whatsoever.

As a fruit of this deplorable delusion, a patent has already been issued upon a convex or concave piston, claiming, upon this theory, to obtain greater pressure than can be obtained by a usual piston. In calculating the power of an engine upon this theory, the transverse section of the cylinder ceases to govern the estimate, and the degree of convexity of the piston, with its diameter, would take its place. This false theory, in the abstract, may deceive; but when applied, and the consequences which would result therefrom are reflected upon, its absurdity becomes so glaring that any further argument must surely seem superfluous. If Mr. Bakewell will carefully read over again Professor Henry's letter (and others) probably he will find that, while endorsing the proposition that the collective pressure upon the half circumference is 1.57, he did not necessarily mean that the tearing pressure, at X, X, is equal to that pressure. Let us have that letter. If it indisputably endorses Mr. Bakewell's theory, I can only exclaim "To err is human—even among the mighty!" But if so, Professor Henry will not hesitate to make the correction.

Williamsburgh, N. Y.

ROBERT CREUZBAUR.

Cooling and Heating our Houses.

To the Editor of the Scientific American:

In regard to the plans and remarks of Mr. Dodge in your issue of February 1, 1873, I desire to make an explanation in defense of my suggestions in your issue of October 14, 1872, to which my abbreviated name "Egbud" was subscribed, and to describe my inventions for simplifying the heating and cooling of our dwellings.

Mr. Dodge says that: "Unless the air in the building was at a higher temperature than that outside, the current would

be from the house through the tunnel and chimney. In warm weather, the air would be heated in our dwellings, and it is also in winter heated by fuel; so that if the space in the tunnel or pipes is corresponding to the size of the dwelling, either in breadth or length, it must draw in the outer air, which becomes modified and purified by the earth. Oxygen is left free to sustain life and produce combustion, and the direction of the air current is natural, as the escapes in building are higher than the air chimney. In mining shafts, of few feet depth, the modifying influence of the earth is sensibly felt; and among our large class of miners, who inhale the air changed by underground currents, many diseases are unknown. My invention for the action of earth on air for cities is both simple and cheap. It is to make an excavation like a ground cistern, close by the house, if necessary, and then take clay pipes, with joints to fit, and lay them from the bottom connecting passage in a square, one upon each other. An outer and inner square is desirable, up to the earth's surface; then fill up the space with earth and connect to a chimney of sufficient height to be above impure surface air. An iron box, filled with wooden flues, or two such, can be used, and any length of air passage can be obtained. For heating purposes, the air would be of genial warmth when coming in contact with the heater, and would save a large per cent of fuel; and as the heater need not be at a high heat, the life sustaining particles would not be destroyed. It is only where the air is impure through some cause that dampness is required to renew vigor.

Of course, action and reaction produce change and purification; but how shall we seek and produce it, by costly heating and steam apparatus with fans, or by Earth's laboratory, in conjunction with Nature's regular laws?

Mr. Dodge and the engineers of our government buildings would find much expense saved by modifying the air as described, before forcing it to its destination.

Budd's Lake, N. J.

ENOS GORLE BUDD.

Entomology in Congress.

To the Editor of the Scientific American:

I notice, in an article under the above heading, on page 64 of your current volume, some strictures upon the debate in the House of Representatives, at Washington, upon the Department of Agriculture. Allow me to thank you, in behalf of myself and thousands of other farmers all over the country, for thus speaking a good word for us. I am glad that Mr. S. S. Cox belongs to New York and not to the State of Maine, for the honor of which latter I have a sensitive regard.

Cudgel, soundly, Mr. Cox and any one else who exhibits so unmistakably his Darwinian relationship, not to the monkey, but to a certain long eared quadruped whose stolidity is proverbial. Belabor him well; but yet I fear that as little good will come to him from your lusty blows as would come if they were aimed at his four-footed cousin. We take a kind of malicious pleasure in seeing the chastisement administered, just because it is aimed at culpable ignorance.

When the farmer sees the crops over which he has spent his time and energies, his fruit, grain, vegetables, cotton, grass, everything, damaged, in his own fields or others, to the extent of millions of dollars annually it does not matter whether the destroyers have the proportions of elephants or of microscopic insects. Very gladly and hopefully he looks to the scientific men of the land to show how the enemy can be restrained and the crops saved. Let the "bug hunters" be sustained and encouraged, for our insect foes are many and alarmingly destructive.

Thus much to you, Mr. Editor, to let you know that your efforts are noticed and appreciated by farmers as well as by those engaged in purely scientific pursuits.

Naples, Me.

SAMUEL F. PERLEY.

Science and Theology.

To the Editor of the Scientific American:

Your excellent article entitled "Can buildings be set on fire by steam pipes?" leads me to lay before you the following deductions, based upon the acknowledgment of water being emblematical of the God of Heaven in life and power, etc.

1. The life of God, having been manifested to the world for its salvation, not for destruction, He will never permit the destructive element of fire to originate in any of the natural emblems of His spiritual existence, one of which is steam produced from pure water.

2. The life of God, being eternal, precludes the idea of man ever being allowed to consume water, its representative, consequently it will never take a place in the economy of nature for illuminating purposes.

3. The omnipotence of God being indisputable, man has a legitimate field from which to develop power, the basis of which is pure water.

Valleyfield, Pa.

JAMES HALLY.

P. S. Your reply to A. J. S., anent "perpetual motion," is very good indeed. The living God alone gives life. So far, a mere man never has, and never will create it, or its equivalent, perpetual motion.

J. H.

Specimen Boiler Inspection.

To the Editor of the Scientific American:

Seeing in a recent issue of the SCIENTIFIC AMERICAN an account of a specimen of boiler inspection, I would inform your correspondent that the party claiming to be an inspector is a fraud and an impostor. There was a law for the inspection of steam boilers, which called for one chief inspector (Mr. John B. Leverick, under Governor Hoffman), and one deputy in each congressional district outside of the police district, to inspect steam boilers. But that law was re-

pealed on February 3, 1871, and there is no such law now in existence; but some of the deputies have been working under the old law in Westchester county up to a few months ago, inspecting steam boilers and demanding six dollars for such inspection. Is it not a fraud on manufacturers, brewers, etc., to make them pay for the inspection of their boilers under a law which is not in existence?

T. LEON CHESTER, Consulting Engineer.

No. 201 Varick street, New York city.

ENGINEERING NOTES.

[Extracts from papers read before the American Society of Civil Engineers.]

In a paper upon "Rail Economy," C. P. Sandberg, C. E., of London, gives the following regarding

IRON RAILS.

The American demand for English rails, of say 500,000 tons yearly, is unlikely to diminish soon. The late increased expense of iron adds to the cost of railroad construction, and tends to reduce the quality of rails. Welsh rails were often imperfect in weld; now they are sometimes also brittle. In the Cleveland district, rail making has greatly improved, chiefly by the increased application of fettling in the puddling furnaces. Still the buyers must guard against lamination and brittleness, by tests for strength and wear, applied before the rails are laid. Rails made of suitable iron, with proper section, will not break in winter; in Scandinavia, with a climate more severe than in America, no accident has occurred from broken rails, though cross sleepers are exclusively used. But a very small portion of the iron rails shipped to America will stand the proper tests.

No late improvement promises so much to perfect iron rail making as mechanical puddling. By means of the Danks and Spencer appliances, more rails can be made at a reduced cost and of a better quality.

STEEL RAILS.

The demand during the past year has been so great for steel rails that they can hardly be obtained at any price: the supply is limited by the lack of ore free from sulphur and phosphorus, and recourse has been had to extensive mines in Spain. It is hoped that America will supply herself with steel rails, and import only those of iron required for new lines or light traffic. There is a scarcity of suitable ore for the Bessemer process throughout Europe, except in Sweden, where the recently discovered coal will render the ores more available.

The Siemens-Martin process of steel making (superior to the Bessemer in requiring a less pure ore), has thus far produced so little that it can hardly be called a source of supply in the great market.

Steel rails are now so well made that they rarely break, except when the flange is punched, and this should be done only while the metal is hot, or the notch drilled and then slotted. Although a steel rail is generally thrice as strong as an iron one, when punched or the flange is cracked the iron may be the stronger. The steel is made as soft as possible, say with one third per cent of carbon; for not by hardness, but by homogeneity, is it superior to iron. Usually a steel rail will carry one fifth more dead load than an iron one; hence, for the same traffic, the steel rail, in comparison with the iron, should not be reduced in weight more than 20 per cent.

Buyers should require each rail to be permanently marked to indicate date, maker's name, and quality, that subsequent use may determine which manufacture is best.

TRAFFIC CAPACITY.

The amount of wear or life of a rail is usually expressed in tons passed over it before rejection; properly the speed of travel should be taken into account, and 220,000,000 speed tons is a fair expression of the endurance of extra iron rails.

The average life of iron rails in England for ordinary traffic is about 10 years; in and near London it is 2 years or less; on the continent, from 12 to 15 years; and in Sweden, with less traffic than in England, from 15 to 18 years.

The weight passed over good iron rails before rejection, has been found to average 10,000,000 tons; this may be taken to represent the life of extra iron rails, and six times that, the life of good 56 pound steel rails. On the London and North Western line, steel rails have lasted 20 times as long as iron, and on the Metropolitan Railway, with the greatest traffic in the world, where iron would not have lasted six months, steel will stand from three to four years.

Equally important with the weight of a rail, is a proper section. In England the double-headed rails are still generally used, and elsewhere in Europe the flat bottomed pattern, as also in America. A specially bad section is the Erie 61 pound rail, which could be replaced by a 45 pound rail, well proportioned.

The late Professor Rankine says that the weight of the rails per yard should equal 15 times the greatest load on the locomotive drivers in tons. Perdonet, in France, takes 12 in place of 15; the writer, by adopting a section which permits a fishjoint stronger than the others in general use to be made, takes 10 and less; thus for a 60 pound rail, the weight on drivers is put at 6½ tons.

Fish plates of steel will enable rails to carry from 15 to 20 per cent greater load than if iron were used of the same section.

The Philadelphia and Reading Railroad, on rails made with great care by the company, prefers not to exceed 4 tons on a 64 pound rail, and the rail section has been gradually increased to counteract wear and tear from even this medium load.

On the Erie Railway, 5½ tons weight on drivers has been found too great for best 70 pound iron rails, and, with a speed

for heavy freight trains of 15 miles per hour, should not exceed 4½ tons.

EXPERIMENTS ON THE RESISTANCE OF STONES TO CRUSHING.

Mr. C. B. Richards, C. E., has recently experimented upon various kinds of American building stones worked into 1 inch and 1½ inch cubes, with flat and smooth faces.

The specimens were crushed between the plane faces of two hardened steel hemispheres, the curved portions of which were seated in corresponding cavities of steel blocks, fixed in the machine. Single thicknesses of lace leather were interposed between the stones and metal surfaces; thus the pressure was uniformly distributed; it was in all cases applied to the faces of the cubes parallel to the natural bed of the stone, and carefully increased to rupture by pouring shot into the hollow weight by which the strain was caused.

Sixteen specimens of granite from 6 quarries gave from 8,620 to 15,622 pounds, minimum, 9,838 to 18,778 pounds, maximum strength. Fourteen specimens of sandstone from 3 quarries gave 5,806 pounds minimum, and 8,956 to 10,928 pounds, maximum strength. And 10 specimens of white marble from 3 quarries gave from 3,905 to 12,917 minimum, and 5,976 to 13,972 pounds, maximum strength. Each was a 1 inch cube. The specimens failed by breaking into slender prisms and pyramids with axes normal to the pressure.

In a paper upon

ROCK DRILLING.

It is stated that a percussive steam drill, with 3 inch cylinder and 6 inch stroke, making 300 to 375 strokes per minute will drill in the coarse gneiss rock common to New York Island, 3¼ inch holes at the rate of 3 inches, 1½ inch holes at the rate 4½ inches, and 1 inch holes at the rate of 5 inches, per minute.

THE CHARACTER AND POSITION OF NEUTRAL AXES AS SEEN BY POLARIZED LIGHT.

Mr. Louis Nickerson, C. E., states that the results of experiments made by him show that the neutral axis is a flexible line, truly parallel to the top and bottom sides of a rectangular beam, and passing through the center of gravity or its sections only when the load is evenly distributed from end to end, or when the beam is infinitely long; and that when there is a local pressure, the neutral axis is more or less governed in its direction and form, by the strain passing from the point of local pressure towards the point of support. The same writer says that in tests made upon columns which changed their forms under pressure, a series of extended rings or periodic waves appeared uniformly separated after the columns had assumed permanent form. He considers that hollow columns if sufficiently under stress within elastic limits may be greatly strengthened by bands placed where these waves would otherwise occur. It is inferred that one third additional material will thus double the strength of the column.

THERE is in course of construction at Woodward's Gardens, San Francisco, a salt water aquarium of modest dimensions, yet designed to be complete in all its parts. The aquarium will be mainly under the surface of the ground, in order to secure an even temperature. There are fifteen tanks in all, one of which is for fresh water specimens. The tanks vary in size from 300 to 1,000 gallons capacity, the largest containing eight thousand pounds of water. Several of the tanks are fitted up with sea worn rocks, some obtained at the Cliff house, and some at Santa Cruz. There will be room for marine plants, shells, corals, etc. It is the intention to obtain deep sea animals and other rare denizens of the deep, with a live shark or two, a devil fish, etc.

MANUFACTURE OF ELECTRICAL APPARATUS.—The Siemenses have extensive works in Berlin, in St. Petersburg, in London, in Vienna, in Dresden, and in Tiflis. The Berlin establishment, it appears, employs 550 workmen, and sent out in the first half of last year the following apparatus: 700 electro-magnetic and 1,750 magneto-electric pointer, 12,060 Morse writer, 12,497 railway bell signaling, and 231 Hughes type printer. That is only one example of the way American inventions are copied on the continent. The firm (Siemens and Halske), now consisting of Ernst and his brothers William and Charles, celebrated in October last their twenty-fifth anniversary, when a sum of \$40,000 was set apart as a pension fund for the workmen.

M. FOUQUE describes a visit he paid to the Azores in 1867, having been attracted by news of a volcanic eruption taking place in the sea, near Terceira. This had spent itself before he arrived, but he went to the scene in a boat, and bottled some of the gas from a part where the water was in a state of ebullition. He found it to contain chiefly hydrogen and compounds of hydrogen. The Azores are, in formation, a true type of marine volcanic regions.

PROGRESS OF HOOSAC TUNNEL TO FEBRUARY 1, 1873.—Extensions of headings in January, 297 feet; opened from east end, westward, 13,340 feet; opened from west end, eastward, 8,859 feet. Total length opened, 22,199 feet. Length remaining to be opened, 2,832 feet, being 192 feet more than half a mile.

THE consignment of half a million of salmon eggs from Germany, heretofore noticed by us, has arrived at New York in good condition and is considered important. In England some extensive importations of salmon eggs from Norway have lately been made.

THE dip or inclination of the magnetic needle was discovered in 1576 by Robert Norman, an optician of London. He first constructed the dipping needle.

IMPROVED ROAD SCRAPER.

The invention herewith illustrated is a convenient machine, recently patented, for scraping and leveling roads. It is especially suitable for removing the weeds and small obstructions on the carriage ways of cemeteries, public parks, gardens, etc., and, being actuated by horse power, will doubtless be found an efficient and valuable substitute for the slow and tedious work of the hand shovel hoe.

The apparatus is mounted, as shown, upon four wheels, the axles of which are connected together by the longitudinal braces, A A. At B are a number of peculiarly shaped bars, through eyes formed in the ends of which the forward axle, C, passes. These bars extend back to the rear of the machine, and their extremities are bent down so as to form an obtuse angle resembling a cultivator tooth. D is the rear axle cast with a number of pendent partition pieces, E E, which serve to keep the bars at a uniform distance apart. Attached by suitable standards to and above the rear axle is the rock shaft, F, the ends of which are bent to form arms, one of which is shown at G. To these arms, by rods, H, are fastened a transverse bar, not represented, which passes under the bars, B. In the socket on the rock shaft, F, is placed a lever, I, which is worked by the person using the machine.

When the device is in use, the ends of the scrapers rest upon the ground. The scraping teeth, it should be noticed, cover the entire surface, notwithstanding the bars, B, are separated by the partitions, E. As the machine is drawn along these scrapers tear up all grass or weeds, leaving the ground level and clean. In case, however, an obstruction is met, the bar, striking the same, will be raised by the contact and, having free movement, being only held by the forward axle acting as a pivot, will pass over the obstacle, and drop again by its own gravity to its former position.

The bars, B, are of varying lengths, and are arranged so that their rear ends form nearly a right angle. The pieces, J J, are a number of weights so arranged as to slide along the upper edges of these bars, and are held in any desired position by set screws. Their object is to give increased pressure to the scrapers at the ends of the bars when the machine is used on hard ground, and their effect is of course augmented or diminished as they are moved toward or away from the scraping portion.

The lever, I, being turned, operates the rock shaft, G, which, by the mechanism above described, raises the transverse bar, and with it the bars, B. By this means the man walking behind can throw the scrapers into or out of action at pleasure. Attached to the lever is a hooked rod which catching in a projection on the rear axle, holds the lever down, and thereby keeps the bars raised when transporting the machine from place to place.

The advantages of this device, as a labor-saving invention, are sufficiently obvious to need no further description. It seems to be an implement in every way efficient and adapted to the wants of gardeners and those having private roadways to keep in order.

Patented through the Scientific American Patent Agency, October 8, 1872. For further particulars address the inventor, Michael M. Brunner, Superintendent, Rosedale Cemetery Orange, N. J.

AUTOMATIC CAR COUPLING.

The principal objection which holds good against a large proportion of the automatic car couplings that have been devised is a want of simplicity, a multiplicity of parts which, by their expensive construction and difficulty in operation under disadvantageous circumstances, neutralize the advantages of the invention. The apparatus which we herewith illustrate, is the least complicated arrangement of its kind that has come under our notice, and, from an inspection of the working model, we are inclined to consider the claims of its inventor, as to its effectiveness, well founded.

In general appearance it is very similar to the device in ordinary use. The mode of connection is the common link, either straight or, if adapted for cars of different heights, goose-necked, and a simple pin. Fig. 1 shows the device attached to two freight cars, and in Fig. 2 it is represented in section. The bumper may be divided into any suitable number of compartments. In the present case it is divided into two by the partition, A. At the rear of the hole, in this partition, through which the coupling pin passes, is formed a recess, B, in which the end of the pin rests, as shown, and is thereby supported while the cars are being run together. C is a bent lever pivoted within the bumper at the rear of the partition, A. When the end of the coupling pin is placed in the recess, B, it pushes the upper arm of this lever back, swinging the lower arm forward. As the cars meet, the link enters the bottom compartment of the bumper, strikes against the lower arm of the lever, pushing it back, thereby causing the upper arm to move forward, strike against the pin, and

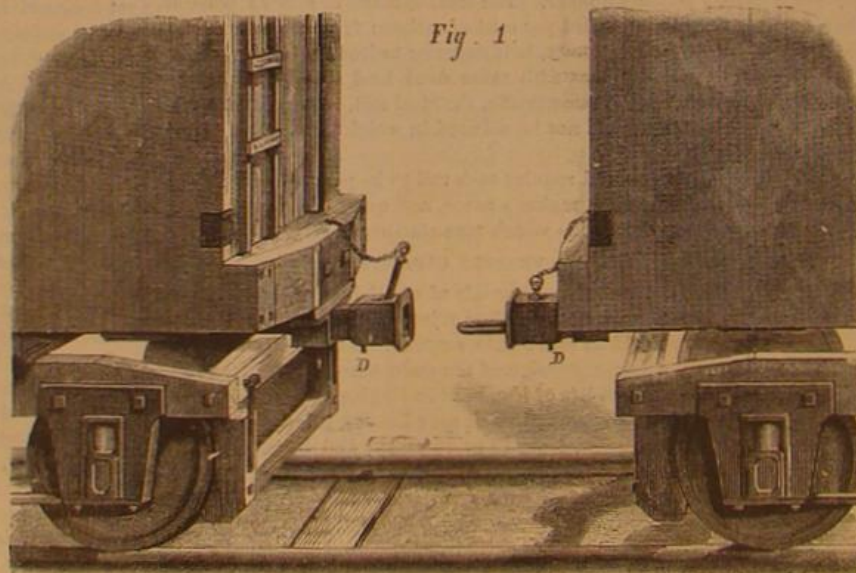
push it out of the recess. The pin then naturally drops into its slot and through the link.

Fig. 1 is more especially designed to show the position of the device just before coupling, and also to indicate that the invention, with the exception of the downward projecting



BRUNNER'S ROAD SCRAPER.

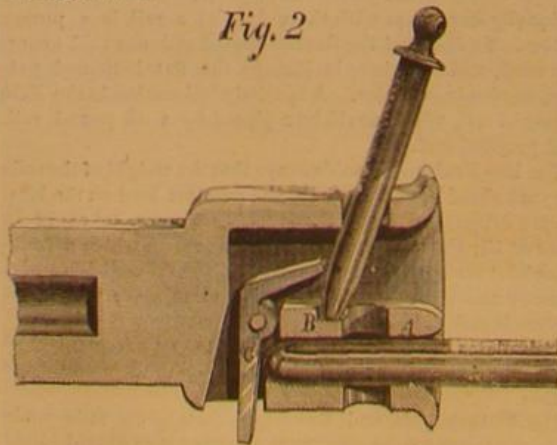
ends of the levers, D D, occupies no more space and, indeed, is hardly distinguishable from the old fashioned coupling. To uncouple freight cars, a chain may be carried from the pin to the roof, by which the pin can be easily withdrawn. One of the principal advantages of the apparatus, other than those already stated, is the facility with which it may be gradually introduced on a road, as new cars supplied with



NORTHROP'S AUTOMATIC CAR COUPLING

it can be readily attached to old cars on which the common coupling is used.

Fig. 2



Patented through the Scientific American Patent Agency, June 11, 1872. Further information may be obtained by addressing the inventor, Mr. Samuel G. Northrop, Wilmington, N. C.

Artificial Tortoiseshell.

According to the *Art Journal*, the appearance of tortoiseshell may be given to horn by brushing it over with a paste made of two parts of lime, one part of litharge, and a little soda lye, which is allowed to dry. This is the same as the Indian hair dye, and acts by forming sulphuret of lead with the sulphur contained in the albumen of the horn, producing dark spots, which contrast with the brighter color of the horn. Artificial tortoiseshell is made by melting gelatin with various metallic salts. The greatest comb manufactory in the world is in Aberdeen. There are thirty-six furnaces on the works for preparing horns and tortoiseshell for the combs, and no less than 120 iron screw presses worked by steam. Forty years ago ladies' back combs—which were larger than ladies' bonnets are now—were made in England and the United States for the Spanish Peninsula and South American markets. They were often a couple of feet wide, encircling two thirds of the head, and from six inches to one foot high on the back, the top being wrought in open work; to these the Spanish ladies attached their veils. As much of the work was done by hand and with the saw, and the polishing was entirely manual, the prices were high, averaging \$15 to \$20. Tortoiseshell was much used to decorate furniture by the Romans. According to Pliny, Carvillus Pollio was the first to apply tortoiseshell to ornamental purposes. The fashion for this style of decoration increased; and in the days of Augustus, the patricians ornamented their doors and the columns of their rooms with this substance. At one time tortoiseshell was used for making watch cases, but the art seems to have fallen in to desuetude, although the results of attempts to resuscitate it were shown at the London Exhibition last year.

Precautions in Using Gas Machines.

The following suggestions, for the use of gas machines in which light and inflammable hydrocarbons are employed, are from the instructions to insurance agents recently issued by the New York Board of Fire Underwriters:

The vault or house in which the gas is manufactured should be at least twenty-five feet distant from the main buildings. Stop cocks should be placed on both the gas and air pipes near the machine in the vault; also on the gas pipe near the place where it enters the building, and on the air pipe near the air pump, when the pump is in the cellar or building. The vent pipe and filling pipe must be so arranged that one cannot be opened without opening both. All the main gas pipes leading to the premises lighted should have an inclination toward the gas machine so as to return all the condensation that may take place in the pipes. The latter should be thoroughly tested before the gas is turned on. The vent should be open and the air pump shut off while filling the machine with fluid. Never allow a light to be used in or near a gas house or vault. No barrels containing gasoline or other fluid, or from which gasoline has recently been emptied (yet full of vapor) should be allowed to be kept in any cellar, barn, shed, or outbuilding where other property is stored, or where there is a liability to use a fire or a light. Great caution should be exercised in the selection of a trustworthy apparatus, and that a competent person be sent to put it up. There are many machines in the market made of poor material and in the cheapest possible manner, the manufacturers of which, by false representations, make large profits. Never allow a machine to be placed in the cellar of a dwelling, as it is apt to greatly endanger the lives and property of the occupants.

Norwegian Narrow Gauge Railways.

Another link in the narrow gauge railway system of Norway has been completed, in the Christiania-Drammen line, which was opened on the 7th of October last. This railway is 32 miles in length, and is connected at Drammen with the 3 feet 6 inch line, running to Hønsfjorden, 56 miles in length, and with it making a continuous line 88 miles long, besides the branch to the silver mines at Rongeborg, 17½ miles, opened in 1872, and another to the Lake of Krødsem, 16 miles. Owing to the exceptional difficulties in construction, the Christiania-Drammen Railway has been the most expensive of all the narrow gauge lines yet built in Norway. The total cost for the 32 miles was \$35,000. For the whole of its length, the line runs through a most beautiful and picturesque country, and will command a large and yearly increasing tourist passenger traffic.

PROFESSOR CORNWALL, of Columbia College, N. Y., has, by means of the spectroscope, detected a notable amount of indium in various samples of zinc blends from New Hampshire and other States.

RAILWAY TIMBER BRIDGE.

Our engraving illustrates a timber bridge, constructed to carry the Southern Railway of Canada over Kettle Creek, at St. Thomas, Ontario. The work not only is an excellent example of type construction, but is remarkable for the rapidity with which it was completed. Its extreme length is 1,366 feet, divided into 736 feet of trestle work and 630 feet of house trussing; the latter is made up of 14 spans, resting upon timber piers. The extreme height of the structure is 92 feet. There were used in its construction 1,070,672 feet of timber, board measure, 4,600 lineal feet of piling, about 35 tons of wrought and 37 tons of cast iron. The work was commenced on the 20th September, 1871, and completed the 13th February, 1872—a period of less than five months, and part of which lay in the severe season. Messrs. Dunn, Holmes, and Moore were the contractors, Mr. M. Courtwright being the president of the railway, and Mr. M. N. Finney the engineer-in-chief.—*Engineering.*

French Prizes.

The Société d'Encouragement pour l'Industrie Nationale, of Paris, has published the programme of premiums and medals, to be awarded between the years 1873 and 1878.

The 2,000 franc prize (1873) for a steam launch 40 or 45 feet long working at 9 knots an hour in still water, and carrying sufficient fuel for 12 hours, working at maximum speed.

A prize of 3,000 francs (1876) for a steam engine of from 25 to 100 horse power, burning as a maximum in full work 700 grammes of coal per horse power per hour, weighing less than 300 kilogrammes (660 pounds), and costing from \$60 to \$100 per horse power. During trials the competitors will be at liberty to make use of any kind of fuel and system of generation which they prefer.

A prize of 1,000 francs (1873) for the best domestic engine, designed with the special object of assisting home work in towns.

A prize of 4,000 francs (1873) for progress made in the process of hemp and flax spinning. This prize will be awarded to the manufacturer who shall, on a production of more than 20,000 francs' worth of yarn, effect an economy of 15 per cent on the power employed, and a degree of fineness exceeding 150,000 feet per pound for the flax, and 20,000 feet for the hemp.

A prize of 2,000 francs (1874) for preparing fibers, hitherto subjected to carding.

A prize of 3,000 francs for a file cutting machine. The cutting tool of this machine to have a form mathematically true, to act without shock, and not to be liable to excessive repairs. The cost and maintenance of this machine, its production, and the driving power required, must be such that the results obtained offer sensible advantages over those obtained by hand work.

A prize of 5,000 francs (1873 to 1875) for a practical and cheap means of dressing millstones, so as to remove the existing dangers of this industry. This prize was founded by subscriptions made in La Ferté-sous-Jouarre.

In the chemical arts, prizes are proposed for the wholesale manufacture of oxygen and nitrogen, the utilization of waste materials, the production of graphite suitable for pencils, for a treatise on steel, based on certain experiments and having for its object improvement in the steel manufacture, and, lastly, for a process capable of disinfecting and clarifying,

promptly and efficiently, the water of sewers, etc. Other prizes will be awarded for an electro-magnetic machine, for a system of heating houses and apartments, with constant circulation; for a process of meat preserving, for drying wood, for an industrial application of the spectral analysis, etc.

Among the agricultural prizes we may mention one of 6,000 francs for steam culture, and one for the best means of distributing powdered manure.

In the section of the Beaux Arts there are two entries, one

RAILWAY PROGRESS IN 1872.

The Chicago *Railway Review* publishes carefully compiled statistics, showing the rapid progress that has been made in the construction of railways in the United States since the opening of the first 23 miles of the Baltimore and Ohio road in 1830. From the various portions of the statement showing the advance made in the past year, we extract the following interesting facts.

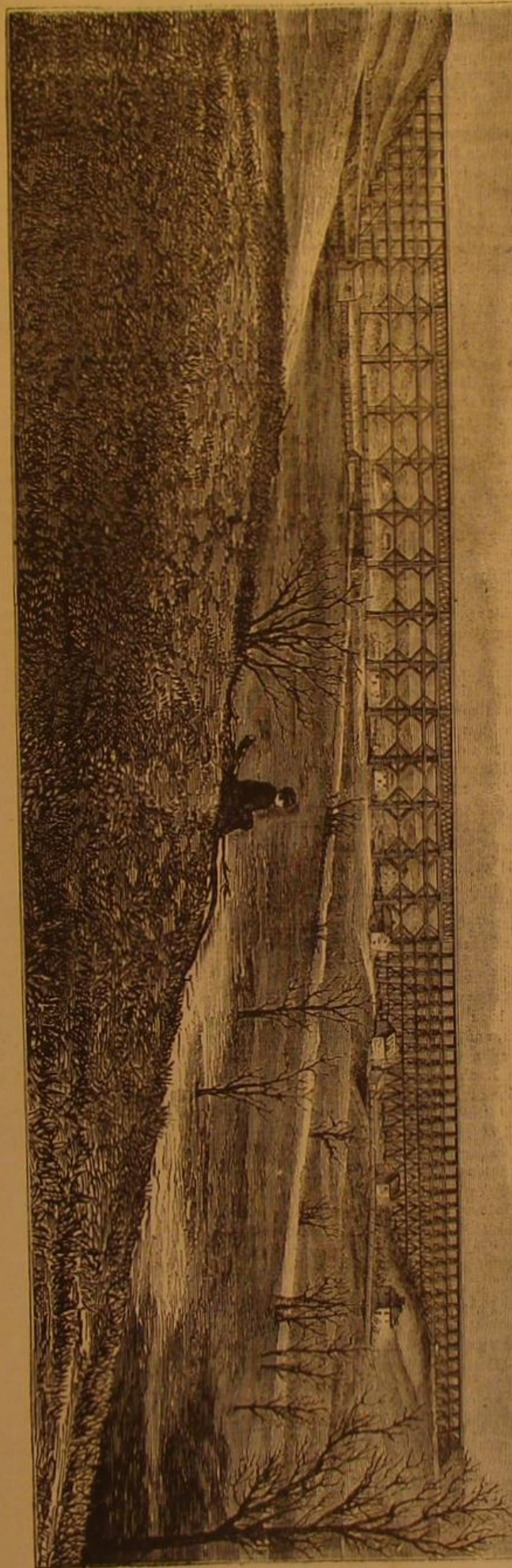
The number of miles added to all railways in 1872 was 7,925. It is estimated that at least 10,000 miles more of road

are under construction and will be completed before the close of 1873. Progress was made on 353 roads. In Illinois 837½ miles, a distance greater than any other State, were finished. The total number of miles in that State on which work was done aggregated 1,401½, the labor being distributed over 28 railroads. In New York construction was carried on over 1,338½ miles, on 32 roads. The longest distance finished on any one line was on the Atcheson, Topeka, and Santa Fé road, in Kansas, 360 miles being laid during the past year. The progress in the States, Territories and Provinces is as follows, estimating on the number of miles completed and in course of construction: Alabama, 299; Arkansas, 316; California, 560; Colorado, 317; Canada, 675; Connecticut, 53; Dakota, 65; Florida, 84; Georgia, 138; Illinois, 1,401½; Indiana, 394; Iowa, 913; Kansas, 773; Kentucky, 463; Louisiana, 106; Maine, 42; Massachusetts, 165; Maryland, 418; Michigan, 625; Minnesota, 942; Mississippi, 173; Missouri, 584; Nebraska, 233; New Hampshire, 162½; New Jersey, 79½; New York, 1,338½; North Carolina, 266; Ohio, 754½; Oregon, 126; Pennsylvania, 732½; Tennessee, 346; Texas, 637; Utah, 123; Vermont, 120; Virginia, 421; Wisconsin, 797. The aggregate tonnage of the roads has increased to nearly 200,000,000 annually. The increase in earnings has averaged about 25 per cent a year since 1851.

The past year will be especially noted as dating the beginning of the operation of narrow gage roads in the United States, as members of the railway system for general business. In the latter part of 1871, the first section of the Denver and Rio Grande road was completed and opened—76 miles from Denver to Colorado Springs—and it was maintained in efficient and economical operation during a winter of unprecedented severity. In the mountain regions of Colorado, the maximum paying gage has been fixed at 36 inches; and this has been adopted for the mountain extensions of the Colorado Central from Golden City, the terminus of the 4 feet 8½ inch gage line of the company. In Utah, also, the 36 inch gage is an accomplished fact. From Salt Lake City starts the Utah Southern, already completed (31 miles), con-

necting with the American Fork road, completed 17 miles; while to the north runs the Utah Northern, already finished for 25 miles. The Kansas Central has been built and opened for 50 miles. More important than the lines above named will be the opening of the Cairo and St. Louis road, extending over 150 miles, midway between the Illinois Central and the Mississippi river. From this road, the narrow gage system in the South may be said to derive almost its chief importance. A project is also on foot for the construction of a line from St. Louis into the heart of the South, east of the

TIMBER BRIDGE AT ST. THOMAS, ONTARIO.



(1874) for the manufacture of good photographic paper, the other (1873) for a process to produce photographic electrotypes which may be printed from in a common press, and used instead of wood engravings.

CEMENT FOR LEATHER.—Ten parts of carbon disulphide and one part oil of turpentine are mixed, and as much gutta percha added as will readily dissolve. The surfaces of leather must be freed, with a hot iron, from fat, and the parts once joined should be well pressed until they are firmly united.

Mississippi, the object of which is to bring the iron ore of Tennessee and the coal of Illinois together at a point favorable for manufacture. It is also understood that the narrow gage road, *via* Ripley, Tenn., to Mississippi city on the Gulf, will form a Cairo and St. Louis connection by way of Paris. This road has already 25 miles in operation. It should be added that a road is proposed to connect St. Louis with Kansas City and Leavenworth. An air line, narrow gage, is also proposed between St. Louis and the Atlantic seaboard. The total number of miles of narrow gage road completed and begun during the past year is 617.

COFFEE.

Mr. R. P. Hewitt, of this city, has recently published a well written and instructive volume, entitled "Coffee, its History and its Uses," from the pages of which we cull the following interesting facts:

THE COFFEE PLANT

is, in its native state, an evergreen shrub, having oval, shining, sharp pointed leaves, white, fragrant five-cleft clustered corollas, with projecting anthers and oblong, pulpy berries, which are at first of a bright red color but afterwards become purple. The flowers, which resemble those of the jessamine, fade very soon and are replaced by a kind of fruit not unlike a cherry, which contains a yellow fluid enveloping two small seeds or berries, convex upon one side, flat and furrowed on the other. These seeds are of a horny or cartilaginous nature; they are glued together, each being surrounded with a peculiar coriaceous membrane. The period of flowering does not last more than two days. The seeds are known to be ripe when the berries have a dark red color.

PREPARATION OF THE BEAN.

When the fruit is gathered, it is measured and thrown into a loft. Within twenty-four hours, it is submitted to the action of the pulping machinery. The pulped berries remain for a day and a night in process of fermentation, when the mucilaginous matter is washed off. In an hour or so the coffee is removed for curing. This is effected by spreading the beans in a thin layer exposed to the sun which, in a short time, absorbs all the water, leaving the coffee fit for housing. Milling is the next process. Here the berries are placed in a wooden trough and the parchment and silver skins dislodged by the friction of a large roller. The coffee is then passed through a fanner or winnowing machine, whence it emerges perfectly clean. Sizing and hand picking follow; and lastly, the produce is packed and forwarded to the markets.

CONSUMPTION OF THE VARIOUS KINDS OF COFFEE.

In the United States, Brazilian coffee is consumed in the greatest quantities, nearly 300,000,000 pounds being used in the year 1871. The Java berry is next in popularity, finding its principal markets in this country and in Holland. This variety of coffee improves by age. Old Government Java owes its fine flavor to the evaporation of the caffeic acid, which is the principle that imparts that harsh, bitter, and astringent taste which cannot be disguised. Coffee is also exported to this country from Maracaibo, La Guayra, Ceylon, San Domingo and other West India islands, Central America and Mexico.

METHODS OF MAKING COFFEE.

The roasting of coffee in the best manner requires great nicety, since much of the quality of the beverage depends upon the operation. It is usually roasted in a hollow cylinder made of perforated sheet iron, which is kept turning over a brisk fire. When the coffee has assumed a deep cinnamon color and an oily appearance, and the peculiar fragrance is perceived to be sufficiently strong, it should be taken from the fire, well shaken and permitted to cool. Not more than half a pound at once should be roasted for domestic use, and the cylinder should never be above one third filled. This operation and the subsequent grinding of the beans should be performed just before the coffee is needed for use. The French, who are celebrated for their coffee making, use various kinds in combination, such as Java, Mocha, Rio and Maracaibo. These coffees are so delicately and in such due proportions mixed as to produce a bouquet of aromatic flavors. With respect to quantity at least one ounce of coffee should be used to make three ordinary sized cups. The coffee pot should be first warmed, and the water poured over the coffee. Whatever is used for clearing, white of eggs, isinglass, etc., should be dissolved before mixing.

There are about one hundred and seventy-five patents in existence for coffee pots. The best form known is one which distills the coffee, never allowing it to boil. By this process the infusion does not become black, bitter or stale, and can be served at any time, with all the aroma of the bean.

ADULTERATIONS.

The means resorted to for detecting adulterations in coffee are of three kinds, namely, certain physical characters and appearances presented by adulterated samples, the microscope, and chemistry. The first means consist in noticing whether the sample in the mass cakes or coheres, whether it floats in water or not, and the color of the infusion. If the ground coffee cakes in the paper in which it is folded, or when pressed between the fingers, there is good reason for believing that it is adulterated, most probably with chicory. If, when a few pinches of the suspected coffee are placed upon water in a wine glass, part floats and part sinks, there is reason to believe that it contains chicory, roasted corn or analogous substances. The coffee does not imbibe the water but floats on the surface, while the other materials absorb the water, and gradually subside to the bottom. Again, if the cold water to which a portion of ground coffee has been

added, quickly becomes deeply colored, it is an evidence of the presence of some roasted vegetable substance or burnt sugar. If, when a few grains be spread upon a piece of glass and moistened with a few drops of water, soft particles like bread crumbs can be picked out with a needle, this is another proof of adulteration. Chicory communicates a reddish brown tint to water, which pure coffee scarcely tinges. The same substance may be readily detected under the microscope by the size, form and ready separation of the cells of the cellular tissue, by the presence and abundance of the dotted ducts and spiral vessels. Roasted corn can be similarly recognized by the peculiar character of the starch grains. Tincture of iodine instantly tells the presence of corn or beans by tinging the cold decoction a blue color.

So-called rye coffee should never be used. Apart from its inferior flavor, it has been found that a single mouthful of wholesome bread contains more nourishment than a dozen cups of a beverage made from roasted rye.

Phosphorescent Mixtures.

Phosphorescent tubes have been sold in France and Germany for several years, but the method of their preparation has not been divulged. Dr. Seelhorst, of Nuremberg, has been experimenting on the subject, and very considerably makes public the best way to secure mixtures that will afford all the colors of the rainbow and are capable of use in imitations of flowers, insects, and objects of natural history. After the powders are prepared, they can be stirred into melted paraffin; and by means of a brush, any pattern or design may be put upon glass. By protecting the glass in a frame, the powder will retain the property of glowing for a year or more. The putting of phosphorescent mixtures upon glass in the form of flowers is capable of very beautiful application, and is one that has not been very extensively practised. With proper care and study, a landscape could be drawn on glass which, after exposure to sunlight, would shine in the dark and form a picture of considerable duration. The use of the paraffin is to protect the powders from the action of moisture and prevent decomposition. As a general rule, it is better to hermetically seal the mixtures in flat bottles, when they will retain their good properties for years. The following colors can be obtained very readily:

Green.—Hyposulphite of strontia, heated for 15 minutes over a Bunsen lamp and for five minutes over a blast lamp until it is fused, yields a yellowish green color after exposure to sunlight. The same color can be obtained by taking equal parts of carbonate of strontia and *lac sulphuris*, heat gently for 5 minutes, then strongly for 25 minutes over a Bunsen burner, and finally five minutes over a blast. It is granular and yields a fine green color, darker than the preceding.

Blue.—Sulphate of strontia is prepared by precipitating with sulphuric acid from chloride of strontium the precipitate is dried, heated in a current of hydrogen gas, then over a Bunsen burner for 10 minutes and for 15 to 20 minutes over a blast lamp. The product sometimes yields a yellow phosphorescent light, and when this is the case, it is necessary to give it another turn over the blast lamp.

Yellow.—Sulphate of baryta 6 parts, charcoal 1 part, fused over a blast lamp, at first afforded no light, but after 24 hours gave an orange yellow light.

It may not be generally known that magnesium light will suffice to bring out all the effects of phosphorescence nearly as well as sunlight.

Pasteur's Method for Preserving Wine.

A great deal has been said and written about Pasteur's wine heating process, and it has been difficult to determine what value to put upon the testimony of those who have tried it. Professor Neubauer, of Wiesbaden, publishes a note of some experiments, conducted by himself, which deserve to be read with attention. He says that the tannic acid and extractive stuff of red wine precipitate most of the albuminous constituency of the wine, so that when the wine is heated it does not thicken or become milky. In his experiments, he carefully corked the wine and covered the corks with parchment paper, and warmed the bottles over a water bath, for half an hour, from 60° to 65° C. Bottles of wine of the same sort, heated and in natural condition, properly labelled, were stored in his cellar; and, on the occasion of the meeting of a club in Wiesbaden, numerous specimens were produced for trial. It was unanimously resolved at this meeting: "That the wine which had been heated was far superior, in odor, taste and ripeness, to the specimens taken from the cask." This decision of impartial witnesses, known to be good judges of wine, created such a sensation among wine growers that they immediately formed a company to purchase the necessary heating apparatus of the French manufacturers. The wine is in this way rapidly prepared for the market. It will bear transportation to warm climates, as was proved at the opening of the Suez Canal, on which occasion Pasteur's wine was preferred to all others. White wines have not been so thoroughly tested, and it is a question whether they are so much improved by heating as the clarets. Our American wine manufacturers ought to repeat these experiments.

A SOCIETY has been formed in England under the title of the National Health Society, which is to have for its object to help every man and woman, rich and poor, to know for himself, and to carry out practically around him, the best conditions of healthy living. The steps at present proposed are the holding of monthly meetings for the reading of papers; the establishing of classes for instruction in various branches of sanitary science; the delivery of free popular lectures; and the formation of a reference library and an information office.

Franks of Electricity.

Mr. C. N. Simmons, electrician of the Western Union Telegraph Company, communicates to the *Chicago Inter-Ocean* the following account of the electrical phenomena which accompanied the great storm of January 7th and 8th: The disturbances were first noticed on the wires in central Iowa. The lines leading west were rendered useless for the transmission of messages, owing to an incessant discharge of electricity, increasing in intensity until it would leap from one strap of the switch board to another, across the intervening space and then, in a luminous stream, to the ground plate of the lightning arrester. Another singular fact observed was that, on some routes where a number of wires occupied the same poles, one wire alone was highly charged or so affected that to work it was an impossibility, while all the others were entirely free from any external influence. In some cases, the wire occupying the top of the pole would apparently receive the whole charge; in others, the bottom wire would be affected, and in a few cases the charge was equally distributed among all the wires. In the Chicago office, the effect was similar to that observed in Iowa, and every observation confirmed the opinion that the center line of the storm was due east from Des Moines, Iowa, to Detroit, Mich., narrowing in its limits north and south as it approached the latter place where it arrived on the evening of the 8th ult., and rapidly subsided. A high wind varying from twenty-five to twenty-eight miles per hour accompanied the storm.

At the eastern slope of the Rocky Mountains, a similar phenomenon has been frequently witnessed upon a wire running north and south, but rarely on an east and west wire. Mr. Simmons ascribes it to the fact that, under the theory that the earth is charged with electricity negative to the atmosphere, there must be a point where discharge occurs or neutralization takes place. At points where the relative humidity of the air is very great, this is doubtless ever silently going on; but during seasons of intense cold, when the air is necessarily dry, the combination is evidently rendered more difficult and the tension thereby greatly augmented. If under these circumstances, good conductors such as telegraph wires are interposed, they would certainly assist in carrying a good part of the atmospheric charge to a point where the electrical tension was far less. What the electrical condition of the telegraph wires on the same pole was, to render one more susceptible than another to this inductive influence, or why wires running in other directions than east and west should not have been similarly affected, are problems yet unsolved. A recurrent storm, it is hoped, will afford an opportunity for more extended and accurate observations.

Electrotyping and Light.

We recently published an engraving and description of the new magneto-electric machine devised by M. Gramme. It consists briefly of a circular electro-magnet with poles consecutively turned before the magnetic poles of a magnet and the currents collected in a plane perpendicular to the poles. Without entering into any more extended explanation of the invention than that already published, as above indicated, we have now to note the results obtained in electrotyping and the production of light through the agency of this machine. M. Gramme states, in *Les Mondes*, that, at a rapidity of 275 turns, the instrument caused 8,101 grains of silver to be deposited in one hour, at 300 turns, 9,317 grains, and at 325 turns, 10,395 grains in a similar period. This last speed was too great, producing a heating of the coils which, if it had been continued, would have injured the machine.

A much larger apparatus was used for the production of light. Its height was 4 feet and its weight about one ton. The wire rolled on the electro magnets weighed 667 pounds and that of the three coils used, 195 pounds. With 300 revolutions per minute, expending about 4 horse power, M. Gramme obtained a light equal to that of 900 carcel burners, a more intense artificial illumination than has ever heretofore been produced by electro-magnetic agency. The calorific effects at the same speed of 300 turns were remarkable. A copper wire of 28 lines and one of iron of 52 lines in thickness, both 39 feet in length, were made red hot. The same iron wire in a length of 8 feet was completely melted.

Blue Color of the Sky.

M. Collas, of Paris, comments in *Les Mondes* of December 12, on M. A. Lallemande's paper on the blue color of the atmosphere, in which it was attributed to a change of refrangibility due to a partial absorption of the chemical or ultra violet rays. In 1870 M. Collas, in an article in *Les Mondes*, attributed the blue color of the Lake of Geneva and other waters to the quantity of silicic acid held in solution, which is brought down by the tributary streams from the strata through which they pass. Numerous observations since have induced him to believe that the blue color of all the water of the globe is due to the same cause. The air everywhere always contains more or less of moisture due to evaporation from the water of the earth; the water thus evaporated always contains a greater or less quantity of extremely fine insoluble particles. Silicic acid, says M. Collas, is one of the most common insoluble substances in nature, and, through evaporation, performs the same function in the blue sky that he believes it does in the blue waters of the earth. He believes his theory is confirmed by the intense blue of southern skies, where evaporation is so much greater than in the colder north.

THE Berlin Geographical Society has opened subscriptions for the contemplated Congo expedition. Dr. Glissfeldt, the glacier explorer, who is to be the leader of the enterprise, has himself contributed nearly \$5000, and there is every prospect that the full amount necessary will be forthcoming.

PATENT OFFICE DECISIONS.

TABLET FOR CLOCK FRONT ORNAMENTATION.—SAMUEL R. JEROME.—APPEAL. LEOGETT, Commissioner.

Applicant says his invention consists in making an ornamental tablet for a clock front by "applying paper, upon which the illustration of ornamentation is first made, to the back of a piece of glass, the paper first being moistened, then the edges turned over, and glued or otherwise secured to the front or outer surface of the glass, so that when the moistened paper dries it will shrink tight down upon the glass, giving it the same appearance as when the painting is made directly upon the glass. In every picture store will be found engravings attached to the backs of pieces of glass in this way, and it has been done no one knows how long. This is the "article" claimed, no matter to what use it may be applied. Patent refused.

BEVEL SQUARES.—FAIRBANKS AND ROBINSON.—APPEAL.

LEOGETT, Commissioner.

Applicant seeks to secure a monopoly of bevel squares having two blades one of which may be set at right angles while the other is left free to move. In other words, he asks for an exclusive property in a certain general plan of construction of squares, without reference to any particular mechanism by means of which it is embodied. If his claim could be allowed, and could be sustained in court, it would prevent all improvement of this class of squares. All invention would be repressed by a monopoly of the broad idea or principle of construction. It is possible applicant has invented only an imperfect means of adjusting and securing his blades. It is desirable that no obstacle shall stand in the way of the production of the best means. But if applicant has produced the best means, then by claiming only the parts and combinations, he actually shows he will be amply protected. In any event, these are all he can lawfully secure. The decision of the Board is affirmed.

Facts for the Ladies.—Mrs. M. G. Phillips, Fort Ann, N. Y., has had a Wheeler & Wilson Lock-Stitch Machine since 1854, doing shirt work and family sewing, without repairs, and it is now in good working order. See the new Improvements and Woods' Lock-Stitch Ripper.

Recent American and Foreign Patents.

Improved Automatic Fan.

William Lawrence and Joseph Sanders, New Albany, Ind.—This invention has reference to a class of fans which are made to operate automatically by means of clockwork or similar motive power, and consists in the construction and arrangement of parts, whereby the fan is made portable so that it can be readily moved from place to place, and made adjustable by elevating or depressing so as to throw the current of air in any particular direction.

Improved Coal-breaking Machine.

Rufus A. Wilder, Cressona, Pa.—This invention relates to a new machine for breaking and assorting coal, and has for its object to obtain, as near as practicable, a clean fracture in breaking, and avoid thereby the production of waste or coal dust. The invention consists in the construction of a horizontal centrifugal machine whose rotary breaking plate has projecting teeth or cutters that reduce the coal while the same rests against stationary breaking plates. The rotary breaking plate is perforated to enable the reduced coal to pass through its meshes upon a rotary disk, from which the larger pieces are by centrifugal force thrown into a chute, the smaller passing through a stationary raker, and then off the edges of the disk, and the smallest through the meshes of the disk, which is also perforated.

Machine for Making Plaited and Puffed Trimmings.

Wellwood Murray, New York city.—This invention consists of a pair of intermittently rotating rollers, either with or without puffing teeth or cogs, combined with a pair of folding blades or knives in such manner that a strip of cloth will be plaited on each border with a row of puffs between, the plates of each slide being reversed as to each other.

Improved Steam Pumping Engine.

James H. McConnell, Harmar, Ohio.—This invention relates to new and useful improvements in steam pumping engines, and consists in the box valve having lugs and movable over the seat, combined with a valve having a neck, so that the main valve is actuated by steam admitted thereto by the action of slide valve, and so that, if the steam should fail to give the requisite throw to main valve, that effect will be insured by the action of the neck upon lugs, and the grooves in the sides of the valve seat, and the orifices, through the same, for permitting any steam to escape in case the valve should leak so that it will not interfere with the proper working of the valve.

Paste for Making Stereotype Molds.

Samuel Crump, New York city.—This invention consists in mixing asbestos, in large or small proportions, with the paste which is used in making paper mache stereotype molds. It is proposed to fill in the cavities in the back of the matrix, which have hitherto been partly filled with pasteboard in order to obtain the requisite stiffness, entirely with this paste, so that, with the pasting of the sheets together, the paper will be largely saturated with the paste, which, by virtue of the asbestos contained in it, renders the molds, to a certain extent, fireproof, so that a greater number of casts of the molten metal can be taken from one mold or matrix than can be taken from the ordinary molds.

Improved Hand Weeder.

Henry B. Sherwood, Westport, Conn.—The blade of the weeder is a thin and narrow steel plate, the side and end edges of which are beveled off upon their lower sides. The ends of the blade are slightly curved upward. This construction enables either end of the blade to be used as may be convenient for removing weeds growing between or close to the sides of the plants, and enables the weeder to be used for loosening the soil close to the plants without danger of cutting off or injuring said plants. Two shanks also serve to break up and loosen the soil when the blade is moved along laterally beneath its surface.

Improved Pianoforte Hammer Head.

John Shaudelle, Courtland, Ala.—This invention has for its object to produce a pianoforte hammer head which shall present a thin and elastic surface to the string and retain its original elasticity after long and constant use; and the invention consists in the construction of the hammer head of India rubber provided with an opening near its tip or striking surface. The opening near the tip of the hammer head presenting a thin and elastic surface to the string, the hammer retains its original elasticity after long and constant use. The strings of the piano are saved from wear by reason of the perpetual softness of the hammer head. There is economy in both hammers and strings, as the latter are not worn out, and there is no necessity for a new hammer to develop a soft, gentle tone. See advertisement in another column.

Improved Compound for Fish Baits.

Samuel Adams Goodman, Jr., Jamestown, Texas.—This invention consists of a compound of the following substances as a mixture to be applied to the ordinary bait for fish, or to the net, by which the bait is rendered more tempting to the fish, and they will be attracted into the net: Oil of anise, asafoetida, cardamom seed, either golden, yellow, or black root, and buzzard meat, all except the latter being in equal parts, and the root and cardamom seed being powdered fine and mixed together in a vial, a small piece only of the buzzard meat (fresh) being put in; the whole being then shaken well together and allowed to stand about twenty-four hours, when it will be ready for use. The mixture should be shaken well each time before using. It is used by dropping a few drops on the ordinary bait after being applied to the hook; or in case of fishing with nets, it is dropped on the net. If the mixture is to be preserved for any considerable length of time the buzzard meat may be omitted until the time of using, as it will not keep so well as the other ingredients. The scientific name of the black root, alluded to above, is *Leptandra*; that of the golden or yellow root is *Hydrastis Canadensis*; and the kind of buzzard used is the one known as the turkey buzzard.

Improved Chalk Holder for Billiards.

Richard H. Thomas, of Kid's Grove, near Stoke-on-Trent, Eng., now residing at Newport, Ky.—This invention consists of a hollow cylinder with a detachable cap at one end adapted to hold a cylinder of chalk and admit the end of the cue to be chalked by bearing the chalk against it and revolving the holder by the fingers. The cap is large enough to receive one end of the cylinder, which is somewhat reduced to fit snugly in it, and is fastened to the cylinder by a pin and spring, which also fasten the piece of chalk in the holder, the pin projecting through it into the chalk. The cap may also screw on the cylinder if preferred.

Improved Compound for Cure of Toothache.

Francis J. Oswald, New York city.—This compound for the cure of toothache consists of essence of bergamot, essence of citron, essence of lavender, essence of rosin, essence of neroli, mixed in alcohol.

Improved Whiffletree and Trace.

Robert H. R. Stewart, River Vale, Ind.—This invention has for its object to avoid injury to field plants by the projecting ends of singletrees or whiffletrees of agricultural machines. The invention consists in so constructing the whiffletrees or singletrees that the traces when attached thereto will be flush with their ends.

Improved Fruit Crate.

Humphrey Humphreys and Eugene W. Humphreys, Salisbury, Md.—The object of this invention is to provide practical and economical means for transporting berries and other tender fruit in small boxes or baskets which are packed into crates. The invention consists in combining and constructing the parts of a crate so that the contents of the basket are kept cool by the air, which freely circulates through the open crate and around and over the baskets.

Improved Music Leaf Turner.

George Robb, McDonald, Pa.—This invention relates to a new attachment to pianofortes, melodeons or organs, for turning over leaves of music by means of pedals, and without necessitating the use of the hands for that purpose. The invention consists in the arrangement and connection with each other of a series of vibrating arms by which the music is turned and held in any desired position. Thin rods connect with pedals, so that the player may, by means of said pedals, cause the vibrating frames or arms to be swung in either direction, thus attaining full control over the music, which may be swung back and forward at pleasure.

Improved Refrigerator.

William M. Baker, Fortville, Ind.—This invention relates to a new construction of refrigerator or ice box, with the object of utilizing the coldness of the ice water in the preservation of the contents and in obtaining a draft of cooled air. The invention consists in a novel arrangement of air and water passages, which cause the air that enters the refrigerator to become cooled and remain dry, and the water to cool the air passages and sides of the refrigerator.

Improved Band Tuck for Grain Binders.

John Beall, Defiance, O.—This invention consists of a stick of wood or metal suitable for tucking the twist of the grain band under, suspended from the wrist by a strap, and from a thumb sack a little in advance of where it is suspended from the wrist in such a manner that it will not interfere with the legitimate operations of the hand in forming, applying, and twisting the band, but will be ready at hand for grasping quickly to tuck the twist under and save the tucking of it by the fingers, which is very trying to them. The thumb sack is secured on the thumb by the wrist band of the tucker, which goes through the upper end of the sack for that purpose.

Improved Thread Waxing Attachment for Sewing Machines.

Clay E. Lewis, York, Pa.—The invention consists in a heater, arranged for heating the horn and waxing attachment. With an attachment of this character the thread is only waxed as the work progresses, so that none is lost by the wax becoming too hard by long standing, as is the case when large bobbins of waxed thread are prepared beforehand.

Improved Fly Trap.

This ingenious little device is the invention of Mr. Perry A. Burgess, of Butler, Mo., and is an improvement on the simple and well known method of fly catching, by covering a tumbler with a piece of bread covered with molasses on its under side, and pierced with a hole in the middle. The present contrivance is a flanged disk of tin, wood or other suitable material with a central hole and an interior recess underneath filled with soft leather, felt or other absorbent substance. It is placed on a tumbler, the vessel being previously filled with soap suds. The absorbent is smeared with molasses. Attracted by the latter, the unsuspecting fly enters the central hole, but on reaching the object of his desire meets with destruction by tumbling off into the soap suds below. The device is manifestly simple and consequently cheap, and is undoubtedly efficient. Patented through the Scientific American Patent Agency, April 30, 1872. For further particulars see advertising page 124.



below. The device is manifestly simple and consequently cheap, and is undoubtedly efficient. Patented through the Scientific American Patent Agency, April 30, 1872. For further particulars see advertising page 124.

Improved Machine for Twisting Oakum.

Lewis Howard and Charles Howard, Watkins, N. Y.—The invention consists in combining a rotary tube, a spring fingered tube, guides and drawing rolls so as to twist and shape crude tow into ropes. By the use of this improvement the material is twisted with great rapidity and nicety, effecting also much saving in manual labor.

Improved Cultivator.

James Sherrill, Harrisburg, Oregon.—This invention has for its object to furnish an improved seed sower and cultivator. The wheels revolve upon the axles of the axle tree, to which the stationary frame is attached. The tongue is attached to the frame and may be placed at the center of said frame or toward one side, as may be desired, according to the number of horses to be used abreast. To the forward part or angle of a triangular frame, the draft clevis is attached. The frame consists of a number of parallel bars of different lengths, connected by cross bars, and is so arranged that the carriage may be drawn from it. The plow beams are of different lengths, four longer and three shorter, arranged alternately. The forward ends of the plow beams are placed between the rear ends of the parallel bars of the frame, and are prevented from having any lateral play while allowing the rear parts of the said beams to have a free vertical movement. The seed box is attached to the frame directly over the axle. In the bottom of the seed box is formed a series of holes, which are arranged directly over the plow beams, so that the seed in falling may strike upon said beams and be thoroughly scattered. A shaft extends longitudinally through the seed box and revolves in bearings in the ends of the said box. Upon the projecting end of the shaft is placed a small gear wheel, which is connected with said shaft by a tongue and groove or other suitable means, so that it may carry the said shaft with it in its revolution, but may slide freely upon the said shaft to be thrown into and out of gear with a large gear wheel when desired. A rod passes through a keeper attached to the rear side of the seed box near its end. The outer end of the rod is bent forward, and is forked to receive the gear wheel and serve as a clutch for moving the said gear wheel into and out of gear. The said gear wheel may be removed from the shaft when the dropping device is not required to be used. A sliding plate is placed upon the under side of the bottom of the seed box, and is slotted longitudinally beneath each discharge opening. By adjusting the said sliding plate the size of the discharge openings may be readily adjusted, according as less or more seed is required to be sown. The depth to which the plows enter the ground may also be limited by bars, and the forward ends of the plow beams may be raised and lowered as may be desired.

Improved Crimping and Fluting Machine.

Robert Werner, Hoboken, N. J.—This invention relates to a new machine for producing a fluted and crimped fabric, substantially like that for which a design patent was granted on the 29th day of November, 1870, from a smooth and flat woven fabric; and the invention consists, principally, in the application to fluting rollers of a detent or finger by which a portion of the fabric is held back, and thereby formed into V-shaped, but more or less irregular, lateral waves or crinkles, whereby the stated and desired effect is produced. This finger is made to bear against a platform over which the fabric is passed to the fluting rollers, or directly against one of the rollers, as may be desired. The invention also consists in a new arrangement and connection, with said fluting rollers, of a device for holding the fluted fabric in contact with the same while the crinkled portion of the fabric is being elevated and pushed up by a projecting rib or stationary plate.

Improved Caster for Furniture.

Cevadra B. Sheldon, New York city.—This invention relates to the construction of casters for pianos, household furniture, and other purposes; and consists in a cup or block, which is enclosed by the shell of the caster, with an annular groove adapted to receive and confine a series of balls, whose function is to bear upon the main ball or roller and thus reduce friction.

Improved Billiard Register.

Marion McKay, Topeka, Kansas.—This invention has for its object to produce a double register, in which one side will not count game if the other side has won the game immediately preceding. The invention consists in so connecting the pawl by which the game counting arbor is turned with a movable bar, and in combining it with projecting pins on the point counting shaft and with a vibrating frame, so that whenever the point counting index on one side has completed a revolution the game counting pawl on the other side will be thrown out of gear, not to operate at the end of the same game. All possible confusion is thus prevented, and none but the winning games will be recorded.

Improved Railway Snow Plow.

Samuel W. Hemenway, Lansing, Iowa.—This invention consists of fan blowers with suction and discharge pipes, combined with the scraper sides, having holes to allow the snow to be conducted into the suction pipes, to be taken up by the air blower and discharged over the side of the way, all in such manner that the snow may be taken from the front and discharged over the bank at the side.

Improved Excavator.

Samuel B. Alger, Oswego, N. Y.—This invention has for its object to furnish an improved excavator or self dumping cart, which shall be so constructed as to raise the dirt and discharge it into the cart. The wheels are made with deep rims, to the inner sides of which are attached the buckets or elevators which receive or take up the dirt and discharge it into the box. The elevators are made with hinged bottoms which are held in place by springs, so that, should the elevators strike a stone, the hinged backs may yield and the elevator pass on without being broken. The box is made in the form of a hollow cylinder with a portion cut away, and is rigidly attached to the axle. The buckets or elevators are made with open inner sides and move close to the curved outer surface of the box until they pass above the open part of the said box, when the dirt falls into the box. Levers are so arranged upon the axle that, when the box is in position to receive the dirt, they may project forward along the outer side of the forward part of the arms of the draft ball, so that they may be secured in place, holding the box in position to receive the dirt. When the box is full, and the cart has been drawn to the place where the dirt is to be dumped, the locking pins are removed. As the cart is started forward, the wheels in their revolution carry the levers and the box with them, dumping the dirt. When the wheels have made half a revolution, and the open side of the box is directed downward, it is held inverted until the dirt has all passed out. The pins are then removed, when the weight of the box brings it and the levers back into their former position.

Conveyor and Separator for Coal Breaking Machines.

Rufus A. Wilder, Cressona, Pa.—This invention relates to a new machine for conveying coal from one breaking machine to another in reducing it to different sizes, and for taking out any required size or sizes between the breakers while so conveying the coal; also, for distributing the different kinds of coal to the several chutes or pockets that hold it. The invention consists, principally, in the arrangement of an endless rotary wire screen between two coal breaking machines, and in the combination, with said screen, of a notched or slotted separator, which will remove any desired grade from the coal that is being conveyed on the screen from one breaker to the other.

Improved Hose Coupling.

John T. Condon, New Orleans, La., and Frank Jeffers, Pawtucket, R. I.—The hose is received in a tube at one end and is compressed by a cut ring and band nut. The connection at the opposite end is similar, but the tube is separate from the coupling and inserted in the hose. This tube is tapering, and the hose is compressed upon it by means of the ring, which is drawn up on to the hose by the band nut. This nut screws into the coupling and draws the ring by means of the shoulders on its inner surface. The inner surface of the ring is formed with projecting beads. The two parts are coupled together by means of a loose band made in two semicircles, connected and fastened together by tubular caps. On the inner surface of this band is a projecting rib or flange. Longitudinal slots are made in the part of the coupling which cuts through the groove which receives the rib. The rib itself has openings at two points to correspond with these slots. The parts of the coupling are merely clapped together, and the band is turned. When the openings in the rib correspond with the slots, the lugs enter, and then the band is turned, which completes the operation.

Improved Car Coupling.

Charles Gallagher, Taunton, Mass.—This invention has for its object to furnish an improved car coupling which shall be so constructed as to couple the cars automatically as they are run together, and which may be uncoupled from the platform, top, or side of the cars; and it consists in the hooks, made with curved inner ends provided with coiled springs and cords or chains, and arranged to operate in connection with the recessed bumper heads.

Improved Sash Holder.

John B. Adams, West Galway, assignor to himself and Frank F. Carnduff, Amsterdam, N. Y.—This invention is an improvement in the class of sash holders consisting essentially of two cam faced levers acted on by an intermediately arranged spring. By suitable construction any attempt to raise the window sash from any position in which it may be will cause an upper wheel to be pressed against the casing with a pressure increasing with a force proportioned to the force applied to the window sash. In the same way any attempt to lower the window will cause a lower wheel to hug the casing. A spring holds both wheels in a position to operate if there is any attempt to move the sash. By pressing thumb pieces toward each other, the wheels will both be turned so as to present their shortest radius toward the casing, allowing the sash to be moved up or down freely.

Improved Boring Machine.

James W. Shaw, Wenona, Mich.—This invention relates to a new machine for boring holes in the ends of logs and other pieces of long timber, in order to make them up into rafts, which is done by stringing chains through them. The machine is secured upon two or more logs, which form a float and leave a space of about four feet in width between them, directly under the auger. At each end of the float is a curved iron rod which connects the logs, in order to keep them in place. The machine is placed in position and the floating logs to be bored are run under the machine, turned one quarter over, and secured thus by means of dogs, one of which is attached to the float, and the other, a double one, attached to the machine, directly in front of the auger, and driven into the end of the log to be bored. While the auger is being turned it is slowly fed down by turning segments or pinions by a crank handle.

NEW BOOKS AND PUBLICATIONS.

TREATISE ON THE THEORY OF THE CONSTRUCTION OF BRIDGES AND ROOFS. By De Volson Wood, Professor of Mathematics and Mechanics in the Stevens Institute of Technology. Illustrated. New York: John Wiley & Son, Publishers, 15 Astor Place.

This book contains the substance of the lectures delivered by Professor Wood, upon trussed bridges and roofs, before the senior class in the University of Michigan. The well known reputation of the author is a sufficient guarantee of the excellence of the work and its reliability as a text book upon the subject to which it is devoted.

MESSES. BRIGGS & BROTHERS, seed dealers of Rochester, N. Y., publish a very beautifully illustrated quarterly, the first number of which we have recently received. Besides a catalogue of seeds, plants, etc., furnished by the firm, the book contains several finely finished chromos of flowers, together with much useful information on horticultural subjects. The four issues for 1873 are offered at the low price of 25 cents for all, or the work is sent free to parties ordering seeds to the value of \$1.25.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From January 11 to January 16, 1873, inclusive.

ROLLING METALS, ETC.—C. H. Perkins, Providence, R. I.
SCHOOL DESK AND SEAT.—A. H. Andrews, Chicago, Ill.
SPINNING MACHINERY.—J. W. Wattles, Mass.
STONE PIPES, ELBOWS, ETC.—A. G. Myers, New York city.
VELOCEPEDER, ETC.—G. Avery, Ottawa, Ill.

Business and Personal.

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

Business Agency in Boston wanted, by an energetic man; references unquestionably first class; good social position; extensive business acquaintance in N. E. States. Address "King," P. O. Box 1205, Boston, Mass.

Piano Forte Improvement—The subscriber has just patented a new pianoforte hammer, which he believes to be the best invention of the kind ever invented. See notice of the invention in another column. Address, for rights, John Shandelle, Courtland, Ala.

For Sale—One half or whole of Steam Saw Mill, 40 Horse Engine. Timber, \$6 per M; Seneca Lumber, \$20 to \$25 per M. Just put up in City. Apply D. Riker, Charleston, S. C.

Buy Gear's Improved Balanced Jig Saw, Boston, Mass.

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Machinist Wanted—To erect work outside. To competent men, constant work and good pay. Apply by letter to Watts, Campbell & Co., Newark, N. J.

See advertisement of Brady & Logan, p. 124.

Water Front, also Stores or Lots to Rent, Delancy St., E. River. Address Bro., 414 Water St., N. Y.

Covering for Boilers and Pipes. The most economical and durable article in use. Took first prize at American Institute Fair. Van Tuyl Manufacturing Company, 728 Water Street, New York.

The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Boilers. L. B. Davis & Co., Hartford, Conn.

Indispensable to every Manufacturer and Machinist—Boston Journal of Commerce; send for a specimen copy. \$3 per year.

Carpenters—For Sale, a Sash Factory, run by water power, at a lumber landing, with a profitable run of trade. For particulars, address P. O. Box No. 2, Charlestown, Jefferson County, West Virginia.

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

Needle and Clock Machinery of every description of the most improved styles. Hendey Bro's, Wolcottville, Ct.

For best Presses, Dies and Fruit Can Tools, Bliss & Williams, 118 to 120 Plymouth St., Brooklyn, N. Y.

Hammer Dies and Heads, strong and durable, cast to order by Pittsburgh Steel Casting Co. All work warranted.

For 2, 4, 6 & 8 H.P. Engines, address Twiss Bro., New Haven, Conn.

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

Diamond Carbon, of all sizes and shapes, furnished for grinding rock, sawing stone, and turning emery wheels or other hard substances, also Glazier's Diamonds, by John Dickinson, 64 Nassau St., New York.

A Superior Printing Telegraph Instrument (the Selden Patent), for private and shortlines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1872, for "Best Telegraph Instrument for private use"—is offered for sale by the Merchants' Mfg. and Construction Co., 50 Broad St., New York. P. O. Box 6865.

Iron Roofing. Scott & Co., Cincinnati, Ohio.

Shafting and Pulleys a specialty. Small orders filled on as good terms as large. D. Frisbie & Co., New Haven, Conn.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 479 Grand Street, New York.

For Wait's Improved Turbine Water-Wheels, Improved Melay, Gear, and Circular Saw Mills, Paper Engines, Rope Cutters, &c. &c., address Marlow & Van Wormer, Successors to P. H. Wait, Sandy Hill, N. Y.

Circular Saw Mills, with Lane's Patent Sets; more than 1200 in operation. Send for descriptive pamphlet and price list. Lane, Pitkin & Brock, Montpelier, Vermont.

Machinists—Price List of small Tools free; Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

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

English Patent—The Proprietors of the "Heald & Cisco Centrifugal Pump" (triumphant at the recent Fair), having their hands full at home, will sell their Patent for Great Britain, just obtained. A great chance for business in England. Address Heald, Sisco & Co., Baldwinville, N. Y.

Read the article on "The Machinists," now being published in the Boston Journal of Commerce. Send for Specimen Copy.

American Boiler Powder, for certainty, safety, and cheapness. "The Standard Anti-Incrustant." Am. B. P. Co., Box 771, Pittsburgh, Pa.

Scale in Boilers. I will remove and prevent scale in any Steam Boiler, or make no charge. Send for circular. Geo. W. Lord, Philadelphia, Pa.

Gauges, for Locomotives, Steam, Vacuum, Air, and Testing purposes—Time and Automatic Recording Gauges—Engine Counters, Rate Gauges, and Test Pumps. All kinds fine brass work done by The Recording Gauge Company, 91 Liberty Street, New York.

Boynton's Lightning Saws. The genuine \$50 challenge. Will cut five times as fast as an ax. A six foot cross cut and back saw, \$6. E. M. Boynton, 90 Beekman Street, New York, Sole Proprietor.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

Steel Castings "To Pattern," from ten lbs. upward, can be forged and tempered. Address Collins & Co., No. 213 Water St., N. Y.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address L. B. Davis & Co., Hartford, Conn.

All Blacksmith Shops need a Holding Vise to upset bolts by hand. For such address J. H. Abbe, Manchester, N. H.

Williamson's Road Steamer and Steam Plow, with rubber tires. Address D. D. Williamson, 22 Broadway, N. Y., or Box 1809.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

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

Always right side up—The Olmsted Oilier, plarged and improved. Sold everywhere.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Army, 321 and 333 Cherry Street, Philadelphia, Pa.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union I. on Mills, Pittsburgh, Pa., for lithograph, etc.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. L. B. Davis & Co.

Notes & Queries

1.—S. E. P. asks for simple directions for gilding cast iron.

2.—T. G. S. asks for a formula for preparing unalterable strap of iodine of iron.

3.—H. M. H. asks how to make and apply a polish on articles made of manyanilla wood.

4.—T. C. M. asks how to gild on marble, so that occasional washings will not injure the gilding?

5.—F. S. S. asks how to give tempered steel spectacle frames that beautiful even blue color, given to fine English steel spectacles. Should the frames be baked in a small furnace, and, if so, at what temperature?

6.—S. F. S. asks: How can a barn be ventilated so that it will not smell strong? It is 22x40 feet on the floor, 19 feet to the upper floor, and 17½ feet from there to the peak of the roof. There are no buildings on three sides of it. I tried disinfecting it with chloride of lime, but it takes too much and does not have the desired effect.

7.—E. F. asks for a recipe for a hair dye that is not permanent, that is, one which will disappear on the application of soap and water, ammonia, or some cheap chemical.

8.—E. F. wants a rule for rating or calculating the horse power of steam boilers, and the pressure per square inch a boiler of any given dimensions and thickness of iron is expected to bear.

9.—W. H. P. asks: In sawing off a board twenty-four inches wide, which requires the greatest power, one saw that cut just 24 inches, or two saws that cut just 12 inches each, one above the other? The saws are to be of the same gauge.

10.—L. F. S. asks: Why is it that some manufacturers of machinery and other goods, in the face of all competition, maintain such excessively high prices for their productions, preferring, as it seems, to sell perhaps a sixth or a quarter of what they might rather than to reduce their prices?

11.—J. C. C. asks what material he should use for a double hull boat made for speed and durability. Of what dimensions ought it to be? Is cloth made waterproof also afloat? If not, what should I use to make it afloat?

12.—R. asks what is the cheapest and quickest artificial process for seasoning timber for staves, etc. Of what material should a kiln 14x30x6 feet be constructed? How should it be heated so as to give a temperature of 115° Fahr. and to season the staves in 4 days? I do not want the smoke or sparks to circulate among the staves.

13.—J. F. P. asks: How can I work aluminum bronze, so that it will be malleable and soft enough to roll or be drawn into wire? After repeated trials of melting together 19 parts aluminum and 90 parts rolled copper, I have failed; it pours and sticks to the crucible like pudding, and is as brittle as cast iron.

14.—N. H. says: I would like to turn some large wooden bowls from 8 to 16 inches diameter, and some cheese molds about 6 inches high, and from 6 to 12 inches diameter. What is the best wood for that purpose? Shall I work it green or dry? If worked green, how shall I treat it to keep it from splitting? What is the best way to hold the pieces to the lathe mandrel? Is it profitable to turn a number of the cheese molds on one piece first, before hollowing them out? Are there tools that will cut in this way several bowls out of one piece concentrically, or does that not pay? Which are the best tools for cutting them out?

15.—A. H. says: At the back of my house is a brook, which for many rods passes over a gravelly bed; and in some seasons of the year it dries up. During the night time and on very cloudy days, there may be quite a stream of water; but when the sun appears, the water disappears; and, again when the sun disappears, the water comes again. There are several theories about it, but what are the facts or true cause? 2. A small cast iron common pump was so arranged that by elevating the piston to its highest point it admitted air and allowed the water to settle down. The end of the handle, or lever, rested on a board of the well curb. On a very cold morning the lever was found broken between its fulcrum and the piston rod, near the former, leaving a piece of about a foot long and of some four or five pounds weight attached to the piston rod, but thrown entirely over it and hanging on the opposite side from that on which it would naturally have fallen. It is easy to understand how the pump could have become frozen up, and how a sound bar of iron, one inch by one and one half inches, could be broken; but how that weight of iron could be raised and thrown over, is a question. The board of the curb could have nothing to do with it, and it does not seem possible that the ice and frost in the pump barrel could affect it in that manner. The elasticity of the cast iron seems to have caused it; but will some one who can, kindly furnish a solution?

Answers to Correspondents

R. A. R. asks us to inform him why the holding a darning needle in the mouth while peeling onions will prevent the onions from affecting the eyes. Answer: It won't do it.

J. E. G. sends two mineral specimens and asks what they are. Answer: The specimens are red jasper, a stone which takes a fine polish and is used in mosaic work, but is not counted among the "precious" stones.

M. B. sends a specimen, which melts readily with little loss, and it is suggested that it may be tin. Answer: It is a chloride of lead with a small percentage of copper, a mineral of rare occurrence in the United States.

T. H. C. asks: What are the ingredients and proportions of Babbitt's metal? Answer: To make Babbitt's metal, melt 4 lbs. copper, add by degrees 12 lbs. best tin, 8 lbs. regulus of antimony and then 12 lbs. more tin. After the last four or five pounds of tin have

been added, reduce the heat to a dull red and then add the remainder of the tin.

G. E. H. says: Please inform me of a process to take the impressions of tree and plant leaves, if possible in some chemical manner, to retain their color in the impression, which is to be preserved in book form for future reference. Answer: Impressions can be very neatly taken, in many cases, by means of the impression paper which is sold by the stationers. In some instances, we have seen photography used to obtain permanent representations of leaves. We know no means by which colors can be either transferred or automatically reproduced.

E. N. says: I have heard it stated that one square foot of heating surface in a fire box of a boiler was equal to five square feet of fine or tube surface for steam purposes. What difference is generally allowed in practice; and what difference, if any, is there between vertical and horizontal tubes for steam purposes? Answer: The estimates of the power of a steam boiler are usually based upon the total area of heating surface. As a rule, the best fire-tubular boilers have about 30 square feet of heating surface to the square foot of grate, and water tube boilers are given nearly a proportion of 15 to 1.

D. M. A. asks: What causes foaming in an engine boiler? Is it dangerous or apt to cause an explosion of boiler? Does steam ever descend under the water in a boiler and force the water up and then take its place? Answer: Foaming is caused by the generation of steam more rapidly than it can disengage itself from the mass of water within which it is formed. It may give rise to inconvenience, and even danger, either by carrying water out of the boiler more rapidly than the feed pump can replace it, or by entering the steam cylinder of the engine and creating a liability to accident, when the piston strikes upon it, at the end of its stroke, by breaking crank pin, connecting rod or cylinder head. Steam does not get under the water but is sometimes so rapidly disengaged, at points on the heating surface under water, as to almost or quite displace the water.

J. H. L. asks: Will you please inform me (1) how much coal a large ocean steamship consumes in 24 hours when under full steam; and (2) how much is usually consumed in a trip from Liverpool to New York and vice versa? 3. Also state the total tonnage of an ocean steamer including fuel. 4. Also give me the tonnage of the Great Eastern, and what coal she consumes in 24 hours under full steam. 5. Is steam used all the time in making the trip, or is sail used part of the time alone, or are both steam and sail are used together? Answer: An ocean steamer frequently burns from 75 to 100 tons of coal in 24 hours. There are vessels in the British Navy which, under full power, will burn about 300 tons in 24 hours. 2. Probably an average of 1000 tons for the whole run. 3. From 2,500 to 3,500 tons registered and up to 4,500 tons displacement. 4. The Great Eastern has a registered tonnage of 18,000 and an actual displacement when down to her maximum draft, of 26,000 tons. We are not certain what amount of coal she now uses. It was formerly not far from 15 tons an hour. 5. We do not think that she is ever under sail alone.

R. J. asks: 1. Can you supply me with any information respecting the application of compressed air, as a motor for manufacturing purposes? In other words: Suppose I have a water power within half or quarter of a mile of a navigable stream where I have saw logs that I desire to cut up, and that it is costly and inconvenient to take the logs from this stream to the waterfall, and the same to conduct the water to the logs; would it be practicable or economical to use the power of the fall to compress air, and convey it by pipe to the river where my logs are? What is the best sort of pump or cylinder for compressing air, and what diameter of tube would be required, taking the relation of distance and horse power into account? What kind of engine would be needed? What amount of power would be lost by friction, in using the compressed air in lieu of the water? 2. Suppose my waterfall admits an overshot wheel of 24 feet diameter, will I gain power by putting up two wheels of 12 feet diameter each, one above the other, and using the water twice, than if I use the water only once on my 24 feet wheel? Or again, will two horses of equal strength draw a greater weight, by attaching each one to a wagon with wheels of only three feet in diameter, than one of these horses will if attached to a wagon that has wheels six feet in diameter? Answer: 1. We should anticipate greater expense both in first cost and in maintenance by the plan proposed than by the adoption of the "telo-dynamic" method of transmission which our readers have seen described in the back numbers of the SCIENTIFIC AMERICAN. A light line of wire rope, travelling at high speed over pulleys of large diameter, will give a better effect, in such cases, than will any other means of transmission of power to great distances. Find a well informed mechanical engineer and obtain plans of details from him. 2. We should use the larger wheel under such a fall, if we were compelled to use an overshot rather than a good turbine wheel. 3. The experiments of Mr. Joseph Coe, at Seaconnet, R. I., have shown a large gain by the use of wheels six feet diameter, approximating that indicated by the laws of friction, but not, we think, to the degree indicated by the question, to which we reply: The larger wheels are, necessarily, of themselves, so heavy as to make an important addition to the resistance. Under theoretical conditions of merely rolling friction, we should reply to this question in the negative. Wheels should always be as large as practicable.

G. S. N. asks: In using a light lubricating oil, made from petroleum, to remove the scale in steam boilers, would there be any danger of the gas, that would arise from the heated oil, exploding? We have two tubular boilers in our mill, and they are badly incrustated with lime. We saw recommended in your paper the use of crude petroleum for removing scale in boilers. We put in our boilers two gallons of lubricating oil made from petroleum, and there was such a gas and smoke made from the burnt oil that we were afraid the gas would ignite and explode the boilers. If there is no danger, we would like to continue the use of the oil, for we think it is doing more good than all the anti-incrustants we have used before. Answer: No explosion can occur where the vapor is unmixed with the proper proportion of air or oxygen. There is no danger except from vapor escaping into the boiler or engine room, and we should presume that such escape would not be likely to occur to a hazardous extent. The boilers themselves are not in the slightest danger.

J. L. B. asks: Why will not a glass fruit jar break if allowed to rest its bottom on a wet cloth when hot liquids are poured into the jar? The wet cloth should be a few times folded, and the cloth may be wet with cold water. The fruit or liquids may be boiling hot; not one jar in fifty will break, and the operation does not seem to require care. This plan of putting up fruit in jars is now altogether practiced by those who know the fact, and it saves the trouble of heating the jars; and with even this precaution a larger percentage will be broken than by the other unexplained or phenomenal process.

Answer: The statement of our correspondent is interesting and will probably afford a valuable piece of house-keeping information to our readers. We presume that Professor Tyndall will be able to give us the information asked, when he reads the request in our columns. We should prefer to make an experimental investigation of the subject before presenting our own opinion.

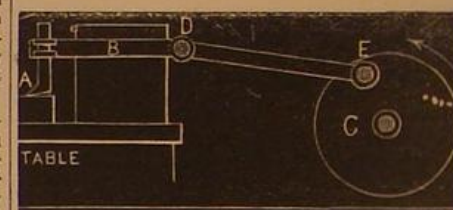
A. S. asks: How does a railway train turn a sharp curve, where the outer rail is considerably longer than the inner, all the wheels being of the same diameter and keyed to axle? And J. H. asks: How the outside wheel of a locomotive or car (on a curve) keeps pace with the inside wheel, on account of the distance to travel being greater, both wheels being fast on the axle? Answer: With wheels of equal size and having cylindrical bearing surfaces, one or both must slip on the rail. The wheels of the cars on railroads are "coned" to avoid this difficulty, their diameter on the outer edge of their bearing or "tread" being less than that of the portion of the tread next the flange. In turning a curve, the wheels ride toward the outer rail, and thus, to some extent, if not wholly, this tendency to slip is prevented.

R. D. and others who ask for information on the setting of slide valves and position of eccentrics are referred to pages 123, 234, 250 of volume XXVII.

C. J. McC. asks for directions for dissolving horn, which he will find on page 91 of our current volume.

J. J. O'F. asks: What would be the cost per spindle (say for 100 spindles) for all the machinery (power excepted) necessary to manufacture cotton yarn out of lint cotton? Answer: From \$3.50 to \$10.50 per spindle according to quality and number of spindles, power and buildings not included.

W. F. C. S. asks: 1. Suppose a builder of engines has a contract to build an engine for a certain sized machine shop or manufactory; how does he ascertain the size of the engine that will do the work? Suppose there were 20 lathes, 3 planers, 2 drills, a line of shafting, counter shafts, etc.: how is the number of horse power required to do the work found? What rule applies to all sized shops? 2. How is the device constructed that produces the fast and slow motion on a compound planer, slow while the tool is cutting and fast while it is returning? 3. I have seen in books on philosophy that a bar, balanced at the middle point, would balance in any direction. I have not been able to do so on a pair of druggist's scales. Why is such a thing stated when it cannot be practically demonstrated? Answer: 1. There can be no general rule for determining power required to drive machine shops. The kinds of machinery and character of the work are so variable that it requires the exercise of experienced judgment in each case. An experienced engine builder should be able to tell at once, upon inspection, what power he must calculate for. 2. The simplest device for the fast and slow motion of reciprocating tools is this, where A is the tool,



carried by the piece B which is driven by the wheel C by means of the link D E. The center, C, is below the level of D. As the driving wheel turns, it throws the tool forward at the proper cutting speed and draws it back more rapidly in proportion as the wheel C is larger and D E shorter. Another is that of elliptical gearing, but it is expensive. 3. The proposition that a bar balanced in the horizontal position will balance in any other is not true except when it is supported exactly at its center of gravity. Bodies of any shape, supported at their centers of gravity, will remain at rest in any position. Take a perfectly straight bar and draw a line through the middle of the two sides and either cut a notch up to the line or drive a pin through, so that the bar may be supported at the middle of the line, exactly; the bar will then be in equilibrium in any position. Scales are purposely made with the centers of gravity below the points of suspension, so that they may return to the horizontal when unloaded.

W. A. G. says: In the packing room of a dry goods store, the goods coming from the salesroom are lowered by means of a Beekman rotary engine (300 revolutions per minute) which is supplied with steam from a boiler distant 100 feet diagonally across the packing room; the steam pipe running immediately under the ceiling. This pipe seems to conduct the sound of the engine in such a manner that the entry clerks cannot hear the caller off, on account of the noise. What coating or covering will prevent the conducting and radiation of this sound in the packing room? Answer: The steam pipe should be covered to prevent loss of heat and consequent waste in using wet steam, as well as to prevent the annoyance referred to. Try making two or three joints in the length of the pipe, or at boiler and engine, with flanges and thick gum packing. For small pipes, covering with felt and canvas is usual.

E. S. B. asks: 1. What are the relative merits of the locomotive and the horizontal stationary boilers? 2. What is the best plan for taking the sap from green wood so that it may be worked immediately? Is it to be boiled or steamed, and how long would it take for a block four inches square and twelve in length? Answer: 1. The locomotive form of boiler is compact, powerful, and, when properly proportioned to its work, very economical. It is more costly than simpler forms of boiler and, in consequence of the difficulty of removing scale from its tubes, cannot be used when the feed water is liable to produce incrustation. The plain cylindrical boiler is of least first cost and easiest to free from scale, but is the least economical in the use of fuel. Other forms of boiler, intermediate between these, usually share their advantages and defects as they more or less resemble the one or the other. Some of the "sectional" boilers have special advantages over either of the above named, in addition to their greater safety. 2. Boil four hours, then dry slowly at a temperature not exceeding 200° Fahr.

E. J. L. asks: Will you give me a rule for calculating the pressure on steam boilers, by the lever and weight? I have searched several works on the steam engine, but have not found two rules alike for calculating the pressure on boilers. Answer: E. J. L. will find his question already answered in our reply to an earlier and similar request.

A. S. asks: 1. Where is the point of suspension in the arms of a regulator? Is it the center of pin where the arms are suspended or where the line of the arms would cross in the center? 2. How can I find out the horse power of a boiler of a given size, say 14 feet long and 3 feet diameter? Answer: 1. The height of regulator for use in estimating the time of revolution is measured from the plane in which the balls are to revolve.

up to the point where the arms, if extended, would cross the center line of the standard. Measure the heating surface and divide by 25, and the result will give the number of cubic feet of water which any fairly designed and well set boiler should evaporate per hour. A good engine uses about half a cubic foot per horse power per hour.

F. D. R. says that P. L., who asked for a good book on pyrotechny, will find Mortimer's work on pyrotechny as good as any.

W. D. O. says: Suppose a man to be suspended from the sun to within speaking distance of the earth. The attraction of gravitation draws him constantly toward the earth's center; he remains stationary and the earth revolves beneath him once in twenty-four hours. This noon when I come under him he asks me the time of day, and I say "twelve o'clock, noon, Friday, January 21." I pass along and he asks others the time of day, and they, being under the sun, of course say just the same. Where is the man to tell him it is twelve o'clock on Saturday? Even suppose I was the first who told him it was noon Friday, ought I not to be the first to tell him it is noon Saturday? But five minutes before I come along, a man will tell him it is twelve, noon, Friday, and our stories will not agree, yet both tell the truth. Answer: Possibly the suspended individual might have an opinion of his own, and believe it to be Sunday all the time. We should advise our correspondent to wait until the case actually occurs before giving valuable time to so fruitless a discussion, which, however, may be promptly closed by reminding those who take part in it that our ideas of time are relative, having no absolute natural standard by which to fix the limits.

F. E. D. asks: How can I find the different diameters of two cones in order to get the required speeds and an equal tension of belt? For instance, I have a counter shaft making 120 revolutions per minute, and I want my machine to run 67, 100, and 133. The largest size of the driving cone is to be 12 inches, and the distance between centers of cones to be 7 feet. What will be the proper diameters to make the steps of the two cones to have the speeds mathematically correct and also to keep the belt equally tight on the different speeds. Answer: For crossed belts, vary the sizes uniformly so that the sum of the diameters of the several pairs on which the belt at any time runs shall be the same for each step. For open belts, the cones must be enlarged at the middle by an amount which can be determined thus: Draw the line A B, equal to the circumference of a circle whose diameter is the distance between the centers of the two lines of shafting. Then draw a line B C,

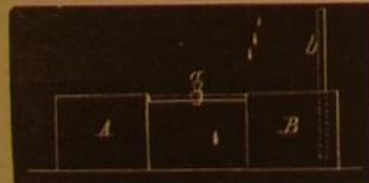


perpendicular to A B, and also the line A C. From B draw B D, perpendicular to A C; and the distance B C measures the amount by which the middle pair must be enlarged in their radii. Those on either side the middle pair must be of proportionally increased radius.

T. J. asks: Is there more than one kind of check valve in use? If so, how many? Answer: The plain check valve is so made as to rise and allow the water to pass through it in one direction, but closes at once when the current sets backward, preventing its return. The screw check valve has a stem fitted with a screw and a handle, which, when lifted to the proper height, allows the valve to act as a check valve, but which may be screwed down, holding the valve in its seat. It then acts as a stop valve. Different makers have different styles of these two classes of valves.

J. S. L. says: Last winter I dug a well and put in an iron submerged pump, leaving in the stone that covers the well, a hole only large enough for the pipe to work in, say a 1 1/2 inch hole for a 2 inch pipe. From six inches below the rock, I began laying the wall in water line and continued it to the top; this I did to keep out the worms. Last fall the water from this well got to smelling badly. I removed the covering stone. After pumping it dry, I made it as clean as I could, finding but one fish worm. I had frequently pumped them up before. Within a few days past it has got to smelling worse than before. What I want to ask is, whether the covering the well as tight as it is would make the water impure? Since I cleaned it out until a few days past, it has been very pure, with no smell whatever. About three rods from the well is a privy with a sink, but the stream that supplies the well comes from the opposite direction, that is, the opposite side of the well from the privy. Please tell me of something that will purify it. Answer: Free access of air may keep the water sweet, by causing the oxidation of impurities and thus preventing their decay from surcharging the water with unwholesome matter. If entirely closed at the top, the well would soon become unwholesome, if any organic matter were to find its way into it, by the putrefaction of such matter, whether animal or vegetable. Thorough cleansing and a free use of its water, in order that none be allowed to remain long enough to become foul, are the best preventives of trouble. We should feel very apprehensive in regard to using water from a well situated as is the one described. Typhoid fever and diseases of that nature are generally ascribed to the use of water or to the breathing of air contaminated with matter arising from animal excreta.

H. G. C. has two similar tanks, A and B,



ranked thus. They are of equal capacity and connected by a pipe having a cock as shown. In B is fitted a tube *b*, rising to the height of a column of water which exerts the pressure of one atmosphere at its base, that is, somewhat above 30 feet. In B is filled with water which is forced out through *b*, by means of air pressure obtained by driving air into A, the cock, *a*, being open. The question is "How many volumes of air must be forced in?" Answer: A containing air, and B being full of water, there is one volume already present, at a pressure of one atmosphere. To force the last portion of water from B, it will be necessary to have, at that moment, both vessels filled with air at two atmospheres pressure, measuring in each case from a perfect vacuum line. Thus there are now present four volumes, of which one was present originally. Three have therefore been forced in.

"Engineer" and some other correspondents have sent us repetitions of the stale question about the man going round a tree on which there is a squirrel. The subject was discussed in our paper some time ago, and we decline to renew it.

G. P. says: I have a house which has been struck with lightning once before I had rods put up, and taking the house as a center, it has struck within a radius of twenty rods, nine times or more within the last twenty years. The position does not seem to be peculiarly exposed. I have stated a fact, and believe science should find a satisfactory explanation. Answer: Lightning always takes a path, when passing between the cloud and the earth, which offers least resistance. In the case mentioned, the point struck may be somewhat higher than the surrounding localities, or its soil may be more moist, or the presence of subterranean springs or mineral veins may offer unusually good routes of travel to the electricity.

F. D. R. says that G. S., who asked for a cement for lamp chimneys, can prepare it by heating common plaster of Paris to 300° Fahr.

D. P. D. says that W. & Co., who asked how to make a paste that will adhere to bright tin, should apply common flour paste in which about one table spoonful of brown sugar to a quart of paste is mixed.

J. S. says in answer to G. W. D., who asked if it would take less power to draw a weight by a long rope than a short one: I imagine that G. W. D. has not put the question properly to elicit the desired information. If a horse is hitched close to the load and his traces are low down, he will draw a larger load than if he were farther off. It gives him more traction and lessens the friction, as he partly lifts the load. If his traces were hitched high up on the load he would lose his traction and create more friction by pulling down, and would pull more if he were farther off. Your answer is, I believe, correct in regard to the use of mechanical power in the manner described.

J. G. D. says that H. L. B., who asks how to remove palat, etc., should take caustic soda or concentrated lye, dampen or dissolve, and apply.

A reader says: In answer to the article "A Novel Problem," in your issue of February 8, 1873, I would say that the creeping of the rails was caused as follows: The centrifugal force of the end of the train nearer the south being greater than that of the northern end (caused by the revolution of the earth), the northern end of the train would act most on the track, which in a train moving south would tend to draw the track after it, and in moving north to pull the track towards it; and the revolution of the earth being from west to east, the pressure of a train would be the greatest on the western rail, thereby exerting the greatest influence, as above, on that rail.

A. H. says, in answer to C. H. B., who asked for a method of tinning cast iron: I used to tin boxes by heating them, then using a flux of alcohol or salt of ammonia, and tinning with a common soldering tool or a copper wire swab, with melted solder. They were cast iron boxes for steam engines and other purposes.

A. F. C. says, in reply to H. W., who asked what caused the heating of his journals: Examine your journal, and you will find an uneven place which cuts the boxing and gives too much play. Try with a pair of calipers or a hole bored in a plank.

W. H. T. says: The answer to E. E.'s query, how to form a perfect cube in perspective, is not correct. It would be an excellent isometrical cube, but a very poor perspective cube, the horizontal parallel sides of which must tend to a point on the horizontal line, at a distance from the center of view proportioned to the situation from which the cube is viewed; while the parallel sides of an isometrical cube, extended, would be parallel *ad infinitum*.

F. D. R. says, in reply to G. W. H., who asked how to make "Alaska scenery": Dissolve 45g grains of nitrate of lead in six fluid ounces of water; if the solution is turbid, filter it. Place the solution where it is intended that it shall remain, and drop into it 300 grains of sal ammoniac, in long fibrous crystals. The result is "Alaska scenery."

J. G. D. replies to S. J. H., who asked why a top does not fall when spinning, that the centrifugal force overcomes the attraction of gravitation.

E. D. says in reply to C. H. B., who asked how to tin cast iron: A process for tinning common cast iron is one of the things that is yet to be found out. Any person having a process to tin gray iron and to give it a finish equal to what is known to the trade as C plate or even to give it a smooth coat of tin, would have too good a thing to let it round loose.

H. M. W. replies to J. B. B., who asks what composition will make cloth waterproof, without altering its appearance: Into a half bucket of soft water put half a pound of sugar of lead. In another half bucket of water, put half a pound alum. Stir till dissolved and then mix the two solutions together. Stir well, let stand till clear and pour off. Put the garments in the liquid for 24 hours, take out and hang up to dry without wringing. Acetate of alumina is here the water-repelling salt.

W. A. C. says, in reply to C., who asked how to case harden part of an object: Labor expended in case hardening the face of a hammer would be thrown away. To harden the face of a steel hammer, I heat the face only at a slow red heat. Then I place it under a stream of water so that only the face will be wetted. When the face is cool enough, I polish it a little, and the heat left in it will draw the temper to the required color.

W. H. B. sends a mineral specimen, and asks what it is. Answer: The sample looks like decomposed mica schist, it is probably of no value.

J. R. asks for a process of separating lead from tin. Answer: If the lead and tin are in solution precipitate the former by sulphuric acid and the latter with sulphuretted hydrogen gas. In an alloy the lead will dissolve in nitric acid, leaving the tin as an oxide.

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 Bursting of Cylindrical Boilers. By R. C.
- On Perpetual Motion. By B.
- On the Creeping Rail Problem. By J. S.
- On the Ignition of Wood by Steam Pipes. By M. M.
- On Fires, their Prevention and Means of Saving Life. By W. M. B.
- On Central Forces. By T. W. B.
- On the Occurrence of Fires from Superheated Steam. By J. A. M.

[OFFICIAL]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

January 21, 1873,

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

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VALUE OF PATENTS And How to Obtain Them.

Practical Hints to Inventors

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Riggall, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

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HOW TO OBTAIN PATENTS.

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct: Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, New York, for full particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new

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