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IN ADVANCE

A LARGE STEAM CRANE.

Messrs. Appleby Brothers, of London, England, have sent to Vienna three steam cranes, for three, five, and seven tons respectively, of the same general design, the difference being only in proportion. We illustrate the largest of these cranes, in which, as in the others, the carriage is cast in one piece, the horns being provided with bearings for the traveling wheels. The central post is of wrought iron, and the top of the carriage is recessed for a spur wheel fitting on the column, and made fast or loose with it, and there is a raised roller path truly turned on the outer edge of the recess. A base plate, fitted with three friction rollers, revolves on the central column, two of the rollers being placed directly below the jib, and one at the back to take the weight of the boiler and tank. The engines are carried on this base plate in a pair of A frames, the feed water tank and the boiler being placed some distance from the center of the crane post, and forming a counterbalance to the weight to be lifted. The boiler is vertical, and is fitted with two cross water tubes, which system, although not so economical as the multitubular as regards fuel, works out better in practice, as cranes are so often fed with the worst kind of water. The work is done with a pair of direct-acting steam cylinders placed slightly on the incline, one outside each side frame, the crank pins being fitted into a pair of balanced disk plates. In addition to the usual lifting and turning motions, each crane has a neat arrangement for traveling by steam and for altering the radius of jib by the same agency. The engine shaft between the side frames carries a bevel wheel made fast or loose on the shaft by means of a toothed clutch, for driving an oblique worm shaft gearing into a tangent wheel on the derrick chain barrel for raising or lowering the jib, the worm

wheel securely locking the jib in any position. A broad spur wheel is geared on the crank shaft, and works a narrow wheel below it on a weigh shaft, which has a small crank pin at each end equal to the stroke of the slide valves. The narrow wheel can be moved by a hand lever laterally about four inches on a spiral feather, thus reversing the valves for running the engines in either direction. This arrangement answers well, and is found to be more durable than a link motion. A pair of spur wheels are placed on the left side of the crank shaft, and which gear into wheels on the countershaft below. One pair of these wheels are of equal, and the other of unequal, diameters, and either pair can be made drivers by means of a double toothed clutch. Provision is made for working the crane by hand if necessary through this shaft, which also carries a set of bevel wheels and double friction cones for driving the slewing and traveling motions. As this shaft has two speeds communicated to it from the engine shaft, it will impart two speeds to the slewing and traveling motions. The motion from this set of wheels is transmitted through a train of wheels to the spur wheel on the column, and which is twice the depth of the pinions gearing into it. The pinions are placed at different heights, so that the slewing pinion clears the pinion driving the traveling gear, and which is fixed. To travel the crane the body is fixed to the carriage, and the wheel, revolving on the crane post, drives the traveling motion. The friction cones are operated by an eccentric lever, and can be thrown in contact while the engine is running, the jib being put in motion gradually without slack. On the cones being reversed, they act as a brake, and arrest the motion of the jib. A pinion sliding on a feather in and out of gear, with a spur wheel on the barrel shaft, conveys the lifting motion from the coun-

tershaft. This pinion is withdrawn for lowering, and the descent of the load is controlled by a strap brake worked from a foot lever, which is fitted with a pawl and ratchet, so that the load can be left suspended at any point of its descent.

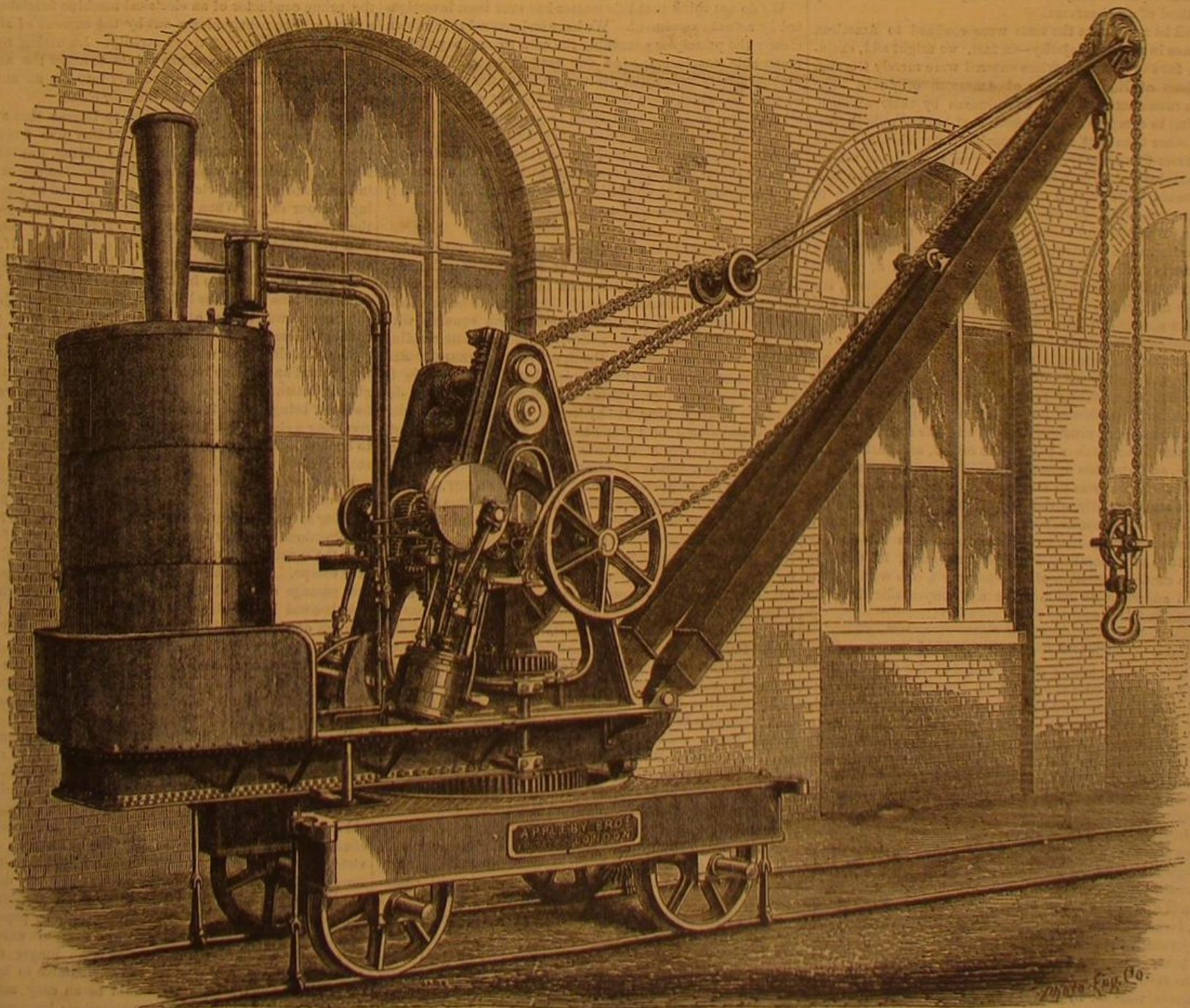
As the slewing motion can be put into action through the cones while a load is being raised or lowered, a considerable saving of time is effected. It will be seen that the speeds of working are in direct relation to the loads; as many as 60 or 70 loads may be lifted and turned round in an hour with the quick speed, while heavier loads, which necessarily require more time to manipulate, are dealt with at a correspondingly lower speed.

The details of construction, says *Engineering*, to which journal we are indebted for the illustration, are well carried out in these cranes, which are well got up, without the superfluous finish too often given to machinery for exhibition.

One of these machines did good service in unloading and transporting the heavy machinery sent to Vienna from England.

Clarifying Beer.

Of the thousand and one methods proposed for this purpose, one of the latest is that of Mr. Garton, and consists in the use of phosphate of lime. The process is as follows: A very concentrated solution of phosphate of soda is first put into the wort, and then gypsum or chloride of calcium and slaked lime are added. Instead of the soda salt, phosphoric acid or some soluble phosphate of lime may be employed. This clarifier can be used at any stage of the process, either before or after fermentation. The same process is also recommended for other fermented liquors.



STEAM CRANE AT THE VIENNA EXHIBITION.

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TRIUMPH OF AMERICAN HARVESTERS IN AUSTRIA—THE ENGLISH EXHIBITORS BACK OUT OF THE COMPETITION.

The result of the trials of the mowing and reaping machines, recently held at the Vienna Exposition, is a substantial and unequivocal triumph for the American inventions. We print elsewhere a full account of the experiments, extracted from the page of our English contemporary *Engineering*, a report which we have purposely selected in preference to many at hand from American correspondents, in order that our readers may have before them the acknowledgment of the victory as dictated by the most adversely prejudiced of all observers.

It will be noted that the tests were confined to American machines in a large majority—in fact, we might add, exclusively, for the German devices entered were merely German imitations of English copies of American originals. The British manufacturers were conspicuous by their absence, declining to compete for no reason that we are able to discover, other than that, after comparing their machines with those from this country, they considered their defeat a foregone conclusion. Their machines, presumably of the best types made, were entered for competition; and according to their own showing, the circumstances of the trials were particularly favorable for them. But in spite of all their facilities for improved construction, in spite of their much vaunted progress in agricultural machinery, and in spite of medals and honors innumerable, won in domestic expositions, the English makers have fairly and squarely backed down, and this on a simple inspection of the American exhibit.

Engineering makes an ineffectual attempt to gloss over the fact by disparaging the nature of the trial and consequently the ability of our machines to perform difficult work; but conveniently forgets that the same conditions were free to the devices of its own country. It seems to us that it would have been much more just and fair for the English exhibitors to have taken part in the ordeal, and sustained, if need be, an honorable defeat, rather than to permit the inferiority of their products to stand publicly confessed by a deliberate and cowardly withdrawal from the contests. The part taken by our contemporary in decrying an honestly won success is neither generous nor graceful, nor is the clumsy subterfuge of ignorance, manifestly advanced in order to avoid a candid admission of superior merit, one worthy of a journal supposed to be upright and unprejudiced in its opinions and dealings.

TOWING SAILING VESSELS.

"Suppose a tug tows a sailing vessel at the rate of three knots an hour: would the vessel be propelled at the same speed, if the engines and propeller of the tug were placed in her?" This is a question recently asked by one of our correspondents; and we propose to give the answer at greater length than would be convenient in the columns devoted to "Answers to Correspondents."

When a vessel moves through the water, it encounters resistance: 1st. The resistance of the midship section, which is influenced by the form of the bow lines, it being a well known fact that a wedge-shaped body is more easily forced through the water than a blunt ended one with the same immersed cross section. 2nd. The skin resistance, which depends upon the amount of immersed surface of the vessel. Both forms of resistance are also dependent upon the speed of the vessel, the resistance offered by the water to the vessel's passage varying about as the square of the velocity. It will be seen, then, that however the vessel is forced through the water, whether by power applied at the bow, such as the action of a tow rope, or by the motions of a wheel connected with itself, there is a definite amount of resistance to be overcome, to produce any given speed. If the vessel is

being towed by a tug, the motive power must overcome the resistance of the tug, in addition to that of the vessel; so that, if the engine and propeller were removed from the tug to the vessel, the resistance to be overcome would be lessened by the amount offered by the tug. It does not follow, however, that the vessel would go faster than before, or even as fast, under these new conditions. The propeller works in a yielding medium, and does not utilize all the power imparted to it by the engines. Part of the power goes to propel the vessel, and part is expended on slip, which produces no useful effect. It is well known that the propeller must be adapted to a vessel; and it might happen that, in changing the machinery from the tug to the sailing vessel, we should give the latter a propeller that was not suitable; so that the slip of the wheel would be increased, and she would not go as fast as before, with the same expenditure of power. In general, the propeller would not be adapted to its new position, for there is ordinarily a great difference in the hulls of steamers and sailing vessels. Tug boats, as usually constructed, have another advantage over sailing vessels, in their capacity for utilizing the power imparted to their wheels. Our readers have doubtless noticed that the stern of a tug is constructed to overhang the immersed hull. The effect of this projection is to partially confine the water thrown up by the propeller in its revolution, thus creating a more solid medium for the action of the screw. The under part of the overhanging portion is also made in the form of an inclined plane, and the effect of the concussion of the water thrown up is to force the tug ahead. If the propeller were transferred to the sailing vessel, and given the same immersion as before, the loss of this overhanging portion would be perceived at once by the increased slip. We conclude, then, that, under the ordinary circumstances which occur in practice, the effect of changing the motive power and propeller to the sailing vessel would be to decrease the speed. It may be interesting to consider whether there are any conditions under which this transfer could be made to advantage.

Suppose the tug were secured behind the sailing vessel so as to form virtually an addition to the length of the latter: it is evident that it would propel the vessel quite as well as if it were in advance, and employed a tow rope. Now conceive the stem of the vessel to be cut down, so as to be exactly similar to the stem of the tug, and a transfer of machinery to be made. Then it is reasonable to assume that the propeller would be as effective as before, and that the vessel would now go somewhat faster, since the resistance to the motion of the tug would no longer be encountered.

We do not think that this matter has ever been investigated by actual experiment. We have endeavored to lay down clearly the principles governing the case so as to point to reasonable conclusions. As our readers know, however, stubborn facts have often overturned many finely constructed theories, which were defective on account of not noting all the data; and we do not claim to give an infallible opinion. The question under discussion has been often propounded, eliciting a variety of answers; and we have thought it well to treat the matter somewhat at length on account of the many interesting points involved in its consideration.

LIGHTNING RODS.

Perhaps one of the most fruitful sources of mischief is found in the practical application of imperfectly understood or incorrectly interpreted scientific theories. Inventors are not unfrequently misled by what they take to be scientific truths, because their understanding of them squares with some favorite idea. Take an illustration. Notwithstanding the reiterated statement, in the *SCIENTIFIC AMERICAN* and other exponents of practical science, that it is impossible to utilize water as a fuel, because it takes as much heat to decompose it into oxygen and hydrogen as one can get from the recombination of these gases, men continue to waste their time in inventing apparatus to accomplish it. In other cases again, a misunderstanding of the principles involved may cause not only the waste of time and energy, but the destruction of life and property. The construction of lightning rods is a case in point. If the reader of the literature on the subject happens to find the experiments of Professor Henry and others, he will note their conclusion that electricity of high tension passes along the surface of bodies and not through their substance, and this will suggest to him to increase the surface of his lightning rods at the expense of their solidity, by making them hollow tubes of greater diameter. Or, perhaps, he will recollect that in all electrical measurements of conductivity, as for example in testing submarine cables or telegraph wires, the conducting power is in proportion to the thickness of the wire, and he will find it difficult to reconcile the two principles. The difference in the nature of the two kinds of electricity, however, will easily explain it. By means of an electrical machine we obtain a very small quantity of electricity at a time, but it is under great pressure; the moment it is delivered therefore, its self repellent nature causes it to fly off towards the surface of any conductor. This was the kind of electricity experimented upon by Professor Henry. On the other hand we have means for developing large quantities of electricity having very little tension or pressure, which will consequently flow quietly through a wire in a mass sufficiently great to permeate its whole substance. Professor Morton very aptly compares the former kind to the water in a hydraulic press; it is under enormous pressure, but extremely little is delivered at every stroke of the pump. The latter kind, on the other hand, would resemble a large mass of water, such as a river or a canal, slowly flowing along with so little "head" as to be incapable of breaking down the slightest obstacle or projection of its banks. Now of which

kind is the electricity of a thunder cloud? Manifestly of both; it is there under high pressure, and at the same time a cloud, say a square mile in area, would contain a vast quantity. It follows from this that, although considerable surface is an advantage, it should not be obtained by a sacrifice of solidity.

In 1823, Gay Lussac presented a report to the French Academy of Sciences, in which the most advantageous manner of constructing lightning rods is described in detail. It is from this source, and from a subsequent report by Pouillet in 1854, that the text books on the subject have chiefly drawn their information. The following are the principal points of interest there stated and subsequently developed by experience:

The object being to make so good a passage for the lightning to the ground as to remove all danger of its leaping to some conductor in the house, the end of the rod should be sunk deep enough to reach moist soil. The greatest care must be taken not to have any break in the conductivity. As it is inconvenient to manufacture or transport the rods in one piece, the different parts must be in intimate connection when they are put up; it is best to have them soldered and the joints protected from the air and moisture.

If moist soil cannot be struck, the end of the rod should branch out in various directions to insure a speedy dissemination of the electricity in the ground. The material most generally used in constructing the rods is iron, but the point is best made of copper. Platina was at first recommended, because it is unaltered by the action of the atmosphere; but copper is so much better a conductor of electricity that it is now preferred. Whenever a thunderbolt struck a platina joint, it almost invariably melted it, while copper would mostly conduct the electricity so fast as to prevent melting. Its greater cheapness is, of course, another and not inconsiderable advantage. Sir W. Snow Harris, F. R. S., states that a copper rod of one inch in diameter, or an equal quantity of copper under any other form, will resist the effect of any discharge of lightning hitherto experienced. The reason for terminating lightning rods in a point is as follows: When a thunder cloud highly charged with positive electricity comes up, it repels the positive electricity of all bodies on the surface of the earth coming within its influence, and causes negative electricity to accumulate in them. This is called induction, and it always takes place before a discharge. Now, it has been discovered that, when electricity is accumulated in a body in this manner, it can most readily escape by sharp points because in them it meets with the least resistance. A lighted candle held near the prime conductor of an electrical machine furnished with a point will be nearly blown out by the current of air produced by the escape of the electricity. Lightning rods are therefore provided with sharp points to allow the accumulated negative fluid to pass off readily into the air and neutralize the positive fluid of the thunder cloud.

It was supposed by Charles and Gay Lussac that a lightning rod protected an area whose radius was double the height of the rod extending above the building, but this rule is no longer reliable by reason of the extensive use of metals in the shape of pipes, etc., in the construction of the buildings of our day. When electricity finds several paths to the ground, it will prefer the best, it is true; but some portion will also pass along the poorer conductors. If, therefore, any metallic substances lie within the area supposed to be protected, they are in danger of being struck. This is especially true where the lightning has a chance to jump to the gas and water pipes of a building. It is a good plan to connect these pipes with the lightning rod; if the rod is struck, the electricity will then have an excellent path into the ground and will be rapidly diffused over the vast underground network of pipes. The danger to the inmates of the house of being struck from these pipes is less than that of receiving a shock from the powerful induced currents, liable to be developed in them, if unconnected, during a thunderstorm.

Houses constructed entirely of iron manifestly stand in no need of lightning rods at all, because the electric fluid, on striking so good a conductor, would rapidly diffuse itself in all directions and flow into the ground, provided, of course, that the construction of the building is such as to allow its free escape. If on the contrary any obstacles oppose the free passage of the electricity into the ground, such buildings become highly dangerous and utterly unsafe, for the storage of inflammable material, from the tendency of the lightning to leap across the interior of the rooms. Whenever, therefore, the iron portion of the building does not extend clear down into the ground, prudence would command the establishment of a sufficient ground connection on every side by means of metallic rods.

People are apt to be indifferent whether their houses and stores are provided with lightning rods or not, and are always ready to give an example where some building so provided was struck in spite of its protection. Such cases have undoubtedly occurred, and they are often quoted by the old fashioned "practical men" with much satisfaction, because they hail in them what they are pleased to call the victory of their sound common sense and the discomfiture of the scientific man. This class is, however, rapidly diminishing in numbers under the influence of the extensive diffusion of scientific education among the people by popular lectures and by the press. It may be well to assure unbelievers that the efficacy of the lightning rod is no longer an open question, and that any failures are attributable to bungling or ignorant construction. It would be an easy matter to multiply statistics in proof of the assertion; but none would carry with them more force than the following statement obtained from the records of the British navy:

Formerly the annual damage to ships by lightning involved an expense of \$30,000 to \$50,000. Between 1810 and 1825, no less than thirty-five sail of the line and thirty-five frigates and smaller vessels were completely disabled; and in 200 cases recorded, 300 seamen were either killed or injured. When the lightning rod was introduced, every mast was furnished with a capacious conductor permanently fixed and connected with bands of copper passing through the sides of the ship under the deck beams, and with large bolts leading through the keel and keelson, and including, by other connections, all the principal metallic masses employed in the construction of the hull (Harris). Since the adoption of this arrangement, "it appears that damage by lightning has positively vanished from the records of the navy." In one case, while the small frigate Conway was under refit in the harbor of Port Louis, the topgallant masts were down on the deck, and a small spar, not having a conductor, was substituted for the time to support the pennant. A thunderstorm came up and the spar was shivered to atoms. No further damage was done, however; for the conductor on the topmast below the spar immediately carried off the terrible flash. No further examples are needed to prove that a lightning rod, constructed according to the principles set forth, is a protector to life and property.

RECENT METEORIC INVESTIGATIONS.

On the tenth of the present month, the earth passed through the first of the two great rivers of meteors which intersect its orbit; and on November 13 or 14 it will encounter another shower of shooting stars, of equal magnitude. The band recently traversed, known in ancient times as the Tears of St. Lawrence, is about 10,948,000 miles in its greatest diameter, and 4,043,350 miles wide at the point of the earth's crossing.

Probably the most recent investigations into the nature of the erratic masses which constitute these vast belts are those made by Father Ferrari and others in the fall of last year, recently published in *Les Mondes*. They are based principally upon the observation of a remarkably brilliant aerolite, which fell near Orvinio, in Italy, during the latter part of August, 1872. The course of the body was from the southward and eastward, it appearing at first quite small and emitting a reddish light which gradually increased in brilliancy, leaving behind a misty train. Suddenly the bolide flamed up apparently as large as the moon, and then instantly disappeared, a long cloud, of serpentine form, remaining in its place. About three minutes after, a violent explosion was heard, followed by two others of less intensity. From the point of first observation to that of its disappearance, the meteor traveled over a trajectory of 62 miles, and its altitude at the beginning was measured at 30°, corresponding to an elevation of about 114 miles. The first detonation took place at a height of 10.2 miles, and the final bursting into small fragments at a few hundred feet above the earth. The velocity of the mass was calculated at 32.2 miles per second.

In order to determine the amount of heat developed by the aerolite after entering our atmosphere, Schiapparelli's investigations were employed. That astronomer has demonstrated that, if a meteor enters the limits of the earth's atmosphere at a minimum velocity of 9.6 miles per second, when it has arrived at a point where the atmospheric pressure is at .36 inch, it will have already lost $\frac{1}{4}$ of its velocity, and $\frac{1}{11}$ of its *vis viva*. It is evident, therefore, that so great a proportion of lost motion must be converted into enormous heat. Applying suitable formulae to the case in point and assuming the specific heat of the body to be .22 of 1° centigrade, which is not far from the truth, it has been found that the augmentation of temperature, after plunging into the earth's atmosphere, would be 3,468,107.8° Fahrenheit, a degree far more than sufficient to explain the phenomena of light and heat, as well as of the explosion or total dispersion of immense masses.

A number of fragments of the meteorite above referred to, quite small in every instance, were picked up and subjected to careful examination. The mass was crystalline, and formed of various substances. An angle was polished with difficulty, owing to the extreme hardness. An abundance of malleable granules of nickeliferous iron were recognized. The interior of the fragments appeared porous, but outside they were covered with a pellicle of vitrified matter. Beyond the iron above mentioned, the greater part of the mass contained soluble silicates, principally those of magnesium and of iron. From the fact that it has been noted that the meteors of the August and November showers, traveling at the rate of from 36 to 40 miles per second, find an insurmountable obstacle in the atmosphere, Schiapparelli has pointed out that only bodies of an enormous magnitude would be able to penetrate it and reach the surface of the earth in a fragmentary condition. Ferrari observes that, from this, it may be considered that the meteor he describes, having a velocity nearly equal to the above, must have been of tremendous size, and he notes, as a remarkable fact, that an unusual number of these bodies, ten in all, fell in Europe between July and September of last year.

The author states the result of his observations to accord with the following conclusions previously enunciated by Schiapparelli: 1. The intimate correlation between the comets, shooting stars, and meteorites is now placed beyond doubt, and the immense velocity observed in some meteorites renders it impossible to ascribe to them a planetary origin; consequently the hypothesis of stellar origin is the most probable. 2. From this supposition, the masses come from no single body, since diverse cases demonstrate the fact that they arrive from totally different regions in stellar

space. 3. The hypothesis admitted, it must follow that the chemical and molecular structure of the bodies of the universe, situated in different positions, must be of similar nature to that of the meteorites themselves.

The below given views regarding the mineralogical structure and composition of aerolites are ascribed to Danbrée, and are the results of examination both by spectral and chemical analysis: 1. Hundreds of analyses by the most eminent chemists prove that meteorites contain no simple body unknown to our globe. 2. There have been recognized with certainty twenty-two elements, given below in the descending order of their importance: Iron, magnesium, silicon, oxygen, nickel, cobalt, chromium, manganese, titanium, tin, copper, aluminum, potassium, sodium, calcium, arsenic, phosphorus, nitrogen, sulphur, chlorine, carbon, and hydrogen. It is a very curious fact that the three bodies which predominate in nearly every meteorite, iron, silicon, and oxygen, are also those which predominate in the earth. 3. Meteorites have also many peculiar mineral compounds, principally native nickeliferous iron, sulphide of iron and of nickel (schreibersite) and sulphide of iron (troilite). There are also common to the meteorites of the earth a great number of combinations, similar not only in chemical composition but even in crystalline form. 4. Meteorites indicate in a measure the temperature at their formation, and that by which they are caused to disintegrate. 5. Lastly, these bodies demonstrate the existence of innumerable masses disseminated through the remotest regions of space, which would be completely unknown were it not for their sudden and splendid apparitions.

LEAD POISONING AND ITS TREATMENT.

Cases of lead poisoning are becoming more frequent now than formerly because there are more persons engaged in manufacturing this metal, who are, more or less, surrounded and enveloped by a lead-poisoned atmosphere. In a metallic state lead enters into alloys; its salts are used in paints and dyes; it is a constituent of enamels and cements. Lead pipes conduct our drinking water; and the purer the water that flows through it, the more danger there is; while, if the water contain certain salts, they are deposited on the sides of the pipe and protect the water from the metal. Zinc vessels contain lead, and while in some countries the law limits the quantity of lead to ten per cent, even six per cent is fraught with danger to health. Horse hair and silk are dyed black with lead; the laces worn by ladies, as well as their cosmetics and hair dyes, contain lead. No doubt many cases of colic, whose origin seems shrouded in mystery, were caused by lead in the solder of metallic vessels or the glazing of stone ones. The foil used in wrapping tea and tobacco causes lead poisoning, and so do the granules of lead that are sometimes left in tin cans and jars. An old soldier has been known to suffer severely from using leaden shot; and the workmen in glass houses where lead salts are used are similarly troubled. Even type setters are occasionally poisoned by handling type made of an alloy of lead. Many other ways may be mentioned in which lead is introduced into the human system, but these must suffice for the present.

Whatever may be the cause of lead poisoning, it is certain that it is generally observed in summer when the heat favors the colic. Lead may be taken up by the digestive and the respiratory organs and through the skin, principally by the former, even in the case of insoluble salts, which probably dissolve in the gastric juices. Indeed some writers claim that cases produced by lung absorption are caused by salts deposited in the pharynx. The most striking symptom of lead poisoning is the peculiar color of the gums, and this is not due, as has been supposed, to the deposit of little particles of lead which are then acted upon by sulphureted hydrogen. It is rather one symptom of the general phenomenon, for it appears whether lead is taken inwardly or lead water is used on distant parts of the body.

Lead colic is usually preceded by indigestion. The size of the liver diminishes; and after the use of powerful cathartics, it becomes normal, and then contracts again. The nervous symptoms caused by lead poisoning are of several kinds, such as paralysis of the muscles, sleepiness, convulsions, blindness, and pain in the back bone; while on the other hand, insensibility and deafness may result. The skin on the back of the hands swells up as in gout. Albumen in urine is a most common occurrence, but the most striking symptom is *anæmia*, or lack of blood. Distention of the veins is frequently observed, and ulceration of the bones is not an infrequent consequence of lead poisoning.

While lead has so many ways of entering the system, there are very few ways for it to pass off. Little or no lead is secreted in the urine, except when it contains albumen, and there is very little lead in the perspiration. It seems that the metal is deposited where it is absorbed. When soluble lead salts are taken, an albuminate of the metal is formed; while insoluble salts, as before stated, settle upon the walls of the organs and are protected from absorption into the system. This explains the fact that lead workmen are sometimes attacked with colic long after they have abandoned their dangerous calling, the accumulated lead being very gradually dissolved and absorbed.

When lead produces indigestion, it is due to the lead's stopping the action of the digestive fluid. When digestion ceases, colic begins, which is the result of the local action of the lead upon the intestines, for it does not occur when absorption takes place in another way. The change of size in the liver is dependent upon changes in the vascular system. Just as far as this whole system comes under the influence of the poison, *anæmia* takes place, with chill, loss of elasticity in the arteries, and diminished capillary circu-

lation. Pallor of the skin, contraction of the liver, and diminished quantity of urine are all referable to these causes. The asthma with lead poisoning is characterized by pain in the breast bone and difficulty of breathing, which, however, is not because the entrance of the air is obstructed, but because the blood does not come in contact with the air. Paralysis is one of the effects of a disturbance in the blood vessels.

In the treatment of lead patients, the pain must be relieved by the use of chloroform or chloral; opiates are to be avoided, as they produce constipation. The lead salts must be expelled from the digestive canal, and the constipation relieved; both these are best accomplished by drastic purgatives. The incrustated particles of lead, which remain attached to the walls of the intestines, must also be removed; and for this purpose, the use of sulphur is recommended, after purging, so as to convert the lead into the insoluble sulphide of lead, which can then be removed by cathartics. Insoluble lead salts, which still remain in the system, are best removed by administering iodide of potassium, which carries off the lead through the urine. Lead workers whose skin absorbs the poison should protect themselves by the use of salt baths. In France, Labarraque's solution (hypochlorite of potash) is used for this purpose; and to this should be added an excess of carbonate of soda. These baths are more useful than mere soap baths; and the bather, while in the water, must rub himself thoroughly. Instead of Labarraque's solution the following may be employed: 15 ounces chloride of lime, and 30 ounces crystallized carbonate of soda, dissolved in 10½ quarts of water.

The Permeability of Cast and Rolled Iron to Gases.

Both these kinds of iron are permeable to hydrogen and carbonic oxide gases. This is an important scientific fact, and the mode of penetration is a beautiful example of what the late Professor Graham named "occlusion," the mass absorbing the gas at one surface, transmitting it to the particles of the interior, and finally allowing it to escape into another gas, in contact with the other surface. This action differs from that of filtration essentially, and it takes place at a very high temperature only, when wrought iron is softened, cast iron changed in crystalline structure, and meteorolites are heated nearly to the point of fusion.

In all these cases, the iron mass retains several times its volume of hydrogen, carburetted hydrogen or carbonic oxide.

While, on one hand, this action corresponds to that where blister steel is formed, on the other it closely resembles the so-called alloying of palladium with hydrogen, the gas assuming a new physical condition.

The writer has learned that this interesting fact has been misunderstood so far as to lead to the belief that cast iron is porous when heated, and allows these gases to pass through castings; and in case of furnaces in use for heating dwellings, the hydrogen compounds and carbonic oxide, produced in imperfect combustion, pass through the iron and enter the air chamber, flowing with the heated air into apartments.

Such conclusions are wholly destitute of proof, as this action takes place, in carefully conducted experiments, only at very high temperatures, and involves molecular changes in the iron. It would now be novel and disheartening to learn that cast iron gas retorts, heated red hot for months and constantly containing carbonic oxide and hydrogen compounds, allowed the gas to pass through the metal even under pressure. Those who have had chemical experience with cast iron vessels highly heated, holding these gases, will not believe that iron has of late gained new properties. Those who use cast iron furnaces for warming may sleep quietly, if they are assured that all joints are tight.

A. A. H.

ELECTRO-DEPOSITION OF ALUMINUM.—John A. Jeancon, Newport, Kentucky, is the author of the following process: Dissolve the desired salt of aluminum or a double salt of aluminum and potassium, sodium, etc., in distilled water, and concentrate to 20° Baume, (at 50° Fahrenheit.) The battery used is either four pairs of Smee's zinc-platinum or three Bunsen's zinc-carbon, the elements connected for intensity. The solution is heated to 140° Fahrenheit, slightly acidulated, and a plate of aluminum is attached to the negative wire in working.

At Mont Clair, N. J., recently, the rods on a dwelling house were struck by lightning and the fluid passed off into the ground, thence upon a gas pipe near the terminal of the rod, to an air gas carbonizer, located a short distance from the house. The gas apparatus was blown up, but no other damage was done.

OPERATIONS OF THE CANADIAN PATENT OFFICE.—From the 12th of February to the 8th of April, 1873, almost two months, one hundred and sixty-four patents were granted in Canada, of which eighty-five were issued to citizens of the United States.

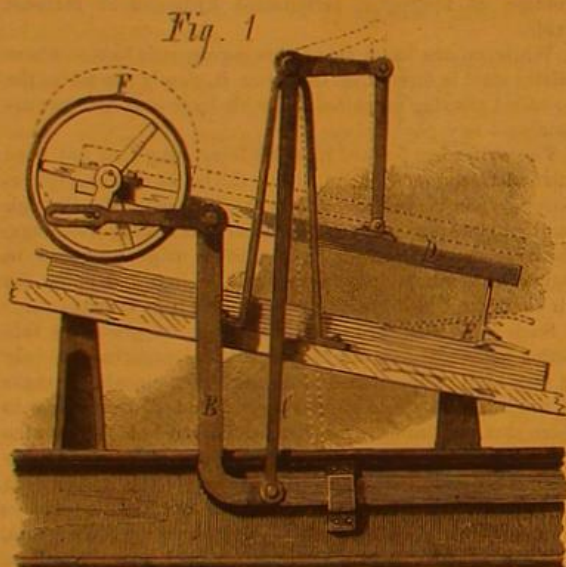
DR. TOBIAS' VENETIAN HORSE LINIMENT.—According to the analysis of Schœdler, published in the *Berlin Industrie Blätter*, a bottle of this celebrated liniment contains 1 ounce ammonia, half an ounce camphor, 1 ounce tincture of Spanish pepper, 7 ounces alcohol, 2 ounces water.

At the close of 1872, there were in operation in the United States 67,104 miles of railroads, operated by 436 different companies. Average cost per mile, \$55,116. Average dividends, 3.91 per cent.

PAPER FEEDING MACHINE.

Our engraving illustrates the essential features of a novel mode of feeding paper to printing presses, recently patented by Messrs. C. E. Baker and S. Schofield. The form of machine depicted is of course not intended to represent the completed device, but simply to show sufficient mechanism to elucidate the novelty and value of the idea. The latter can best be understood by first referring to the small figures, 2, 3, and 4. In Fig. 2, A is a pressing pin or point made blunt at its forward extremity and flat beneath. This, by suitable mechanism, is brought down upon the top sheet of a pile of paper. If now this upper leaf be drawn along from right to left, it is evident that the blunt point of the pin will catch in the paper, as in Fig. 3, and that its motion, continuing the latter, will travel up the pin into the position Fig. 4. Furthermore, only a single sheet will be thus caught: for as the pin penetrates the first leaf, it forces out a small chip, which remains under the flat part of the instrument, effectually preventing it from entering the paper below. The pin then rests with its full holding power on the second sheet; and as the first sheet is drawn along as above described, the friction between the two is insufficient to move the former from under the point. The reader can practically demonstrate this for himself by pressing the flat side of a bevel-pointed piece of wire down upon a few sheets of paper, and then drawing the upper sheet back against the point by the friction of his finger or a piece of India rubber.

From Fig. 1 will be understood a combination of devices for operating the inclined pin and friction pad with each other, so as to raise the sheet from the pile in order to properly present it to the carrying grippers of the press. Motion is imparted to the elbow rod, B, which is carried to the left. The effect of this is first through the upright, C, right angled arm and connecting bar, shown to push down the frame, D, and consequently to press the point at E firmly upon the paper; then, when near the end of its motion, by means of the slotted arm acting on the crank, to rotate the rubber covered roller, F. The revolution of the latter for a very short distance draws, by friction, the upper sheet from right to left, causing it to catch upon the pin in the manner above described. The rod, B, then moves to the right and through the upright, C, raises the entire frame, roller, and all, clear of the paper, so that the relative position of the parts is indicated by the dotted outlines. The pin, it will be noticed,



carries the top sheet up with it. At this juncture the grippers come up, seize the projecting edge of the paper, and, drawing the sheet from the pin, carry it down the incline to the press.

There is other mechanism for keeping the pile of paper at a uniform height, as it is depleted, and also a new method for insuring accurate register, claimed to be perfect, which need not be entered into here. The principal feature is the holding by the pin, which makes a tear in the sheet no greater than that now caused by pointing, which it of course avoids. The puncture can be readily arranged to come in the fold of the sheet or near the edge to be trimmed off in the binding. The device is automatic in its action, and can be so fitted to a press as to require no attention, stopping of its own accord in case of accident or in event of the supply of paper becoming exhausted. The simplicity of the mechanism and its ready adaptability to all requirements enable the machine to be offered at a very moderate price.

Mr. Charles E. Baker, office of the Independent newspaper, New York city, will be happy to exhibit his apparatus to publishers interested in paper-feeding machinery.

PROGRESS OF STEAM CULTIVATION.

Mr. Max Eyth, of Messrs. Fowler & Co., of Leeds, England, in a paper recently read before the Council of the Society of Austrian Engineers and Architects, made the following interesting remarks regarding steam cultivation:

The great difficulty in steam plowing is the moving about of engines under all circumstances and conditions. Some twenty years ago, the idea of employing the portable engine, in connection with what is known as the roundabout tackle, was suggested; but although to a degree successful,

the plan proved to be, practically, a mistake. It has lately found some encouragement by the introduction of self-moving anchors, but it is not able to compete with the now more perfect, though at first sight more expensive, systems. The introduction of Fowler's double English tackle, the first of which was constructed in 1863, made steam plowing that which it is today. The advantages of the system are simplicity of plan of working, minimum of hands employed, direct pull of the rope, shortest possible length of the latter, facility of shifting, etc. Steam plowing should not be measured by its cost but by its results, as deep cultivation by steam has a beneficial influence on crops by draining the soil in wet, and by keeping it moist in dry, seasons, by avoiding the footsteps of animals in fields, and by doing the work at the proper time. In hot countries it is in use, especially the West Indies and Egypt, and also in South America and the far East, where steam cultivation is being introduced on a constantly increasing scale, while Germany and Austria have, in the course of the last three years, started in the same direction. Not less than 56 double engine tackles are at present at work in the two latter countries, and the results are so strikingly favorable that the new idea appears to be now firmly established, especially in the best growing districts of Central Europe.

IMPROVED FISHING ROD.

A common defect in fishing rods is the liability of the connecting portions to become worn by use, so as to be insecure and loosely fitting. This difficulty it is aimed to overcome in the invention represented in our illustration through the medium of the notched metallic cylinder, A, formed upon the smaller ferrule, B, which, when the rod is joined together, as shown in Fig. 3, fits into the ferrule, C. Around the exterior circumference of the latter is a collet, D, Fig. 4, through which pass three set screws, as shown, which, when turned inwards, lock into the grooves of the notched cylinder. By this means, it is claimed, the separation of the parts of the rod and the annoyance resulting therefrom, while following the sport, are effectively prevented. Instead of the cylindrical grooved extension, a plain conical piece, E, Fig. 2, may be used, which serves the same purpose, and may be made of the same size at all the ferrules of the rod.

The locking screw heads may be formed of any ornamental pattern. A guide ring is attached to the collet, to serve for passing the line to the reel. Fig. 1 represents the rod put together, showing that these improvements occupy but little space, while rather adding to its neat and attractive appearance.

The device has the merit of simplicity, and it may be arranged in connection with any ordinary fishing rod, and may also be applied to jointed poles for all purposes for which such articles are required.

Patented through the Scientific American Patent Agency, July 8, 1873, by William M. Smith. For further particulars address Messrs. Smith & Ermentrout, 318 Penn street, Reading, Pa.

Novel Mode of Locating Obstructions in Pneumatic Tubes.

In London, as in Paris, the telegraphic executive make use, to a large extent, of pneumatic tubes for the transmission of messages, which, packed in suitable cases, are driven through the tubes under pressure; and it not unfrequently happens that one of these cases becomes arrested in its course, causing an obstruction, the locality of which it is very difficult to ascertain.

M. Bontemps, director of pneumatic telegraphs in Paris, has, says *Engineering*, recently devised the following ingenious

method of ascertaining with considerable precision the locality of the block:

At the free extremity of the tube an elastic membrane is placed, and its alternate distensions are registered on a revolving cylinder by means of electricity. A wave is produced in the tube by detonation of a pistol placed near the membrane. This wave travels through the tube at a speed of 333 meters (1,000 feet) per second, and strikes against the obstacle; there it is reflected back, passes through the tube in a contrary direction, and inflates the membrane; this places the first mark on the revolving cylinder. The sound wave sent back by the membrane against the obstacle is reflected a second time, and a second mark is obtained on the cylinder. To determine the distance between the membrane and the obstacle, it will only be necessary to know the interval of time that has elapsed between registering the two marks on the cylinder. The half of this interval (reckoned in seconds) multiplied by 333, gives the distance required. The time is calculated by an ordinary chronograph, with three tracing points worked by a magnetic needle.

The first is placed in the circuit, which is closed by the alternate distensions of the membrane.

The second answers to an electric governor, and marks the seconds on the cylinder.

The third divides the second into periods of equal duration to the second, by means of the pulsation of an electric needle.

These vibrations are not absolutely isochronous, but are sufficiently so for the object in question; or if it were thought necessary to have the isochronism perfect, the vibration of a diapason could be used. The following example illustrates the operation of the instrument: An obstacle is placed in a line at a known distance, say, of 186 feet. The needle oscillates 33 times per second, the interval included between the two marks determined by the pistol shot corresponds to 120 oscillations, and the distance of the obstacle will be

$$D = \frac{1}{33} \times 330 \times \frac{12}{83} = 60 \text{ meters (180 feet).}$$

The approximation obtained is thus 6 feet. But in practice this method gives approximation of 9 feet, and consequently only one opening in the pipe is required.

"THE PEOPLE'S" STEAM WASHER.

The principal advantage of the invention herewith illustrated consists in its ready adaptability to any ordinary cooking stove wash boiler, without regard to size or shape, so that the owner of one of the latter vessels need only procure an attachment thereto instead of incurring the expense of an entirely new apparatus.

The device consists in an inner receptacle, A, which fits tightly at its upper edge, and is thus sustained within the usual form of wash boiler represented. Its sides incline inwards toward the bottom, leaving an intermediate chamber between the two vessels, and are perforated with a number of holes. At the bottom is an aperture covered with a shield, B, to prevent its becoming clogged by the clothes; beneath



is a ball held in wires or similar contrivances by which its movement is limited. It will be noticed that the inner vessel, A, fits into the boiler steam tight, and that it may be readily lifted in or out, for cleansing or other purposes, by the handles, one of which is shown at C.

In operation, the clothes are folded and packed into the inner receptacle, which is then lifted by its handles into the boiler, a sufficient quantity of soap and water being previously placed in the bottom of the latter. On being set upon the range, the steam fills the intermediate chamber, being unable to escape through the orifice at the bottom and so enter the vessel, A, from the ball rising and closing the opening. The steam is therefore compelled to pass through the holes in the sides of the last mentioned receptacle, and thus reach and force its way through the clothes. When condensed, it passes down through the hole in the bottom of the washer, into the outer boiler, thus causing a constant circulation of steam and heated water, which, it is stated, speedily effects the cleansing of the garments.

Although this invention is based on the same principle as many that have heretofore been illustrated in our columns, it differs in construction from previous devices in the detachability of the inner washer, which can thus be purchased separately. The apparatus is therefore cheaper at the outset, and, besides, presents facilities for cleaning and repair which similar appliances made in parts inseparably connected necessarily do not possess.

Patented in Canada, May 5, 1873. Application pending in the United States. For further particulars address J. B. Davidson & Co. Halifax, Nova Scotia.

AIR PUMP FOR RAISING SEWAGE.

Mr. Ernst Hahn, engineer, of Stuttgart, exhibits at Vienna, says *Engineering*, a transportable air pump for the emptying of the open cesspools which are still in use in many of the continental towns. This sewage pump, of which we give illustrations herewith, is one of those adopted by the authorities of the city of Stuttgart; the *modus operandi* consists in pumping, by means of this machine, the air out of the wooden tubs or vessels in which the sewage has to be removed from the different houses; and, the tubs being brought into connection with the open cesspool by a flexible pipe provided with a screw valve, the sewage is forced into the tubs. The machine, as will be seen from the illustrations, is mounted on a wooden platform carried on two pairs of wheels and mounted on springs, and is arranged for being worked by manual power. In our engravings, E is the air pump, A is the safety vessel for preventing any liquid from entering the air pump, and B is a small furnace through which the air and gases, exhausted by the air pump, are passed before escaping into the atmosphere. The air pump, E, which works without dead space, is connected with the safety vessel, A, by means of the pipe, C, while the vessel, A, which, as we said, prevents the fluid sewage from passing from the tubs into the air pump, is provided at the top with a flange to which is fastened the suction pipe for the tubs. The air-discharging pipe, D, is connected to the furnace, B, as shown.

With the apparatus we have described, a vessel of 432 gallons can be filled, as stated by the manufacturer, within five minutes by two men. The machine, with carriage complete, weighs about 12 cwt.

Photography at Vienna.

A correspondent of the *British Journal of Photography* awards to Kurtz of New York the merit of presenting the best specimens of portraiture that are to be found in the exhibition. He, however, finds fault with the practice of retouching the negatives, which he thinks is badly done by the Americans, and is seen in nearly all of their exhibited pictures. The prints of the magnificent series of the Yellowstone region and California are in some cases marred by the stopping out of the sky in the negative; in other examples, an imitation of cloud effects in the sky by painting on the negative has been attempted, with poor success.

On the whole, thinks this critic, the American exhibits, both in portraiture and landscape, evince a lack of fine artistic feeling.

(From *Engineering*.)

Reaping Trials at Vienna.

The great expectations originally created by the liberal programme, prepared by the Committee of the Agricultural Department at the Vienna Exhibition, have been doomed to disappointment. The determination at which the English makers had arrived, to decline entering into competition, entirely ended all chances of any valuable trials, and the only part of the programme which has been even partially carried out are the reaping and mowing trials at Siebenbrunn, which took place on Wednesday, the 9th of July. Of course, English implements were entirely absent; and with the exception of a few German "improved" copies, the reapers and mowers on the ground were American. Altogether there were eighteen reapers ready for competition, single and combined, and sixteen mowing machines, including nine of the combined implements, were tried. The site selected was upon the estate of a local proprietor, Herr Schwartz, at Siebenbrunn, about 20 miles from Vienna; and the ground, which was good and almost level throughout, improved from the stations occupied by No. 1 machine to the lots numbered 15 to 18, that lay on the opposite side of a small stream which divided the ground. Everything was so consistently favorable that the operations scarcely constituted a trial at all; the weather was dry and hot, the crop allotted to the reapers was a thick growth of rye, every stalk of which was set bolt upright in the field, while the mowers operated upon a mixture of peas, grass, green oats, etc., which might have sprung from an autumn sweeping of a barn floor, and, though close lying, was soft and moist in the stalk. An acre and four tenths of each crop was allotted to the reapers and mowers, the lots being of course divided by clearings made for the implements to take their first cut.

As we have said, eighteen reapers were entered for the trial, but only seventeen competed, the missing one being the chain rake reaper, manufactured by Walter A. Wood, of Hoosick Falls, New York. Of the German implements, one was an "improved" Samuelson, by Messrs. Hopherr & Co., of Vienna, and two by Messrs. Siedersleben & Co., of Bernberg, Anhalt; one of these machines was also an improved Samuelson, and the other, in which were combined selec-

tions from details of the leading English makers, broke down from some cause or another.

The American manufacturers were admirably represented and their presence at Vienna in such force shows how successfully they compete with English makers, especially in the corn-growing districts of east Europe.

One of the striking features of the American implements is the Johnston rake, of which many different varieties are used, the leading principle of course being the same in all, namely, the means of controlling the action of the rakes, and causing them in each revolution to follow the platform

was sold on the ground to Prince Schwartzburg. Wood's New Champion, from the makers of the chain rake, also did good work. It is a well designed, well made implement, with four rakes coupled together in pairs, and which can be arranged at will to be thrown out of gear in pairs. The rakes are mounted on a revolving bonnet, which is driven by gearing, and beneath which is a fixed cam, against which the end rollers of the rakes take their bearing and direction. The McCormick implement was on the field, and worked well, but the pattern, so long and so deservedly celebrated, now looks very antique when compared with many of the later patterns.

Of the German competitors but little is to be said. Hopherr's copy of Samuelson's reaper made fair time on the ground, but it was very heavy, and open to the objection, common to the type of implement, that there is no seat for the driver, who must therefore walk—a very wearying operation. Neither do the Siedersleben implements call for any special remark.

The chief points upon which the jury were to decide concerning the merits of the implements were: The time occupied, the length of stubble, and the throwing off of the sheaves. As we have already said, the conditions under which the reapers, and equally the mowers, were tried were such as to make a proper comparison of merit quite impossible, but it was evident, with the exception of the German Samuelson, which being a copy could scarcely be considered in the decision, that the trial, such as it was, was purely American. Of these implements we should, judging from the performance, place that of the Johnston Harvester Company first, the Wood New Champion second, and the Warder, Mitchell, and Company's Champion, and the Buckeye (Adriance, Platt, and Company), third and fourth.

The mowing trial may be dismissed in a few words. There were altogether sixteen competitors, of which seven were simple mowers, and nine combined machines. Of the whole number

there appeared little doubt that Wood's so called combined, but really single, mower did the best work. * * *

Returning for a moment to the trials of Siebenbrunn, we learn from them, incomplete and imperfect as they are, that German manufacturers will have to make great changes before they can compete with the American trade. How far this can compare with English productions, the absence of the latter from the trial prevents us from forming any conclusion.

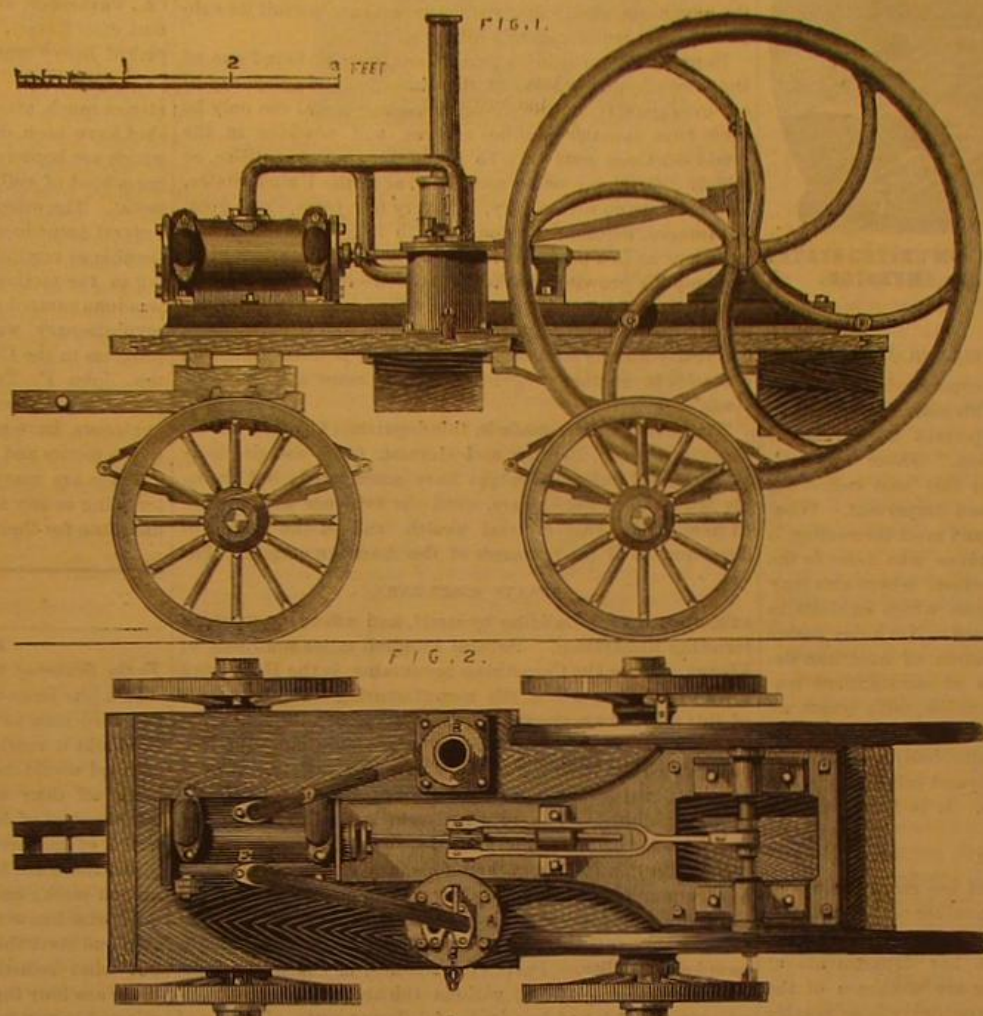
New Experiments with the Electric Current.

MM. P. and A. Thénard communicate to *Les Mondes* the following conclusions derived from recent electrical researches:

1. The vapor of water does not hinder the production of the current, which decomposes it into its constituent gases.
2. The current, while determining the combination of nitrogen and hydrogen, decomposes equally ammoniacal gas; but, in both cases and without absorbent bodies, there is found in the gaseous mixtures a quantity of ammonia quite feeble but sensibly equal.
3. Nitrogen, under the influence of the spark and the vapor of water, disappears to produce an undetermined body which is believed to be nitrite of ammonia.
4. Gaseous phosphoret of hydrogen is similarly incompletely decomposed by the current, and this decomposition is accompanied with phenomena which prove first the formation of liquid phosphorus, then solid phosphorus, and lastly a body supposed to be the same substance in its amorphous state.
5. The current acting on a mixture of gaseous phosphoret of hydrogen and bicarburet of hydrogen reproduces one at least of the phosphoric alkalies.
6. Under its influence, the bicarburet of hydrogen alone condenses rapidly into an odorous liquid, soluble in ether but insoluble in water.
7. On the other hand, the monohydrate of methylene is transformed in presence of water into marsh gas, into pure hydrogen, into a powerful acid soluble in water, and into a resinous body differing from the viscous substance furnished by the bicarburet.

W. S. M. says: "I notice that some of your correspondents mention trouble with pumps which they require to draw water almost farther than is possible. I have succeeded in such cases by letting a very small portion of air in at the bottom of the pipe, which, passing up in bubbles in the water, lessens the gravity of the column of water so that the pump can raise it."

C. H. S. says: "My two line advertisement in the 'Business and Personal' column brought me about one hundred letters."



AIR PUMP FOR RAISING SEWAGE.



THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 2.

VIENNA WELT-AUSSTELLUNG, JUNE, 1873.

Probably every engineer who has come to visit the *Welt-Ausstellung* is greatly disappointed in his search for novelties in mechanism, or for evidences of important improvements in methods and processes of production. There seems almost nothing to be found, throughout this vast collection, which can be considered both new and important. What there is of machinery that is newest and most interesting is said, by the majority, if not all, of those who refer to the subject, to be in the United States section, where also may be found, frequently, the originals from which exhibits in other sections have evidently been copied. Not a day passes without some new example of imitation of American designs, and often of precise *fac similes* of our standard machines, presenting itself. Our own exhibit, with which we have been so greatly dissatisfied on the score of its small extent and its incompleteness, appears decidedly creditable in its marked characteristics of excellence and originality when compared with those of other nations. It is far in advance of them all.

GREAT BRITAIN

covers a larger area, in consequence of her requirements of space for textile machinery, but the number of her exhibits is less than those from the United States. Great Britain gives evidence, always observable in her departments at these exhibitions, that her mechanics are workmen of the very highest class, and that British machinery is as notable for its solidity, strength, and durability, and for excellence of workmanship, as is that from our own country for its originality and its ingenuity.

FRANCE

displays a considerable amount of machinery which, lacking preeminence in those qualities which distinguish the two great English speaking nations, is still excellent and highly creditable. In scientific apparatus, and machinery which must be classed by itself as intermediate in character between the industrial and the purely scientific, the French excel.

Other nations present exhibits which contain some exceedingly creditable examples of good design and workmanship, and which, particularly those of

GERMANY AND AUSTRIA

are of great extent. They are almost invariably, however, very barren of really original designs, and, judging from this display, the observer is very much inclined to conclude that the talent for invention which is the leading characteristic of our mechanics is a very rare attribute among these people.

ITALY

has made a magnificent display in the Industrial Palace, and in the Fine Art gallery, where elegant textile fabrics, beautiful *bijouterie*, splendid paintings, and life like statuary prove that she is still foremost in all that most delights the artistic mind; but in the Machinery Hall she presents no single strikingly meritorious production, and the impression made upon the engineer who looks through the collection is that he is inspecting a museum of antiquities rather than of the newest and best machinery which that country has produced.

SWITZERLAND AND BELGIUM

exhibit some excellent examples of standard machines, neat in design, well built and well finished.

The most beautifully finished work in the whole exposition is probably that sent by the Creusot works, in the south of France. A small compound marine steam engine, of the Napier type, and a locomotive for heavy work, have been constructed of the best of materials, and have been given a finish which is simply magnificent.

Metal products, iron ores, and iron and steel particularly, are exhibited by all those nations which produce for the world—with the exception of the United States—in large quantity and of splendid quality. The steel is usually the product of

THE BESSEMER PROCESS

and the facility with which every grade can be obtained is here illustrated, not only by beautiful specimens of every degree of carbonization, but by a wonderful variety of manufactured articles, in which every quality finds its most appropriate application. The fact that we are rapidly passing from the iron age to the age of steel is here most fully and

convincingly exhibited. In truth, it would seem as though the transition had actually taken place.

The low grades of Bessemer metal, containing in the neighborhood of one half per centum of carbon, are vastly stronger than iron; and this strength, together with its ductility, malleability, and homogeneity, makes it vastly preferable, for almost every use, to any iron. Bessemer metal is already becoming nearly as inexpensive as the better grades of iron, and it cannot be long before the rapid extension of Bessemer manufactures, and the still rapid succession of improvements in the details of the method and of the apparatus, shall so far reduce its cost as to permit its substitution for iron for nearly all uses.

Here, it may be said in parenthesis, may be found one of the most promising signs of the times for the prosperity of our own country. Really good Bessemer metal can only be made from superior qualities of ores, and nowhere in the world can these good ores be found in such quantities, so widely distributed or so accessible, as in the United States. There seems no reason why, in a very few years, these great advantages, together with our wealth in good fuels, should not place us in a position to supply not only our own great and rapidly growing market, but even—improbable as the idea may appear—to export largely to countries which have but limited mineral resources, or which, like Great Britain, are yearly finding both the natural and the politico industrial obstacles to further progress becoming more and more serious.

The noble exhibits made in this department by well known English, French, Belgian, and German firms are precisely what the well informed might have anticipated; but probably few visitors were aware, until the evidence was presented here, of the vast mineral wealth, and of the degree of development of the resources of the Austrian empire. The

STAATS EISENBAHN

exhibit occupies a building by itself, and affords a most interesting illustration. Several hundred miles southeast of Vienna, among the Carpathian mountains, is the Hungarian town of Resicza, where the manufacturing establishments of this railroad are situated. There have been brought from thence and placed on exhibition some of the finest of iron ores, which are to be found there in great variety. A very excellent coal is obtained from a vein of which a large section is exhibited. The principal vein is said to be 294 feet in thickness. Several immense ingots of Bessemer metal, made with this fuel from these ores, are exhibited, and also a large number of samples of every grade, broken to show the character of the material by the appearance of the fracture, or bent or tied into knots to exhibit its immense toughness and ductility. Parts of machines, as shafts and rods, difficult shapes, plates of various thickness, tools and manufactured articles of hundreds of different sorts, all made of steel, illustrate at once its wonderful power of adaptation to all purposes, and exhibit the extent to which the "Staats Eisenbahn Gesellschaft" have developed their Hungarian possessions.

Prince Schwarzenburg, who invited us to visit his immense estate at

WITTINGAU

a few days ago, and who there exhibited to our astonished republicans an illustration of the old feudal system in its most unobjectionable form, has also a *peccillon* of his own which is equally interesting. The most careless observer cannot fail to find the most interesting evidences on all sides of the magnificent, but as yet imperfectly developed, natural resources of this great Austro-Hungarian Empire. When the proprietors of this fertile soil shall have imbibed something of the energy and the enterprise of our venerable host of Horskysfeld, and shall have profited well by the opportunity which is now offered them of introducing the agricultural machinery which our inventors have brought to such perfection, and when these valuable mines shall have been developed, and manufactures shall have become well established here, the world is likely to see a national development which has been, as yet, quite unanticipated by foreigners generally.

There are still other illustrations to be observed here of the splendid future which may be secured to the country should a wise policy, liberalizing its government, wake up and educate its people and develop its natural advantages. The good work seems begun; and, if the management of affairs is allowed to remain in as good hands as those which have conducted the great enterprise which has now attracted representatives of all nations to Vienna, it may be confidently hoped that it will be uninterrupted.

GERMANY

is best represented by the contributions of Fred. Krupp, from his immense establishment at Essen. A block of crucible steel, weighing a hundred thousand pounds, illustrates the great capacity of the steel-making department. It has been worked into shape by the great fifty ton steam hammer, which is one of the wonders of Essen. A steel cranked axle for a locomotive is a splendid piece of work, and smaller straight axles, intended for cars and for tenders, are very fine examples of hammer finish; and a considerable number of specimens of locomotive work are of the same admirable quality. Some of these are of Bessemer metal. Krupp evidently takes much pride in his artillery manufacture, and if his exhibits here are average specimens of his work, he has most excellent reason for it. A considerable number of guns for both land and sea are exhibited. On one of the largest he has adopted the "Ericsson compressor," which is one of the most beautiful and effective contrivances of its inventor. The guns are generally breech loading, are rifled

with a large number of narrow grooves, and are mounted on iron carriages. The largest gun has a caliber of 305 millimeters—twelve inches—and weighs 36,600 kilogrammes, 80,000 pounds. It has a magnificent finish, and is made of beautifully homogeneous metal. These are built guns, or, as the maker describes them, are constructed upon the "ring system" of Armstrong. In most cases, the recoil of the gun is taken up by a very neat form of "hydraulic" gear, which we should expect to work well, and which experiment is claimed to have proved satisfactory.

Among British exhibitors, Cammell & Co., John Brown & Co., Vavasseur, and Armstrong & Co. compete to some extent with Krupp. The two first named present fine examples of heavy work, and their

ARMOR PLATES

attract much attention. Several are shown which heavy shot have been driven against, making deep indentations which are bordered, in some instances, by a sharp fin, forming a kind of collar and showing well the fine quality of the metal. The other firms exhibit heavy and well built guns. Several torpedoes are exhibited, which are principally noticeable as reminders of the revolution which seems impending in the methods of naval warfare—a revolution which was inaugurated as long ago, at least, as the time of our revolutionary war, and which has exhibited its greatest progress in the United States, where Bushnell, Robert Fulton, John P. Taylor, and other inventors of an earlier period, and Ericsson, Lay, and others of our contemporary engineers, have proved that it promises to change completely the tactics and the *matériel* of navies at a very early date.

There are many special exhibits which are nearly as interesting as any already referred to, and we may be able to find time for their examination at some future period.

R. H. T.

Correspondence.

Testing Steam Boilers.

To the Editor of the Scientific American:

In a late issue of your paper, you mention the need of an iron clad man to take charge of old worn out steam boilers. No doubt it would be a money-making invention; but as the demand would be greater than the supply, we should be no better off than we are now. But why do we not have the same system of boiler inspection and testing, and the examination of engineers, on land as we have on the sea? In this place, there are four saw mills; in two of them there are 130 men at work; and the engineers in both of these mills are men who know nothing about their business, except how to stop and start their engines. One of the boilers is worn out; but what remedy is there? None. On the other hand, there are four tug boats in this harbor (two of them are only allowed to run inside the harbor); and on these, each engineer has to have a license, for which he pays \$10. The boilers have to be tested once a year, and the engineers' certificates renewed. Now, have the engineers on those tugs (each carrying three persons) any more responsibility than those in the mills mentioned? What we want is a strict law in regard to testing boilers and a strict inspection of engineers, as we have on board boats. Let insurance companies refuse to take risks on buildings using steam power unless the owners have an inspector's certificate. Let a law be passed, compelling all men using steam power to employ no engineers but such as have passed the required examination. Who will set the ball rolling? We look to you to start it, and to all sensible men to keep it in motion.

Frankfort, Mich.

ENGINEER.

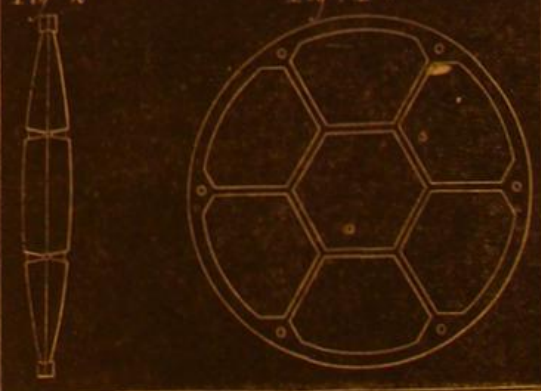
The Million Dollar Telescope.

To the Editor of the Scientific American:

The plan, shown in Figs. 1 and 2, of constructing a large object glass, with polygonal lenses having the same focus and arranged in a metallic frame, has been suggested as the probable solution of the great telescope problem. I desire

Fig. 2

Fig. 1



to call further attention to this plan, and request those who have evidence of its impracticability to bring it forward. With means now at our command, an object glass of this kind can be constructed with a diameter of five feet, and very possibly six feet. If a 25 inch glass can be furnished for \$50,000, one of 60 inches should not exceed \$600,000. Of the proposed million dollars, this would leave \$400,000 for machinery, mounting, etc., which would probably be sufficient, although it is no small task to build a tube 75 or 100 feet long, and mount it in the air so that it shall have sufficient stability and yet be easily managed. Of course the field would be divided by dark bands into polygonal sections similar to the object glass; but would this be a serious objection? I think not.

F. H. R.

New Britain, Conn.]

The Lay Torpedo.

To the Editor of the Scientific American:

Your issue of July 19 has an article entitled "Recent Improvements in Torpedo Warfare," in which you give a description of the Lay torpedo. You also state that "experiments made at Newport some time since proved quite successful; but of late, we note that, from various causes, such promising results have not been attained." As this statement is made in your leading article, it has undoubtedly led the many readers of your valuable journal into an error, as well as committed a great injustice to Mr. Lay.

During the winter last past, there were two experimental trials which were unsuccessful, not on account of any fault in the principle of the boat. At one time, the rudder broke; at the other, the cable was defective. These defects were easily remedied; and on May 29, the final test of running one mile and returning was made, entirely to the satisfaction of the commission of naval officers appointed to witness it. The writer was present and knows that the whole run was a perfect success, and that the Lay torpedo boat has proved quite as successful as her inventor had ever promised. When I add that our government immediately accepted the boat, and has already paid Mr. Lay therefor, there can be very little question as to its success. I also have in my possession a letter from Captain Matthews, Chief of the Torpedo Corps, United States Navy, stating that, since such acceptance, he had made even a more successful run with the boat than that of May 29, and expressing himself highly gratified with the performance.

Please give this explanation a place in your paper, as I trust you are ever ready to make amends for any error, however slight, in your columns, especially when it takes from a worthy inventor the tribute of success.

W. W. ROWLEY,
Buffalo, N. Y. Attorney for John L. Lay.

The Causes of Boiler Explosions.

To the Editor of the Scientific American:

Having read of the appointment of a commission to investigate the causes of boiler explosions, I think it proper to assert boldly that no boiler has ever been exploded from gases generated from steam or water. A want of capacity or carelessness of the engineer, a defect of construction or general weakness of boiler, but mainly want of water is the cause of explosions. When any part of a boiler, from want of water, becomes heated, and water is let on to it, the water, striking that part, will assume a globular form; and the globules, in cooling the surface, suddenly become steam, and as a consequence the boiler explodes. Who has not seen globules form on stoves, red hot plates, etc., and suddenly expand? I have experienced this fact in boilers, upon two different occasions (accidentally); and to prove my assertions, I propose, to any party willing to bear expense of the ruin of the boiler, to fill said boiler with water to the usual height (which is at best arbitrary); then build my fire, raise the steam to 70 pounds pressure, allowing it to escape, and then reducing water, pressure and fire, till the gage shows less than 5 pounds, with but a few gallons of water in the boiler; I will then introduce into the boiler from one to three gallons of water and raise the pressure to 70 pounds again in less time than I can write it, say from one to three seconds. I will be present at the boiler during the trial. The boiler is to be of the tubular or locomotive kind, to have a very large safety valve, and to be previously submitted to my thorough inspection.

GEO. H. LENHER.
Elizabeth, N. J.

The Zodiacal Light.

To the Editor of the Scientific American:

T. R. L., in his explanation of the cause of the zodiacal light, on page 51 of your current volume, made, I think, the following mistakes:

1. There is no reason why the lune 112 G only, and not every part of the surface of the earth that is illuminated by the sun (the entire lower half), should reflect solar rays in the indicated manner. Why should the phenomenon, explained in the diagram, be seen only east and west and not north and south, and in every direction, the sun being in a vertical line below the observer?

2. A second reflection of the rays on the outline of the atmosphere can hardly take place, because the density of the gaseous envelope of our earth diminishes gradually, and hence does not exhibit a reflecting face. The air, however, does absorb and disperse some of the light which passes through it; and, therefore, "dispersion" should be substituted for the "second reflection."

3. In the diagram, the atmosphere is supposed to be higher than the radius of the earth. Had T. R. L. made the diagram with better proportions, sketching the height of the atmosphere as about $\frac{1}{10}$ of the radius of the earth, he would at once have seen that his theory cannot account for a "double light."

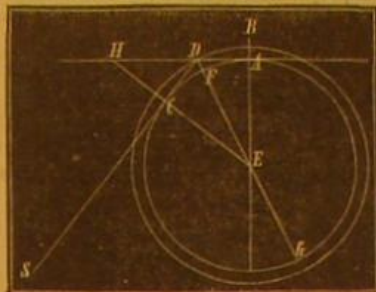
4. That section of the atmosphere, above the horizon of the observer, which is illuminated by the reflected rays is also illuminated by the direct rays of the sun, as the diagram clearly shows; and therefore, I fear, T. R. L. gives a theory, not of the zodiacal light, but of the ordinary twilight.

HUGO BILGRAM.
Philadelphia, Pa.

To the Editor of the Scientific American:

Most of your readers, I am persuaded, will need no demonstration to convince them that the theory of your Mount Airy correspondent, which attributes the phenomenon of the zodiacal light to "reflection of the rays of the sun from the earth upon the atmosphere and thence to the spectator," as

contained in your issue of July 26, is untenable. However, lest the diagram contained in the article alluded to may confuse some of your readers, I submit the following as a refutation of the position taken in that article.



Let E represent the center of the earth, S the point of the observer, AB the height of the atmosphere (50 miles, we will assume), and SC an incident ray. Then, from the well known proposition (Euclid, 36, III), we have $DG \times DF = AD^2$. Therefore, $AD = \sqrt{8,000 \times 50} = \text{about } 633 \text{ miles}$. Because the angles of incidence and of reflection are equal, the last ray of reflected light that can be seen at D corresponds with the incident ray, SCD, which is tangent to the earth at C, and consequently $CD = AD$. Now, $AE : AD :: \text{radius} : \text{tangent of the angle AED}$, whence we find angle $AED = 9^\circ$. Therefore angle $AEH = \text{angle SDH} = \text{twice angle AED} = 18^\circ$; and consequently the last ray of either incident or reflected light is seen when the sun is only about 18° below the horizon of the observer. But it is well known that the zodiacal light is seen when the sun is much lower; and, according to the testimony of Mr. Jones, it may sometimes be seen when the sun is 90° below the horizon, that is, at midnight.

Hence it is certain that the zodiacal light is not "caused by reflection of the rays of the sun from the earth upon the atmosphere and thence to the spectator," as is assumed by your correspondent F. R. L.

J. E. HENDRICKS.

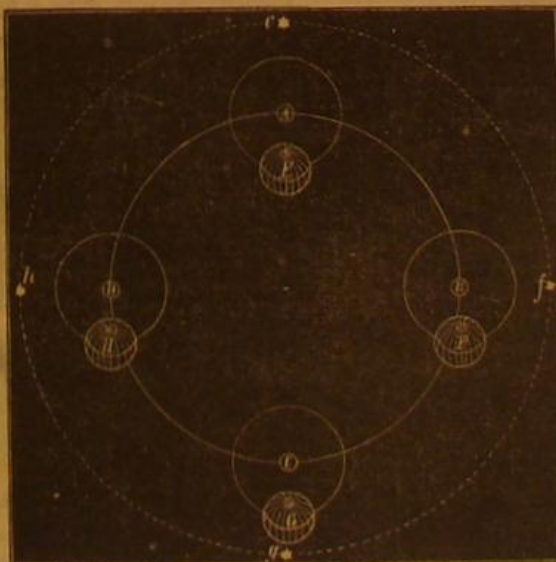
Des Moines, Iowa.

The Retrogression of the Sun.

To the Editor of the Scientific American:

One of your correspondents, on page 51 of your current volume, argues that the precession of the equinoxes is owing to the motion of the sun in an orbit, and he gives a diagram of the position of the sun and the earth at the summer solstice, in four different points of the supposed solar orbit.

Now his figure is incorrect, because, if the sun had such a motion in such an orbit, it would not change the direction of the earth's axis in the manner which he represents, or in any other manner; and the earth at the summer solstice would not be in the positions, which his figure indicates, in the given places of the sun in its orbit, but would be in the positions indicated in the diagram which I send you. This diagram is a correction of your correspondent's, with the lunar orbit left out as not affecting the question. This figure represents the direction of the earth's axis as unchanged by the sun's motion in his orbit, which is in accordance with the principles of philosophy and the motions of the moon in regard to the sun and earth.



Now such a motion of the sun as this might cause a precession of the equinoxes, but it would also cause a change in the angular distance from each other of all the stars in the heavens, which is not the case in Nature. For instance, if the sun had receded so far westward from A that it no longer appeared in conjunction with the star, c, but thirty degrees to the west of it (about the amount of the precession of the equinoxes since Hipparchus' catalogue), then the stars, c and g, would no longer be 180° from each other; while c and h, and g and h, would be nearer together, while c and f would be further apart than at first; besides, the motions of the stars near the poles would not be such as is observed in Nature.

JOHN S. PLUMER.

Sandown, N. H.

To the Editor of the Scientific American:

Your correspondent Mr. Hepburn appears to labor under a singular delusion in regard to what is, in reality, a simple mechanical question; and thus, in trying to avoid a merely imaginary difficulty, he has fallen into a real one. For while

a very slight excess of that retrograde rotation, which, in consequence of inertia, takes place in the earth as well as in all revolving bodies, is fully sufficient to account for the apparent retrogressive motion of the sun, it is equally clear that there could not be such a motion of the sun as is represented in the diagram on page 51, without such a counterbalancing weight on the other side of the center of revolution as would require a complete change in the arrangement of the solar system.

If astronomers were but able to understand the simple fact that a body in free space, while rotating on one axis in one direction, can, at the same time, have a rotation in a contrary direction on another axis crossing the first at the center of gravity, they would find no difficulty in comprehending many of the so called anomalous motions of the planets which they have so long attempted to account for on the supposition that one side of a perfectly well balanced body may sometimes be heavier than the other.

JAMES A. BAZIN.

Canton, Mass.

Hot Air Engines.

To the Editor of the Scientific American:

Having had considerable experience with hot air engines, especially with the Roper engine, I have been much interested in your correspondent F. G. Woodward's remarks and suggestions in regard to them. The design which he gives, on page 37 of your current volume, though possessing some advantages (especially the self-oiling device, which is good), has many defects which, I think, make it impracticable. Among these are the fire box and fly wheel, which must both be of great weight, being placed high; and the whole engine, as it stands on the air pumps, which must necessarily be small, renders the machine too topheavy for practical use. The location of the cylinders, also, seems to make them difficult of access for the purpose of packing, cleaning, etc. The fire doors being so high, also, make it inconvenient to fire up and rake out the ashes; and, the cylinder being placed beneath the fire box, the ashes and dirt, which are sure to arise when raking out the fire, would settle in the cylinder and cut out both it and the packing.

He does not give his proposed arrangement of valves, or the kind of valves which he supposes will stand when placed above the fire. After considerable and careful observation, my impression is that no successful hot air engine can be built unless the valves are placed outside. This is a subject which deserves discussion, and I am glad to see it agitated. Hot air possesses advantages over steam which, it seems, should eventually recommend it almost universally for a light power, and whosoever has the best engine will certainly have a large field for its sale.

H. S. W.

New York city.

REMARKS BY THE EDITOR:—We are glad to draw out correspondence on so important a subject. Mr. Woodward did not send a working drawing of his proposed engine, but merely a sketch of moving parts, and he may have provided sufficient support for the cylinder. He also omitted to mention several details, to which we called attention at the time. We would be pleased to hear from him, if he cares to reply to any of the criticisms contained in this letter.

The Belief of Hippocrates.

To the Editor of the Scientific American:

In reading the article, on page 320 of your volume XXVIII, on "Medical Practice in Early Times," to the progress of which, as you justly observe, Hippocrates contributed not a little, any one not acquainted with the writings of the Prince of Doctors may be led to infer from the context of the article that good Hippocrates was nothing but a materialist; whereas he firmly believed that no disease can be ascribed to a material cause. He, in fact, says that it is impossible to discover the nature of ailments if they are not known in the indivisible (part of man) from which they proceed. By indivisible, we, of course, understand the soul of man. All matter is divisible; the soul, being immaterial, is indivisible.

That Hippocrates was devoutly religious, his life and writings furnish ample proof; in this characteristic, some of our doctors would do very well to imitate his illustrious example, particularly for their patients' sake.

PHILO-HIPPOCRATES.

Kingfishers and Fish.

To the Editor of the Scientific American:

Mr. Darwin in his last book states that the kingfisher always kills the fish before swallowing it. Dr. Charles C. Abbot, of Trenton, N. J., states that the fish is swallowed without killing and often while the bird is on the wing. So far as my observation goes, when a fish is large, or about two and a half inches long, it is killed before being swallowed. I once saw a kingfisher light on a limb close to the surface of the water in a creek; and the bird, having an eye to the business in hand, did not see me (I was about fifteen feet off); it presently dived into the water and returned to its perch with a fish in its bill, about the above stated length. The bird then began to beat the head of the fish against the limb on which it was standing; after a few beats it would stop to see if the fish was dead or not; this was done three times, when the head of the fish was bleeding, and the limb against which the head was beaten was stained with blood. The fish was dead, and it was then swallowed. Now the above named gentlemen may both to a certain extent be correct. The kingfisher may swallow the small fish without killing them; in my mind there is no doubt that they do.

San Francisco, Cal.

D. D. S.

IMPROVED CHURN.

The accompanying engraving is a sectional view of a new churn which, in addition to having various improvements in its construction, is claimed to produce and gather butter with great celerity. The apparatus rests on a base plate from which arise two standards, one of which is shown at A, which are surmounted by a top piece. The latter is cut to fit partially around the churn body, and is held in place by a detachable strap, B. The churn body is cylindrical in form and has a false bottom in which is pivoted the lower end of the dasher shaft, C. A number of radial arms or blades, made wide and inclined laterally, are secured to the dasher shaft, which is also surrounded by a curb or tube, D, in which it freely revolves. The curb, D, fits into a similar tube, E, which has radial flanges, F, attached to it, the outer edges of which rest against the inner surface of the churn body, so as to keep both curbs accurately centered and securely in place. The lower ends of the flanges, F, project below the lower end of the tube, E, supporting the same at a distance above the bottom so as to give a clear passage for the milk beneath. In operation, the curb, D, is adjusted so that its upper edge may be a little above the surface of the milk to be churned. Then, as the dasher is revolved, the blades raise the milk through the curb and project it outward over the edge against the sides of the churn body. A constant inflow of milk is thus caused beneath the lower edge, thus providing a continuous circulation and violent agitation of the contents of the churn, causing butter to appear in a very short time. The flanges, F, prevent the milk from receiving a circular motion from the dasher, by which its inflow beneath the curb would be impeded.

The cover of the churn is made in two parts, and has half round notches in the center, which, when the appliance is in place, form the upper bearing of the dasher shaft. To the upper end of the latter is attached a small pulley which communicates, by means of a belt, with a larger wheel provided with a handle to serve as a crank, as represented. The faucet shown at the base of the churn serves to draw off the contents when desired.

Patented April 22, 1873, by Mr. William H. Holdam, of Crab Orchard, Lincoln county, Ky., from whom further particulars may be obtained.

ODORLESS WATER CLOSET ATTACHMENT.

There is probably no more insidious cause of disease than the foul emanations from sinks and water closets. In city houses, the latter especially, through their close proximity to other portions of the dwelling, are often the source of serious nuisance.

In order, as it is claimed, entirely to obviate the disagreeable odor attendant upon the employment of these receptacles, the device illustrated in the accompanying engraving has recently been invented. It consists of a bellows, A, arranged with suitable inlet and outlet valves, the supply pipe of which connects with the upper end of the trap or the closet, and the pipe leading therefrom communicates with the lower part of the trap or the soil pipe, thus conveying the foul air from the bowl to the sewer conduits. The bellows arrangement is operated by a lever, cord, and pulleys in combination with the pull, as represented, or, in hopper closets, by the working of a cock.

The device is simple, and easily attached to ordinary closets. The inventor relates that he has tested it for some time in actual employment, with uniformly satisfactory results.

For further particulars address Mr. Philip C. Rowe, 203 Harrison avenue, Boston, Mass.

Improved Ship Signal Lights.

William Harvie, a coppersmith of Glasgow, Scotland, is the originator of an excellent improvement in this line, which has come into extensive use for steamships and sailing vessels. He employs lenses on the dioptric system, of pressed glass, and has succeeded in getting a paraffin light to burn brightly in any weather, without a glass chimney.

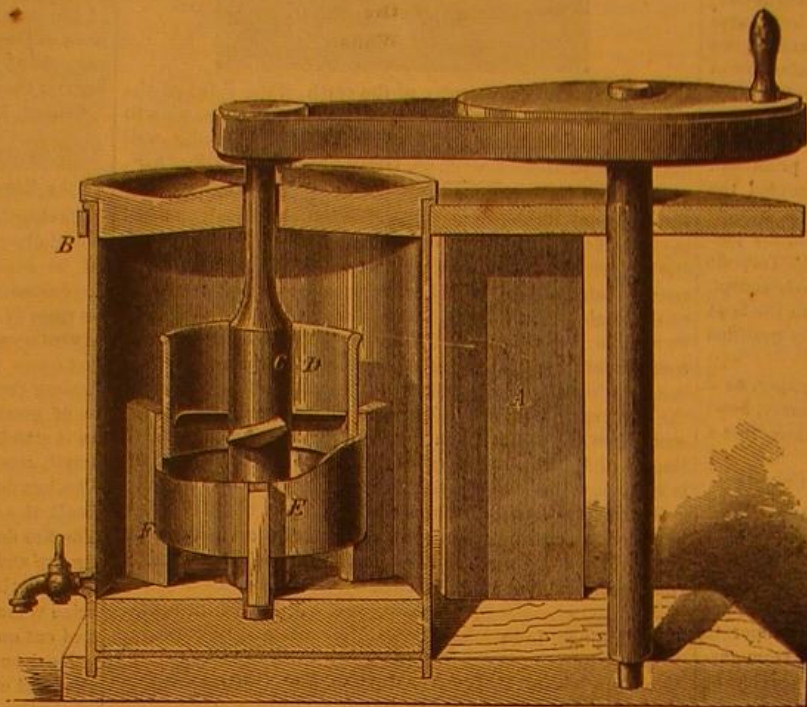
In order to accomplish this result, Mr. Harvie so divided the lamp that the inside chamber formed the chimney proper, the air for maintaining combustion passing down the upright tube, entering under a false bottom. The funnel by which the products of combustion escape from the lamp is so protected that no blow-down can take place; indeed, it seems that the Harvie lamp burns better in a storm than otherwise.

When subjected to a photometric examination in the public gas testing office Glasgow, the Harvie patent signal lamp was found to give, in front, a ray of light from the center of the lens equal in intensity to that given by ninety-eight standard sperm candles, and at the side a ray of light from the center of the lens equal to the light of sixty-seven candles; while the common lamp in front gave a light equal to eight

candles, and at the side the light of three candles. And while the naked light of the patent lamp was equal to eight and a half candles, that of the common lamp was only equal to three candles. Hence, not only are the rays of light thrown in the proper direction, but the increased illuminating effect of the light is due both to the lens and the lantern itself.

The Australian Water Cooler.

In reference to this device, illustrated on page 371 of our volume XXIX, our excellent correspondent Mr. O. C. Woolson states that similar vessels are used in the West Indies;



HOLDAM'S IMPROVED CHURN.

they are made in Spain, of a very porous earthenware from blue clay. "In no case must you touch your lips to the jar, but hold it above your head, anywhere from six inches to two feet, and let the liquor run into your mouth, or, rather, clear down your throat. It is a remarkable fact that, in quenching thirst in this way, you cannot drink one drop more than just what your stomach needs; and if you keep on pouring after that point is reached, you run in danger of

would, for the reason above given, save many a fellow from the cramp. I am going to try the clay in this country, to see if it is suitable for the purpose."

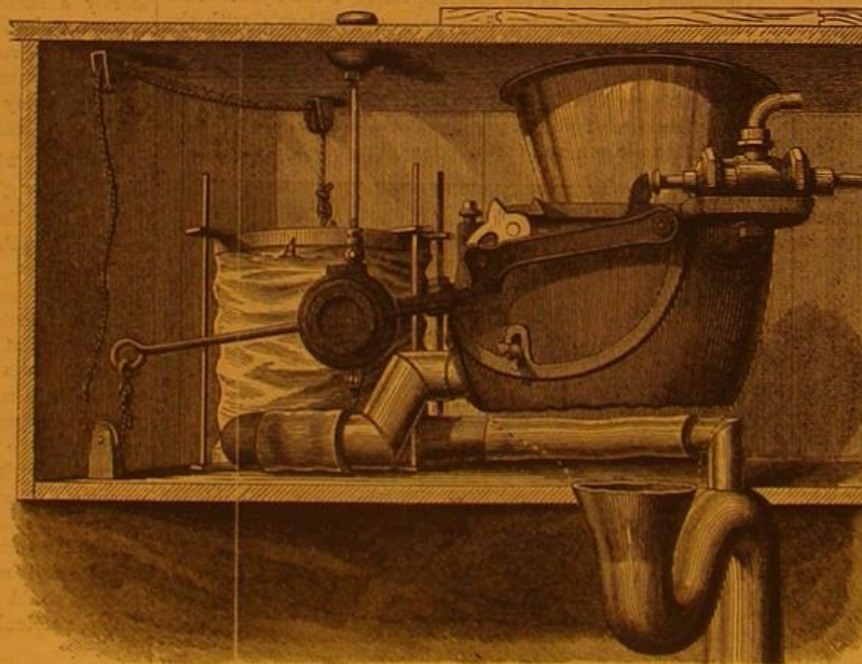
What shall we do with our Boys?

It is as impossible to make a chemist, or an engineer, or a naturalist, of a boy, if he has no special taste or aptness for these studies, as to make a poet out of a Digger Indian. It is no unusual circumstance for parents who have boys just entering upon manhood to come to us desiring counsel in regard to placing them in a chemical laboratory, that they "may learn the trade," as, to their eyes, the business appears remunerative. They have no special genius, no training in preparatory studies, no decided leaning towards chemical manipulation or research, but the desire is to have them "made" into chemists. There is a mistaken idea, common to many parents, that their children are as well adapted to one employment as another, and that they only need opportunities to learn regarding this pursuit or that, to become proficient and rise to eminence. More than half the sad failures so commonly observed are due to being forced into the wrong road in early life. Young men are forced into pulpits, when they should be following the plough; forced into courts of law, when they should be driving the plane in a carpenter's shop; forced into sick rooms, as physicians, when they should be guiding a locomotive, or heading an exploring party into the Rocky Mountains; forced into industrial laboratories, when they should be in the counting room or shop.

It is a wise provision of Providence that nearly every boy born into the world has some peculiar distinctive capability, some aptness for a particular calling or pursuit; and if he is driven into channels contrary to his instincts and tastes, he is in antagonism with Nature, and the odds are against him. One of the earliest and most anxious inquiries of parents should be directed to the discovery of the leanings of their children, and if they find that their boy, who they earnestly desire shall adorn the bar or the pulpit, is persistently engaged in constructing toy ships, and wading in every puddle of water to test their sailing qualities; if he reads books of voyages, and when in a seaport steals away to the wharves, to visit ships and talk with sailors, it is certain he is born for the sea. Fit him out with a sailor's rig, put him in the best possible position for rising to the honorable post of ship-master, and you have discharged your duty. If, on the other hand, he is logical, discriminating, keen, fond of argument, let him enter the law; if he is fond of whittling, planing, sawing, constructing, and neglects his studies, turn him over to a good carpenter, to learn the trade. If he begins early to spend his pennies for sulphur, niter, oil of vitriol, *aqua fortis*, etc.; if he is such a persistent experimenter that you fear he will kill himself, or set your buildings on fire; if his pockets are full of abominable drugs, and his clothing so charged with the odor of stale eggs that you refuse to admit him to the table at meal times, why, the chances are that he is a "born" chemist, and it will be safe to start him off to some technical school for instruction.

The question is, not what we will make of our boys, but what position are they manifestly designed to fill; in what direction does Nature point, as respects vocations or pursuits in life which will be in harmony with their capabilities and instincts? It is no use for us to repine and find fault with the supposed vulgar tastes of our boys. We must remember that no industrial calling is vulgar; every kind of labor is honorable; and it is far better to be distinguished as a first class cobbler or peddler than to live the contemptible life of a fifth rate lawyer or clergyman.

There are thousands of boys born into the world possessing scarcely a trace of ambition. Such do not care for distinction, or even for wealth; if they can procure the humblest fare, by constant toil, the aspirations of their boyhood, and subsequently of their manhood, are fully met. They are negative characters, happy with nothing, and suffer no elation or depression, whether in sunshine or under a cloud. These boys, who often afford much mortification to ambitious parents, fill a most important niche in the world; in fact, the world could not do without them. They constitute the great army of men who build our railroads, tunnel our mountains, load and unload our ships, cut down our forests, and manipulate the red hot iron masses which come from our blast furnaces. We cannot alter the temperaments of such boys. Nature is stronger than we are, and well is it that this is so. We may hold them by the power of wealth or controlling influences, but when these fail they fall at once to their place, in obedience to a law as irresistible as that which Newton discovered in the fall of the apple. Study to learn what they are capable of doing for themselves; encourage them to do well whatever work is suited to their natures. Regard every calling as honorable, the labor of which is honorably performed, and thus insure happiness and prosperity to our offspring.—*Boston Journal of Chemistry.*



ROWE'S ODORLESS WATER CLOSET ATTACHMENT.

choking yourself. There may be some of your readers and thinkers who doubt this, but I state it as a fact; and you may try again and again to swallow more than you really require, and you will be foiled every time; and for this reason I regard the practice of quenching thirst in this way the most healthy that was ever tried. In very warm weather, when one is inclined to drink often and much, to the injury of health, it goes beyond the practice of taking one swallow and two breaths, etc. It takes a little practice to accomplish the throwing the water in the mouth, and the first attempt will probably require a change of shirt and possibly one's whole attire; but that would only occur with those that are extremely awkward; generally the third or fourth attempt is successful, and then it is as simple as drinking from a glass. In some parts of Spain, they drink wine from these jars; and it is said that, when it is passed around the table for each person to drink, in case any one, not accustomed to the practice, allows his lips to touch the spout, the next in turn takes it and without a word throws it upon the floor and calls for another jar. That will do very well for Spain, but we do not handle wine in that way. I hope the time will come when these jars are generally used in this country. For rolling mill and furnace men they are very suitable, and

JAPANESE BIRDS.

We select the herewith illustration from a handsomely gotten up work on Japan, by the celebrated German traveler Wilhelm Heine. It represents birds of the heron and crane species, and was made from a sketch by himself personally. These birds are very numerous, and are diverse in their appearance and characteristics. They are not allowed to be hunted except by the nobles; and according to the popular belief, they are the symbols of happiness and good fortune, and are frequently represented as such in the plastic and pictorial arts.

The ibis (No. 4) is a beautiful and rare bird, the first specimen of which was brought to Europe by Siebold. It is two feet six inches high; the bill is of a dark violet brown, red at the point. The skin covering the head and ears, and also that of the legs and feet, is of a brilliant red; and the nape of the neck is covered by a bunch of long narrow feathers extending to the base. The color of the bird is white.

The white crane (No. 2) appears in the southern part of Siberia as well as in Japan. The color of the young birds is of a reddish brown, which soon changes into white. The feet, the bill, and a piece of bald skin above the eyes, are of a brilliant red color.

The monk heron (No. 7) is two feet eight inches high, being covered with black feathers on the upper part of the neck and head. It has similarly colored legs, with a bill of a greenish gray, which changes towards its base into a rust-red color.

The great spoonbill heron (No. 3) is two feet nine inches high. It resembles, in general, the European species, with a small difference in the length of the feet and bill. The color is white, the bill being yellow and the feet black.

The small silver heron (No. 1) differs greatly from the Eu-

ropean herons, and from those of Egypt and Persia. The specimen represented in our engraving measures two feet in height. The feathers which cover the neck and back are long and thread-like, and are used in trimmings and other ornamentation, being of a resplendent white color. The feet are dark black.

The bittern (No. 5) does not differ from the kinds indigenous to Europe, Egypt, Nubia, Abyssinia, and Siberia.

The great kingfisher (No. 6) is frequently found in the presence of a company of herons; he appears to listen attentively to the chattering of the birds, with the air of a reporter to whom it is necessary that not a word should be lost.

The Cause of the Gulf Stream.

Mr. John P. Whipple, of Whitewater, Wis., sends us a pamphlet in which he argues that the Gulf Stream and all other ocean currents are produced by the tidal wave and the land with its peculiar formation. We fail to perceive the practical scientific value of our correspondent's suggestions, particularly as he observes that the land and tide are continually making the water unequal and that the tide and winds stir up the ocean. Some of the theories advanced are hardly in accordance with accepted views, especially those relating to the trade winds where "the sun is continually warming the air at the surface of the earth, which makes it lighter, and the night cools it and makes it heavier, so the cool air follows the sun around the earth and that is the cause of its keeping one direction;" and also the statement that the earth's rotation is due to "the sun continually expanding the side nearest it, making it lighter; night condenses and makes the opposite side heavier, and its motion round the sun forces it to rotate."

As the inventor of these novel ideas naively remarks that his Gulf Stream theories depend on the fact of the water on the east shore of the Isthmus of Panama being on a higher level than that on the opposite side, he probably will abandon them on learning that the mean height of the two oceans is precisely the same. The old idea that the Atlantic is many feet higher than the Pacific has long since been exploded.

Iron Shipbuilding in Iowa.

A correspondent, J. H., states that two iron steam yachts have recently been built in Dubuque. They are built on the same style as the Cunard steamer China, built on the Clyde. The building of the yachts was done under the superintendence of a man who worked on the China. The dimensions of each yacht are: Length of keel 47 feet, width of beam 7 feet 6 inches, depth of hold 4 feet. They are propelled by screws which make 300 revolutions per minute and propel the boats at a speed of 12 miles an hour. The screw of each boat is driven by a twelve horse power upright boiler, and engines of unique pattern, which will soon be patented. Everything aboard each yacht is so arranged that she can be entirely managed by one person. They can be used as sail boats and are capable of carrying 50 passengers each. They are the fifth and sixth iron steamboats built in this city (one of which, the Clyde, has a 150 horse power engine and is one of the fastest tow boats on the Mississippi river). She was the first built west of the Alleghany mountains. Except the masts and seats, there is no woodwork on the two yachts. Their names are the Island Queen and the J. D. Eddy. They cost \$2,000 a piece, and are built by Rouse & Co., proprietors of the Iowa Iron Works.



JAPANESE BIRDS—HERONS AND CRANES.

SCIENTIFIC AND PRACTICAL INFORMATION.

TUNGSTEN IN THE ARTS.

In the last few years the consumption of tungsten and its compounds has vastly increased. It is now used for improving the quality of puddled iron and steel as well as cast steel, and is one of the constituents of Mushet's special steel. Its addition to German silver renders it tougher, and it is employed in many other alloys with gold, silver, lead, etc. One alloy called minargent contains 100 parts copper, 70 nickel, 5 tungsten, and 1 aluminum. Bartels in Hanover makes a large number of tungsten preparations for use in dyeing and printing; the tungstate of soda serves as substitute for tin salt, for fireproofing fabrics, and for the manufacture of bronze powder and blue carmine. In cosmetics, tungsten is taking the place of white lead and zinc. Tungsten in steel gives it the property of retaining magnetism for a longer time and makes it useful for magnetic needles.

CONVERSION OF STARCH INTO SUGAR.

The conversion of starch, cellulose, and the like into glucose or grape sugar has usually been accomplished by the use of dilute acids in open vessels. Some Parisian chemists, Gibon, Dusart, and Bardy, now propose to conduct this operation in closed cylinders under a pressure of 3 to 4 atmospheres. The proportions taken are 35.3 cubic feet water and 4.4 pounds sulphuric acid to 4,400 pounds dried starch, and the operation lasts two hours. If a thicker sirup is desired, it is only necessary to diminish the amount of water taken. Some other acid may be used than sulphuric. The advantage of the process consists in obtaining the desired product by a single operation, since neither concentration by evaporation nor filtration is necessary.

DETERMINING THE QUANTITY OF ALCOHOL IN FUSEL OIL.

When fusel oil is imported into England, it is admitted free of duty, provided that it does not contain over 15 per cent of alcohol of 0.93 specific gravity. The method employed in the London custom house for determining the amount of alcohol depends upon the insolubility of fusel oil in water. A certain quantity of the liquor to be tested is shaken with an equal volume of water and left standing for 12 hours. At the end of that time two layers are formed, the upper one of fusel oil, the lower of alcohol and water. The specific gravity of the latter is taken, and from it the percentage of proof spirits is calculated.

This method, according to Dr. G. L. Ulex, gives too high a percentage of alcohol, for crude fusel oil contains not only amyl alcohol, but also ethylic, propylic, and butylic alcohols, which are more soluble in water. Ethylic alcohol is soluble in every proportion, propylic alcohol is very soluble, butylic alcohol dissolves in 10 parts of water, amyl alcohol is as good as insoluble.

From some experiments by the author, he found that fusel oil from beets consists of 2 parts of soluble alcohols and 1 part insoluble alcohol, and that only a small part of the former is wine alcohol. Although this liquor contains only 3 to 4 per cent of proof spirit, according to the custom house rules it would seem to contain 40 per cent of proof spirit and be taxed accordingly. This leads to very great injustice in English import duties, and although this law is not in force here, we give the following more accurate method of making the determination:

The boiling point of absolute (ethylic) alcohol is 173-12° Fahr.; that of propylic alcohol, 206° Fahr.; butylic alcohol, 228-2° Fahr.; amyl alcohol, 269-6° Fahr., so that this difference can be employed in separating them. If wine alcohol is present in considerable quantities, it alone will be found in the first portion of the distillate. Three and two fifths ounces of the fusel oil to be tested is placed in a retort and 1-35 drams distilled off. This distillate is mixed with an equal quantity of a saturated solution of common salt, and, after shaking, left to settle. If the quantity of fusel oil then found floating on the top is 40 minims or more, it is certain that less than 15 per cent of proof spirits is present, and hence it is free of duty. If the quantity of fusel oil is less than that, the liquor is tested by mixing it with an equal quantity of salt solution, shaking, and allowing to rest.

The salt solution is then separated and distilled by itself, and the quantity of proof spirit determined in the distillate by taking its specific gravity.

THE VELOCITY OF LIGHT.

Olaf Roemer, an eminent Danish astronomer, while observing the eclipses of Jupiter's satellites, in 1676, found that light occupied about 16 minutes and 26 seconds in passing through the diameter of the earth's orbit, and assuming the distance of the earth from the sun to be nearly 95,000,000 miles, he determined the velocity of light to be 192,500 miles in a second.

In 1723, Bradley, an English astronomer, discovered the aberration of light, and determined its velocity to be 191,515 miles per second.

In 1849, M. Fizeau invented an apparatus for measuring the velocity of light between terrestrial stations, and determined it to be 194,577 miles a second.

M. Foucault, with substantially the same apparatus, determined the velocity to be 185,177 miles per second, and showed that this result was correct to within $\frac{1}{100}$.

Quite recently M. Fizeau has published the particulars of a long series of experiments, made between stations about 6 miles apart, using the rays from a oxyhydrogen light; and he gives, as the mean of 650 good observations, a velocity of 186,363 miles per second. The result obtained by Roemer is usually given in text books, and in fact is commonly quoted as the correct velocity of light. But the close agreement of the more recent researches of MM. Foucault and Fizeau, and

the elegant methods used by these philosophers in their researches, render it nearly certain that the velocity of light in the air is between 185,177 and 185,363 miles per second.

SULPHITE OF SODA AS AN ANTICHLOR.

The term antichlor, which applied originally to any substance employed to destroy the free chlorine remaining in fabrics bleached with it, is now almost entirely limited to hyposulphite of soda, $\text{Na}_2\text{S}_2\text{O}_3$. During the reaction of this salt upon chlorine, free sulphur is deposited upon the fabrics, much to their detriment. The probable reason, that this has never before been observed, is because its injurious effects have been attributed to overbleaching. This finely divided sulphur, when deposited in the fiber of paper, gradually oxidizes to sulphurous and sulphuric acid, which renders the paper brittle, and, if written upon with iron ink, bleaches or fades it. This effect upon paper has sometimes been attributed to its containing too much wood fiber.

A larger quantity of active sulphurous acid can be obtained from a given weight of sulphite of soda, Na_2SO_3 , than from an equal weight of the hyposulphite, and from this no sulphur is deposited, so that it ought most certainly to be preferred for use as antichlor on a large scale. We are informed by large manufacturers of chemicals that sulphite of soda can be made at a price not higher, in proportion to its efficiency, than the hyposulphite.

Jet—How and Where it is Obtained.

A writer in the *Practical Magazine* gives the following interesting particulars regarding jet, a material much used for the manufacture of mourning jewelry. In this country, we may remark, the substance is largely imitated by vulcanized rubber, which, when new, closely resembles the genuine article. Real jet jewelry mounted in gold is worth from five and six to as high as seventy dollars per set, the price, however, depending principally upon the quantity of precious metal used. It is very serviceable, and, unlike rubber, it retains its brilliancy.

Jet is of two distinct species—hard jet and soft jet—but the latter is of very minor importance and will be referred to hereafter.

The hard jet is found in the strata known as the jet rock, which appears to be a deposit of sea anemones, and some years ago a patent was taken out to distil petroleum from it.

The jet rock occurs in the lias formation, some thirty yards above the main band of Cleveland ironstone, and is discovered in compressed masses in layers of very different sizes, being generally from half an inch to two and a half inches in thickness, from four to thirty inches wide, and four or five feet in length. It invariably tapers away, running, as the miners say, to a "feather edge."

These jet layers are always protected by a skin, the color making another division; for that found in the cliffs by the sea has always a blue skin, while that discovered in the inland hills has a yellow coating. The jet found in the same mine varies very much in quality; its worst specimens, those which are quite brown and will not take a polish, are termed "dazed jet."

The soft jet is confined to the lower oolite—in the sandstone and shale—some 160 yards higher than the hard jet, and is undoubtedly of a pure ligneous origin, the fiber and the branches of trees being more or less distinctly marked.

The most valuable finds of jet have been washed down by the sea's action, where the jet rock crops out in the cliffs, and on the cliffs, where the seams are exposed. The dealers of the town of Whitby, in Yorkshire, England, where the principal deposits of the material exist, rent these jet cliffs and inland seams from the owners, generally for a fixed lump sum paid in advance—not for a royalty—for the right to work a certain number of yards. Nearly all the jet now obtained is found inland, but in former days tales are told of men being swung by ropes over steep cliffs like the elder-down hunters of Norway. At present, cliff jet is worked with the same mining operations as that lying under the inland hills.

The process is very simple, and, to those acquainted with the intricacies of iron and coal mining, of no very great interest. A mine is commenced by drifting into the face of a rock a passage of seven feet by five. A tramway is then laid down, and the shale is tilted from the mouth of the mine, the drift continued for about forty yards, at the rate of from two to four feet per diem; then cross drifts are started in a variety of directions. As soon as the rock becomes too hard, the miners retire, pulling in the roofs as they recede, for the bulk of the jet is found generally in the falling top rock.

There are at present twenty-three jet mines in full work, only one of these being of soft jet. The average number of men employed in each mine is six, and there are now some hundred and fifty miners engaged in this industry. The men are generally paid by the week, and only earn from twenty-four to twenty-six shillings—a sorry contrast to the high wages of the iron miners.

Hard jet varies in prices from 75 cents to \$3.50 per lb.; soft jet from \$1.37 to \$7.50 per stone, according to size and quality, and sometimes also according to the fluctuations of the market. For instance, when the Prince of Wales' life was in danger, Whitby was thronged with buyers for both the raw and manufactured article at any price, and some speculators were severely bitten by his happy recovery.

It is stated that the turn-over in rough English hard jet amounts to \$200,000 annually.

The material is manufactured as follows: The jet is first peeled and stripped of its skin, be it blue or yellow, by means

of a manual chipping process with a heavy iron-handled chisel. It is then sawn up into the exact sizes for the object for which it is intended, the saw being guided by an ingenious arrangement of little wooden directors. Much care is taken in this process of "sawing up," for great economy can, by rigid supervision, be effected, one manufacturer stating that by a very simple arrangement he was able to make his raw material go a fifth further than any of his rivals. The little fragments are then delivered to workmen, who, with the aid of small grindstones driven by a foot treadle, take off the angular portions and reduce them more nearly to the required dimensions. They then pass into the hands of the carvers who, with knives, small chisels, and gouges, soon, if it be rough work only, cut them into the desired pattern. If the work, however, be really artistic, the carving is of course a much more artistic process; and it is curious to see lads and men, who one might fairly think had not the slightest knowledge in the world of art principles, cut deftly and rapidly cameos that in their beauty of profile resemble the old masterpieces; flower scrolls and groups of fruit that have a marvellous fidelity to Nature herself; and crucifixes and pendants that rival all the ingenuity and patience of the "heathen Chinese." Sometimes you notice them with a pattern placed before them, or with a rough design scratched by a knife's point upon the material itself—oftenest, however, it would seem as though the work were altogether original.

After being carved, the goods are removed to the polishing room, where the first process, in the case of rough goods, again takes place, upon a treadle grindstone fed with oil and "rotenstone." Then the finish and the polish are given by what is termed "rougeing." Here the articles are held against quickly revolving wheels, covered with chamois leather for the larger portions and with strips of list for the indented parts of the pattern, the beautiful polish being given by means of a composition of a red pigment and oil. They are then set (the settings all coming from Birmingham) and taken to the warehouse, where they are carded, or strung if necessary, and priced and packed by young women, being then stored for the inspection of the buyers.

NEW BOOKS AND PUBLICATIONS.

THE COMMERCIAL AGENCY REGISTER, published by the McKillop & Sprague Co., 109 & 111 Worth Street, New York.

We are pleased to learn that our old neighbors and friends, Messrs. McKillop and Sprague, continue to prosper, and to issue their semi-annual volume, improved and enlarged. Their present premises are much better and larger than those they occupied at 87 Park Row; and are, we believe the best and most commodious offices in the United States used in that business. The up town movement, however, has not disconnected them from their down town subscribers, as they have established a branch office at 125 Pearl Street, near Wall, connected with the office 109 & 111 Worth Street by telegraph; they can also, from their own office, telegraph to their correspondents at any point. Their Register is a large volume, full of information such as every dispenser of credit requires, be he machinist or manufacturer; while their weekly circular gives the important changes occurring from day to day. On their circular they indicate the change, the Private Key to which is printed in front of the Register. To us this appears a most valuable feature, and it enables every holder of a book to mark off the changes, weekly.

THE UNITY OF NATURAL PHENOMENA, a Popular Introduction to the Study of the Forces of Nature. From the French of Emile Saigey, with an Introduction and Notes by Thomas Freeman Moses, A.M., M.D., Professor of Natural Science in Urbana University. Price \$1.50. Boston: Estes and Lauriat, 143 Washington Street.

In this work, M. Saigey has collated some of the more strikingly similar natural phenomena, and applied them to furthering the belief in the great truth that all Nature is one harmonious system. Although the doctrines of the correlation and conservation of force, and of the unity of all the sciences, have been already promulgated by higher authorities than our present author, there is much food for reflection and pleasant reading in this work, which aspires rather to popularize facts already ascertained than to startle the world by its originality.

BREECH LOADERS. By "Glean." Price \$2. New York: G. E. Woodward; Orange Judd & Co., 245 Broadway.

The author of this readable little book has given, in addition to a practical description of the construction, mechanism, and treatment of a breech loading shot gun, a very curious historical account which will surprise many readers, as it demonstrates the origin of the breech loading system to be at least four centuries old. The book is written in a chatty, pleasant style, and will be acceptable to the numerous votaries of outdoor sports.

REPORT OF THE MINISTER OF PUBLIC INSTRUCTION for the Province of Quebec, for the year 1871. Montreal: La Minerve Press.

This pamphlet gives the reader a favorable impression of the state of education among our Canadian neighbors, and explains the system, of imparting instruction in all branches of knowledge, now used in the British provinces on this continent.

ON YEAST, PROTOPLASM, AND THE GERM THEORY. By Thomas H. Huxley, F.R.S.

THE RELATIONS BETWEEN MATTER AND FORCE. By John H. Tice, St. Louis, Mo. Price 25 cents. Boston: Estes and Lauriat, 143 Washington Street.

The first of the papers in this pamphlet is most welcome, as it gives us one of the most striking of modern theories on the mystery of the origin of life, as explained by one of the creators of contemporary science, in a popular and accessible form. The second essay is full of thought and sound argument, and will be widely read as a new contribution to our knowledge of the question of all questions in the world of physics.

A TABLE OF CHANGE WHEELS FOR THE SCREW CUTTING LATHE. Camden, S. C.

This heading is all the information we possess as to the origin of one of the most handy little books we have ever seen. We have, dozens of times, answered queries on the proportions of screw cutting gear, and here we have, neatly printed, the whole subject reduced to tabular form and giving the figures to three places of decimals. We regret we cannot give the author and publisher due credit for this practically useful publication.

DIGESTION AND DYSPEPSIA; a Complete Explanation of the Physiology of the Digestive Processes. By R. T. Trall, M.D., Author of "The Hydropathic Encyclopedia," "The Hygienic Handbook," etc. New York: S. R. Wells, 389 Broadway.

Accurate information on health and dietetics is a public necessity; and we have here a fresh contribution to the voluminous literature on the subject. The book is copiously illustrated.

Improved Coal Car Elevator.

Philip H. Lamey, Wilkesboro, Pa.—This invention relates to car elevators generally, but more particularly to such as are employed to transfer coal from the bottom of the mine up a slope and to the landing from which it is to be discharged. It consists in several improvements upon the patent granted to the same party February 4, 1872.

Improved Stool.

Ceres B. Sheldon, New York city.—This invention consists in a ring constructed with journals that are arranged at intervals and provided with friction wheels to allow the cap to be dispensed with altogether.

Improved Glove.

Remus D. Burr, Kingsboro, N. Y.—This invention consists, 1st, in a glove or gauntlet in which the back of the hand is formed or cut without fingers, and with which, in a gauntlet, the back or portions of the front of the wrist are all in one continuous piece of material. 2. A gauntlet, the front of whose wrist is gone shaped, is so arranged and combined with the remaining portion of the wrist that, when folded or made, the seams are brought on the inside of the wrist. 3. A glove or gauntlet having the parts that form the palm and the front, back, and side portions of the fingers made of a separate piece or pieces from the body of the back. 4. A glove or gauntlet finger back composed of or wholly reinforced with leather when combined with a back composed of cloth or other textile fabric. 5. A glove or gauntlet in which these pieces, portions or parts that form the side of the palm and back portion of the fingers are connected, joined to, and closed on the body of the back with a continuous stitched seam.

Improved Bee Hive.

David Latchaw, Barkeyville, Pa.—This improvement relates, 1st, to a mode of preventing robber bees gaining access to the brood or honey chamber, and also entrapping them by means of adjustable pivoted guides arranged in the bee entrance, and of a cage or prison placed at one side of the bee frames, both the guides and cage serving for other useful purposes in the ordinary economy of the hive when not thus utilized. 2. To providing the comb frames with removable guides, thus enabling the filled comb of one frame to be removed and transferred to an empty frame or to a box for transportation to market or elsewhere without removing the frame itself. 3. To a cloth or flexible guide plate for forming a division between comb frames and thus compelling the bees to build comb the whole length of one frame instead of building it in one end of several adjacent frames, as they will often do if left to themselves. 4. To devices for closing the bee entrance, which are adapted to co-operate with the guide strips above mentioned.

Improved Fire Place.

John L. Garlington, Snapping Shoals, Ga.—This invention is an improved grate, which may be adjusted to any chimney place, allowing full control of the fire and increasing the heating properties of the same. It consists of a grate with inclined back plate and sliding dampers to throw forward the heat and regulate the same. It also consists in adjustable side plates to fit the grate into a chimney.

Improved Subsoil Plow.

Augustus L. P. Valrin, Ripley, Miss.—This invention consists in an improvement of subsoil plows. The front of the standard is made upon the arc of a circle, and is made sharp from near the beam to its junction with the cutter of the share, forming with the said cutter of the share a continuous colter from the beam to the point. The back part of the standard is made of such a form and thickness as to give it the strength necessary for the particular kind of work for which the plow may be intended. By suitable construction the bottom of the furrow is cut flat, and the slice is gradually raised from its old position and is broken to pieces by its own weight as it falls over the raised rear edge of the share, pulverizing the ground as deep and wide as the furrow is cut. The standard and share, presenting three cutting edges, go easily through the ground, making the draft light. The concavity of the share, raising the middle part of its bottom from the bottom of the furrow, diminishes the friction, causes the plow to run steadily and makes it self-sharpening.

Improved Washing Machine.

William K. Flitstra, Holland, Mich.—This invention is designed to furnish an improved washing machine in which the clothes are washed by being projected from end to end of the machine as it is rocked upon its pivots, the labor of rocking being lessened by a balance weight connected with it. To the sides and bottom of the box are attached ribs or cleats, against which the clothes are rubbed as they slide back and forth; and in one or both ends of the box are secured a number of plates, the upper edges of which are formed with rounded projections, gradually increasing in height toward the end of the box, and which are designed to catch upon the clothes and turn them over as the box is oscillated.

Improved Farm Gate.

Mahlon Burtless, Seneca Falls, N. Y.—To open the gate a latch is turned up so that its rear end may enter the space between the parts of the front vertical bar of the frame, which allows the gate to be slid back upon wheels for half its length or less. The gate and frame may then be swung around upon hinges to fully open the gateway.

Improved Cutter Head for Moldings.

Elde H. Hinners, New York city.—The object of this invention is to produce a rotary cutter head for making moldings with a rabbet at one side, separated from the molding by a narrow strip too thin and weak to sustain the strain to which it would be subject if the rabbet was formed with the ordinary rotary planing cutter; and it consists of a staggered saw attached to the cutter head of the molding planer to form the rabbet.

Improved Washing Machine.

Francis B. Preston, Fayette, Mo., assignor to himself and William H. Stapleton, of same place.—In using the machine, levers are raised into an upright position, the clothes are inserted between the beaters, and the cover is closed. As the levers are lowered the beater moves forward, pressing the clothes against a forward beater, forcing the water and dirt out of said clothes and through the perforations of the said beater. As the levers are again raised the beater moves back for another stroke, and the forward beater is rocked, its upper edge moving rearward and its lower edge forward, so as to loosen and detach the clothes.

Improved Blasting Plug.

Julius H. Holsey, Butler, Ga.—This invention consists in having the meeting edges of a hollow blasting plug made in sections, rabbet-jointed together to prevent the escape of the blast until it has nearly expended its force on the object to be blasted or wholly separated it. It is also proposed to provide the plug with strong spurs on the sides, to be forced into the wall of the hole of the object to be blasted, to prevent the plug from being forced endwise out of the hole.

Improved Horse Power.

Zachariah P. Landrum, Columbus, Miss.—This invention is an improvement upon the horse power for which letters patent No. 136,975 were granted, and consists in a novel mode of combining certain parts so as to facilitate the draft and simplify the general construction.

Improved Table Caster, etc.

Ceres B. Sheldon, New York city.—This invention relates to casters and analogous devices having a seat or holder that is allowed to rotate on its stand or support. It consists in converting nearly all the sliding friction which is usually created by the surface contact of the holder and the bolt into rolling friction, by making the guide tube bear against the bolt only at the top and causing the enlarged bottom to bear on the outside of the bearing plate that moves on and with adjacent anti-friction rolls. It consists also in a peculiar construction of the bearing plate to enable it to embrace and work against the outer side of the balls, whereby the plate itself is prevented altogether from contact with the bolt, and therefore from all sliding friction.

Improved Pump Valve.

Wilson Barnes, Maquoketa, Iowa.—This invention relates to the lower or check valve for pumps, which are liable to break off, to twist out of position, get out of shape, retain sand or grit, and become useless in a short time. The invention consists in constructing a valve with a series of wings to which is screwed a cap, while between the two is compressed a leather, rubber, gutta serena, or other suitable packing, and in forming the valve seat upon a raised and tapering tube with a bottom flange.

Improved Extension Hat Brim.

I. Ygnacio Cassiano, San Antonio, Texas.—For an extension sunshade attachment to hat brims, to be extended for use or folded back at will, it is proposed to have a wide annular piece of cloth, having an India rubber cord sewn to the outer edge of the ordinary brim, and stationary arms projecting from a supporting ring at the base of the crown under the ordinary brim to the edge, with branched extension arms pivoted to them, so as to swing outward and engage with socket clips on the flexible cord to extend the brim. These clips, with which the extension arms connect detachably, engage with hooks at the base of the crown, when the extension brim is folded back under the principal brim, to hold it up close to the under side of the latter. At the same time the rubber cord shifts the edge of the reversed extension brim around the opening of the crown in a manner to dispose it completely and neatly when it is not required to have it extended. The same inventor has also patented a similar device, which consists of an annular extension brim of cloth, sewn to the outer edge of the permanent brim, with folding arms for extending it, which are mounted on sliding arms for moving them out or in for extending the brim more or less, and elastic straps on the extension brim, in combination with the sliding extension, to control the extension brim when not wholly extended. The sliding extension arms have spring catches combined with them in such manner as to hold them in any position to which they may be adjusted.

Improved Harrow.

Alexander C. Carnes, Smithville, Tenn.—This invention consists in constructing a harrow frame of longitudinal and cross pieces, the first on edge while the second are flat, and the first notched underneath so as to receive and brace the second. This forms a very strong, durable, and cheap harrow frame, which any farmer can construct for himself. The harrow may be made larger or smaller, according to the work for which it is designed; or two of them may be connected together for cultivating both sides of a row of plants at the same time.

Improved Plow.

Levin B. Richardson, Carrollton, Ill.—This invention has for its object to furnish an improved attachment for plows, to roll down stubble and weeds, and hold them until turned under by the plow so as to wholly cover them and leave the ground clean. An iron roller revolves in the bent down ends of a bar which extends along and parallel with the said roller. To the bar is attached another bar, the upper part of which is bent twice at right angles, or into U shape, to pass over the beam to keep it in place, and at the same time allow the roller to rise and fall to conform to the inequalities of the ground. Several holes are formed in the rear part of a brace bar to receive the bolt that secures it, so that by shifting the said bolt from one to another of said holes the roller may be moved toward or from the plow to adapt it for use with short or long grass or weeds. A rod projecting forward and bent upward, rearward, and inward, is designed to prevent the stubble or weeds from falling down toward the plowed land, so as not to be rolled down and held by the roller, and consequently not fully covered by the plow.

Improved Boot Blacking Kit.

Somers Van Gilder, Knoxville, Tenn.—This invention consists of an ordinary polishing brush with a blacking box attached to the back, and a daubing brush attached to the handle, so that all are collectively combined in one article so as not to interfere with the use of the polishing brush, and thus preventing accidental separation and misplacement of either of the articles. The daubing brush is detachably connected to the handle of the polishing brush, so that it can be taken off to use.

Improved Traction Wheel.

John G. Gallet, St. Augustine, Ill.—This invention consists in the means for holding the rubber sections of a tire on the wheel, so that they will be held securely and yet be easily detachable. The solid plate or spoke wheel, of suitable metal, is provided with two projecting rims. The outer rim is flanged to keep the rubber in place, and the latter is of two or more pieces, placed around the periphery of the wheel. The rubber tire is firmly sustained on the wheels by guard plates. By tightening the bolts in slots or holes in the rim, the rubber tire will curve out slightly between the interstices of the guard plates, forming, instead of a polygonal, an almost circular, periphery, avoiding thereby, in connection with the elastic washers, the noisy concussion of the old wheels. The breaking strain of the rubber tire is, by means of the strong support of the guard plates, obviated, and the elastic material applied so as to give bearing surface and spring action against concussion.

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, Hec, 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 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, 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 needed 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.

Design Patents.

Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

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The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is \$100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

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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 \$30) or 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.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors, 37 Park Row, New York city.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an honest opinion. For such consultations, opinions and advice, no charge is made. Write plainly do not use pencil, nor tale ink; be brief.

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Wanted—Several first class machinists. Good wages to the right men. Address, stating terms, &c., Oneida Community, N. Y.

Inventors or parties having, for sale, Machines for digging Potatoes, send illustration and description to D. G. Penfield, Flushing, L. I., N. Y.

Inventors who desire to have their inventions and patents introduced and represented in Europe by a gentleman of experience and integrity, should address K., Box 272, New York Post Office.

To Capitalists and Manufacturers of Edge Tools—Address John G. Cobb, Shoe Heel, N. C., as he has obtained a Patent for a Valuable Tool which he wishes to sell or have manufactured on Royalty.

Turner Wanted—Good chance for a man with small capital. Address Box 318, Keene, N. H.

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Wanted—Buyers and Manufacturers to buy Rights all over the United States of my Patent Combined Sissors and Tape Line. For Drawings and Specifications, with full particulars, address Margaret J. Stubbings, Box 430, Youngstown, Ohio.

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The New Remedy retains the Rupture in ease and comfort, night and day, till cured. Sold cheap. Fitted without charge, by the Elastic Truss Co., 683 Broadway.

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Cheap Wood-Working Machinery. Address M. B. Cochran & Co., Pittsburgh, Pa.

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

Sure cure for Slipping Belts—Sutton's patent Pulley Cover is warranted to do double the work before the belt will slip. See Sci. Am. June 21st, 1873, Page 389. Circulars free. J. W. Sutton, 35 Liberty St., N. Y.

Notes & Queries

J. M. C. asks: How can I make a permanent and brilliant green for the edges of blank books?

C. R. C. asks: Are buttons made from rice in imitation of pearl?

H. R. asks for a recipe for a composition marble, and for tinting and veining the same.

W. H. asks: How can I make some sort of alarm to wake me at night which will not make sufficient noise to wake the rest of the family?

D. & M. ask (1) how to prepare zinc so that it will hold paint without breaking or scaling, and receive a fine finish. 2. How are ornaments fastened on metallic cases without screws or tacks?

ANSWERS TO CORRESPONDENTS

B. S. asks: 1. Where is the crank pin of a locomotive when the cross head is exactly midway in its travel? 2. I have heard of instances of the lower flues in a locomotive boiler being burned while the upper ones were unharmed. What is the cause of that? 3. When an engine is pulling a train, where is the actual center of the drivers? I have been told that it was at the point where they came in contact with the rail. Answers: 1. It depends on the length of the connecting rod. When the cross head is at the center of the stroke, the connecting rod, if detached from the crank pin, would swing to the center of the driving wheel, so that you can lay down any particular case to scale and determine what you want to know. 2. Probably on account of scale or mud. 3. So far as we know, the actual center of a driving wheel is always the same.

C. H. M. asks: Having an ordinary steam gage, showing pressure of 70 lbs. per square inch, would a steam gage representing 2 square inches show double the amount of pressure? Answer: It would, if graduated in the same manner, and having the same sized spring as the first. But in practice, as steam gages are made, both would register alike.

W. W. A. says: We have trouble with the gate to our reservoir. There is 25 feet head. Will a gate, substantially like the circular dampers sometimes seen in stoves, answer a good purpose? If not, what will be better? Answer: If the moving parts are inside, it would be difficult to open the gate; and if they are on the outside, a great deal of water will leak through, when the gate is closed. There are several good gates in the market, and you can obtain particulars by communicating with a plumber or hydraulic engineer.

H. C. M. asks whether a photographer is liable to suffer in health in consequence of handling the necessary chemicals; and if so, are there any means of avoiding this by filtering the air inhaled while using the poisonous chemicals? Answer: There is nothing about the practice of photography that is necessarily injurious to health. The handling of the chemicals, if ordinary care is taken, is not deleterious. The apartment should of course be ventilated.

S. M., Jr., says: I claim that, if two balls of the same diameter, one made of wood or any other light substance, and the other of a heavy substance such as iron or lead, are dropped from the same height at the same time, they will reach the ground together, while my friend claims that the iron or lead ball, being the densest, will reach the ground first. Which is right? Answer: You had better try the experiment. We think the lead ball will reach the ground a little the sooner; though in a vacuum, they would both fall together.

J. H. K. asks: What is the cause of water gathering on the outside of a pitcher filled with ice water? Is it the water passing through the pitcher, or is it the moisture of the atmosphere condensed upon it? Answer: When the water in the pitcher is colder than the surrounding air, the moisture in the air is condensed in the form of dew upon the outside of the pitcher. If the water is as warm or warmer than the air, no condensation takes place.

T. H. and J. P. D. ask what phosphorescence is, its cause, etc. Answer: There exists some difference of opinion among scientific men, but the best authorities consider it a slow oxidation of phosphorus, since experiments prove phosphorescence impossible in a vacuum. Phosphorus, in the state of slow combustion which takes place on exposing it to the air at ordinary temperatures, gives off solid vapors, which shine in the dark with a faint bluish light, hence the term phosphorescent has been extended to all bodies which exhibit a similar luminosity, from whatever cause it may arise. Familiar examples are phosphorescence of dead and decaying wood (fox fire) and of putrid fish. Some plants also emit in the dark a faint continuous light, probably arising from the combustion of some substance, such as a hydrocarbon, emitted from them. A more familiar kind of phosphorescence is that exhibited by many living animals, as by the glow worm and fire fly, and the numberless small marine animals which give rise to the phosphorescence of the sea at night. In nearly all phosphorescent plants and animals, the phosphorescence appears to be due to chemical action, in fact to a slow combustion; for it increases in brightness in pure oxygen gas, and ceases altogether in a vacuum. The female glow worm (*lampyrus noctilucus*), whose abdomen is divided into 8 segments, shines on the under part of the last three abdominal rings. Within these is found the luminous matter, a yellowish white transparent substance, consisting of ramifying fibers and granules of an organic structure, heavier than water, yellow and opaque when dry, and consisting principally of a material which exhibits the chemical properties of soluble albumen. Dr. T. L. Phipson has given the name of noctilucine to this substance, and we published his description on page 37 of our volume XXVIII.

T. C. W. asks: What will soften hard water, in order to make it fit for washing clothes without injury to the fabric? Answer: You can soften the water by adding carbonate of soda—washing soda—as long as a whitish precipitate is formed. Let it settle and draw off the clear water above. Sometimes simple boiling will render the water after settling fit for washing.

F. R. asks: What is zopissa? Answer: Zopissa is the patent name of a patented compound in which we believe that pyroxilin or gun cotton is a prominent ingredient. In the opinion of the inventor, it is a marvelous substance.

A. asks for a touchstone for testing gold. Answer: The material commonly employed as a touchstone, and generally known by that name, is a species of quartz, colored dark by bituminous matter, of which large quantities are found in Saxony, Bohemia, and various other localities. Black flint slate will serve the same purpose. A set of needles or bars, of various degrees of fineness, are rubbed on the stone, and acid is applied to the streaks made by the needle and by the piece of jewelry to be tested. If the jewelry is not so good as the test needle, the streak made by it will dissolve first. Nitric acid of a specific gravity of 1.2 is commonly employed for testing gold.

H. M. asks: 1. Will a type setting machine that will only set two sizes of type be useful, and how many type should it set per hour? 2. On a locomotive, why do they have two eccentrics to each valve, when, by fastening the slotted piece on a pivot in the middle and the eccentric rod at one end, and by moving the valve rod up or down, the slot would produce the same effect with greater simplicity? 3. Are all the advertisements in the SCIENTIFIC AMERICAN of reliable parties, and are we sure of getting the worth of our money by sending to them? 4. Please give me a good recipe for making ice cream. Answers: 1. A good workman sets about 800 type ems per hour. A machine should beat that. If it sets two kinds of type, all the better. It depends upon the kind of work you wish to do. 2. If only one eccentric is employed for the forward and backing motion, it must be free to revolve partially upon the shaft. It is not enough to move the valve to the backing position; the eccentric must be shifted also; and it is generally considered more convenient to have two eccentrics. 3. We endeavor to exclude all advertisements from unreliable parties, but some little latitude is given to advertisers, every manufacturer thinking his own goods the best. In buying articles with which you are not practically acquainted, it is best to obtain advice from some reliable agent. 4. The best ice cream is said to be made of pure cream, sugar, and flavoring extract. We consider ourselves good judges of the quality of the manufactured article, but do not know much of the details of making it.

A. B. L. says: In the engraving of the Scott & Morton revolving steam engine (in your issue of April 5) I see a bearing on both sides of the cylinder in which the cylinder revolves. I would like to know how the bearing between the cylinder and fly wheel is supported, seeing that all means of supporting it is cut off by flywheel, crank pin, and piston? Answer: This bearing is attached to the hub of the flywheel, and is supported by the wheel bearings.

E. B. says: In view of the coming aerial voyage of Messrs. Wise and Donaldson, I submit to you the following propositions: 1. That a rocket shoots up when fired. 2. That a cannon, when fired, is thrust backward. 3. That at a recent trial with a new fire ladder (as stated in your paper) the same was driven backward by the stream of water, suddenly issuing from the hose on the top of the ladder. The moving effect in these 3 cases is caused by pressure against the atmosphere; and if such heavy bodies are moved by it, how much more would this be the case with aerial crafts, which are floating in the air, and are thus without any weight? It would be difficult to apply steam or gas, but I believe that a rotary blower, built of as light material as possible, would produce a stream of compressed air, strong enough at least to serve as a rudder. A spherical form of the balloon would, however, not be practicable, as any propelling power ought to be concentrated, and should govern the craft equally. I therefore would suggest a form wherein the balloon consists of two separate gas bags, the boat being between them. This scheme of course can be worked out in many different ways, but I believe that a rotary blower driven by hand with the help of a flywheel would answer the purpose admirably. Answer: The power that could be produced in this way would be entirely inadequate. We have heard a much better plan proposed. It is to produce frequent discharges of some light and powerful explosive, such as nitro-glycerin, and thus guide the balloon in any desired direction.

T. B. Jr. says: 1. I have a small steam engine cylinder 3 inches in diameter and 4 inches between ports. What boiler and what sized feed pipe will it require? 2. What power would it have, and (3) would it be enough to run a small lathe? 4. I also wish to know what a pattern for such a cylinder would cost. Answers: 1. About 2 square feet of heating surface, steam pipe about 1/4 inch area. 2. About one horse power. 3. Yes. 4. Write to a model or pattern maker.

W. S. M. asks: 1. What is the best plan of annealing cast steel, to make it very soft without injury? 2. Suppose a well formed boat runs at 10 miles per hour with 10 horse power, how many horse power would be required to drive it at 15 miles or 5 miles per hour? Please explain the increase of power required for the increase of speed. 3. I would like to have directions as to the proper size, power, and speed of well shaped boats. Answers: 1. Heat to a cherry red, and allow the steel to cool very slowly, either covering it with hot ashes, or keeping it in the fire in which it was heated, allowing the fire to die out gradually. 2. The general law is that the horse power varies as the cube of the speed. On this assumption, the horse power required will be: For 15 miles an hour, 33½; for 5 miles an hour, 1¼. 3. We will probably soon give some general proportions for small boats, and would be pleased to hear from such of our readers as have been building small steamers.

C. P. T. asks: What can I put into tonic beer to make a heavy foam when poured into the glass from the bottle? I put it up with carbonic acid gas, like soda water. I have tried gum arabic, litmus, eggs, hops, etc., but they do not give the foam that I wish for. Answer: Try adding enough sugar or sirup to give it consistency. We would not advise adulterating with any chemical.

S. G. Jr. says: I have seen some specimens of paper which had been made extremely hard. It was said to have been done by soaking the paper in a solution of chloride of zinc. I have tried it, with weak and strong solutions, and on different kinds of paper, but have failed to get any hardening results. I also saw some pieces of gas pipe, with screws and sockets, which was made out of paper. Answer: The property that chloride of zinc has of hardening paper was first discovered accidentally by Dr. E. Böhm in 1849. This gentleman was filtering a concentrated solution of chloride of zinc through filtering paper, when he noticed that the paper became thick and strong. He suggested that it might be rendered very useful, but little attention was paid to it until 1859, when T. Taylor took out an English patent for its use in making parchment paper. The solution used was as thick as sirup, and made perfectly neutral by adding the oxide or carbonate of zinc. The specific gravity is then 2.10. The action on the paper is stronger when heat, from 60° to 212° Fahr., is employed. When several sheets are prepared and pressed together they unite to form one. The ammonia sulphate of copper is now highly recommended.

C. F. E. says: Our water contains iron, calcium, sodium, potassium, alumina, silica, and magnesia, &c. basic elements, with chlorine, sulphuric and carbonic acids as non-basic. One gallon of the water, as it flows from the well, contains 480 grains of solid matter, after evaporation by heat. This residue, after reaching a certain point of condensation, gives up a portion of the carbonic acid which is held in the water in combination with bases as bicarbonates. Can it be used with safety in a fire engine? Is it a good way to blow off a certain portion with a surface blow-off, say, every five minutes while running, and after stopping blow off all the water and fill up with fresh water from river? Answer: We are afraid to recommend the use of this water. Still, with some good scale preventive, such as the tannate of soda, it might be safely employed. But in the boiler of a steam fire engine, the spaces are so small that it is always best to use pure water, when practicable.

C. R. C. asks how chalk crayons are made; what amount of pressure is necessary, and if any substance other than pure chalk is used? Answer: There are numerous recipes for the manufacture of chalk crayons. One of the simplest is as follows: Pipe clay and the finest prepared chalk, equal parts, or pipe clay alone. Coloring matter according to tint desired. Mix into a paste with mild pale ale. Various substances are sometimes used to give the chalk a clay consistency, as Castile soap, shellac, gum arabic, etc. To give the crayons solidity, manufacturers use a cylinder two or three inches in diameter, open at the top and bottom, the lower end being secured over a perforated plate, having holes of the size of crayon desired. A tight fitting solid piston, moved equally by a screw, forces the soft mass through the holes in long fingers, which are afterwards cut into pieces and dried. The coloring matters used are indigo, Prussian blue, yellow ochre, carmine, vermilion, etc.

S. G. asks: Was the meteoric display, which occurred last August, at midday, and seen by most of the citizens of Lexington, Ky., noticed at any other place? Have astronomers or scientists given an explanation of the phenomenon? Was it connected with Biela's comet, which must have been near the earth at that time? Answer: Meteors are comparatively rare between August 11 and September 4. A shower "on the 29th and 30th of August at midday, lasting from noon until four o'clock," is very unusual. We have not heard of such a display elsewhere. If seen again this year please let us know.

S. B. D. asks: 1. Is it possible to make any use of iron after it has been burnt, such as old grate bars? 2. Is there any way of reducing old rusty scraps of sheet iron into cast iron? 3. Could a blast furnace be worked on a small scale with a hand bellows, profitably, if coal and ore were plentiful and cheap? Answers: 1. It can be re-melted. 2. Yes, in an ordinary blast furnace. 3. Not unless labor were very cheap, also.

E. C. B. says: An amount of oxymuriate of tin has become much diluted with water. How can it be precipitated and returned to its metallic state? Answer: The protochloride of tin, commonly known by dyers as tin salt, is soluble in water, but by contact with the air a white precipitate of oxychloride of tin is formed, which remains suspended in the solution, giving it a milky appearance. If this is the oxychloride that you refer to, you will find that it is soluble in an excess of hot muriatic acid. From this solution tin may be precipitated in the metallic state by a strip of zinc, the tin forming gray laminae or a spongy mass. Some manufacturers of tin salt mix sal ammoniac with it to prevent the precipitation of the oxychloride.

Ig. asks: 1. Is there any reward offered by this or any government for the discovery or invention of perpetual motion, and if so, how much? 2. Would the inventor of such a device derive any great benefit therefrom? Answers: 1. No reward is offered. 2. We think not. But you may try it practically. Put your feet within a tub and pull steadily at the handles. This is the simplest form of perpetual motion. In other forms, cog wheels and levers are arranged to pull against themselves. This is the "idea" in all perpetual motion machines, and no advantage can result.

H. asks: If a tug boat can tow a ship at a certain rate, can the same engine, being placed in the ship, be made to propel her at the same rate? Or does the engine, by being in the tug, have more power to move the ship than if it were in the ship itself? Answer: See our editorial columns in this issue.

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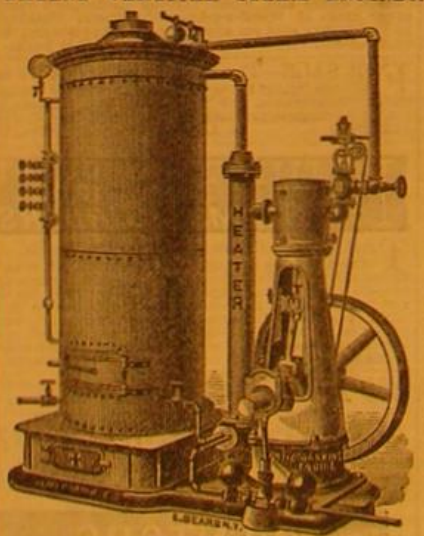
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(NEW SERIES.)

NEW YORK, AUGUST 23, 1873.

\$3 per Annum
IN ADVANCE

MANUFACTURE OF OIL OF VITRIOL.

BY J. F. GESNER, M. A.

OME one has said that the world knows least of its greatest men. If this be so with reference to individuals who shape, for weal or for woe, the destinies of their kind, with how much more truth may it be asserted of the great material products, that minister so vastly to man's comfort and enjoyment! Few have any adequate idea of the importance in our arts and manufactures of the corrosive liquid, known in commerce as the oil of vitriol. So important is the subject of our article, and so various and numberless the products, necessary almost to our daily existence, depending upon its manufacture, that it has been said that the material prosperity of a country may be judged of very accurately by the amount of oil of vitriol it produces.

The chemist knows oil of vitriol as sulphuric acid, and writes it, in characters rather cabalistic to the uninitiated, as H_2SO_4 . The characters, however, are easily understood. The capitals are merely the initials of the elements composing the compound, and the figures under them (1 being understood when no figure is written) denote the number of times each element enters into combination.

And here comes in one of those great and comprehensive laws which it is the glory of science to discover and apply. We have written sulphuric acid H_2SO_4 , and we have not done so at haphazard. Our hydrogen, oxygen, and sulphur behave, contrary often to our experience in the case of individuals, with unvarying decision and consistency. For the sake of simplicity we may write our compound SO_3 , H_2O , bearing in mind that the second half of the symbol, H_2O , indicates 1 part of water, H_2O always meaning water in chemical language. The elements in the first part of the compound, SO_3 , are sulphur and oxygen, and SO_3 means 1 part of sulphur and 3 parts of oxygen. Now we cannot change these relative proportions of sulphur and oxygen and retain the same compound. The instant we do so, a new chemical compound springs into existence. If we make, for instance, two parts of oxygen combine with one of sulphur, we

have no longer sulphuric acid, but the pungent suffocating odor of a burning sulphur match, due to sulphurous acid gas, a definite compound that cannot be formed with any other different proportions of the combining elements.

By investigation, chemists have discovered that the different elements have certain and unvarying combining weights. For instance, the combining weight of sulphur is 32, that of oxygen 16, that is, in the case of sulphurous acid, 32 grains, ounces, or pounds, etc., of sulphur, have combined with twice 16 grains, ounces, pounds, etc. (not twice any other number of grains, ounces, pounds, etc.) of oxygen to form $32 + (16 \times 2) = 64$ grains, ounces, or pounds of sulphurous acid. So that, in any number of grains, ounces, or pounds of sulphurous acid, we know that $\frac{32}{64}$ is sulphur and $\frac{32}{64} = \frac{1}{2}$ is oxygen; in the same way SO_3 denote that 32 grains, ounces, or pounds of sulphur, have combined with three times 16 grains, ounces, or pounds of oxygen, making up $32 + (3 \times 16) = 80$ grains, ounces, or pounds of anhydrous sulphuric acid. In any number of equal parts, by weight, then, of SO_3 , we know that $\frac{32}{80} = \frac{2}{5}$ parts are sulphur and $\frac{48}{80} = \frac{3}{5}$,

parts are oxygen. In the case of SO_3 , we have a striking example of the change a new entering element or compound can effect in a given substance. SO_3 , without its equivalent of water, which we have called anhydrous sulphuric acid, is a white, solid substance, and may be molded in the fingers like wax, without danger if not pressed too hard. It has neither acid nor corrosive properties. Drop a quantity, however, into a little water, and there is a hissing noise, and an evolution of steam, as when you quench a red hot iron. So strong is the affinity of this inert harmless wax for the equally bland water, and so violently do they combine, that no amount of heat will serve afterwards to separate, without decomposition, the two, which make up the intensely acid liquid, oil of vitriol.

Although sulphur was well known to the ancients, they were not acquainted with its compound with oxygen, the subject of our article. Paracelsus, who died in 1541, seems to have been the first who understood its composition. That sulphur, or brimstone, should have been known, centuries before its compound, sulphuric acid, was recognized or applied to any use, is due not only to the limited knowledge possessed by the old alchemists, but to the fact that the acid rarely occurs in the free state. The affinities of sulphuric acid are so strong that, not content to exist alone, it must, as it were, have some intimate chemical companion with which to form a chemical alliance. And how different the compound from the elements and compounds composing it!

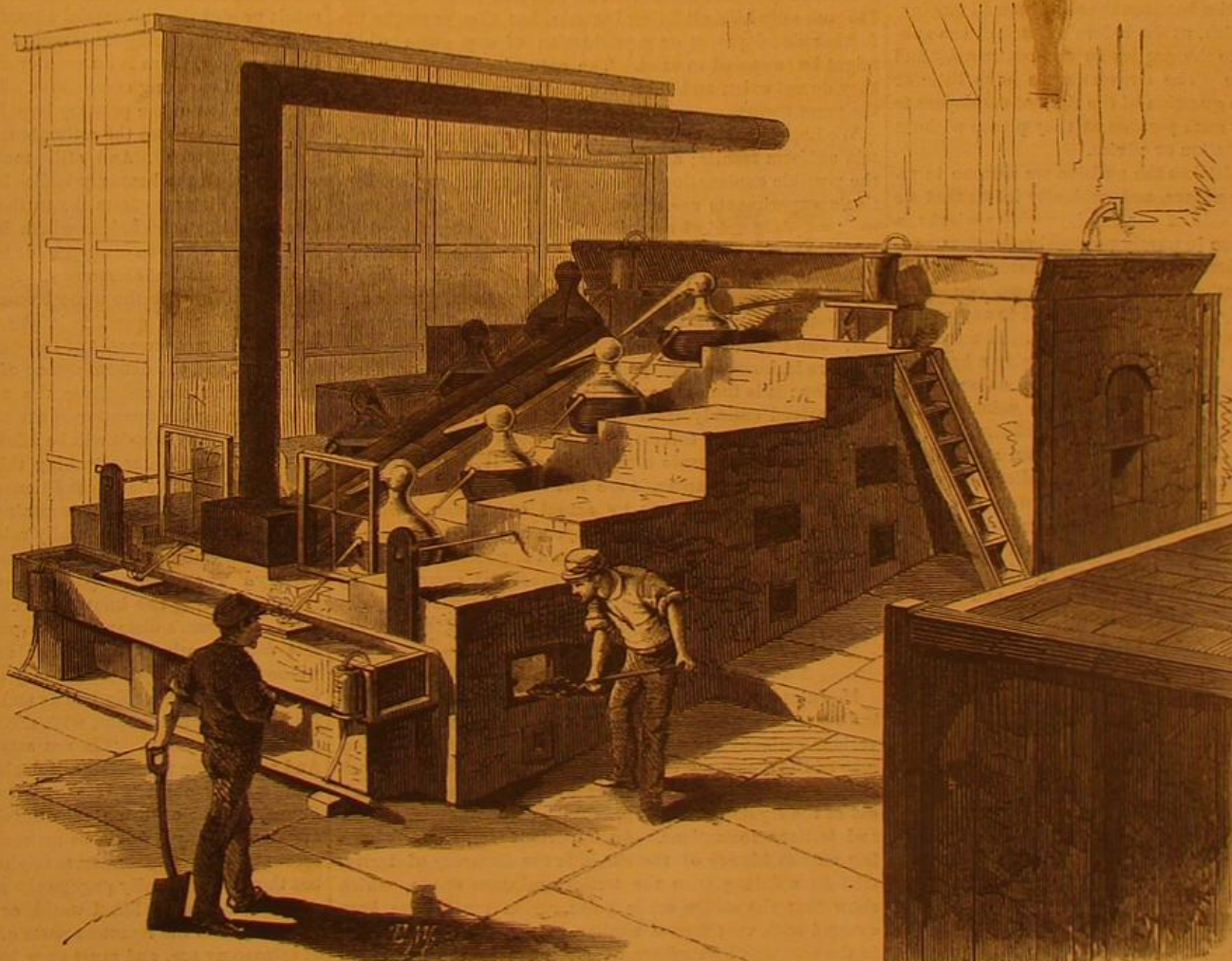
tense heat, the salt known as green vitriol or copperas. The substance does not, as the term copperas would seem to imply, contain any copper, but is simply a sulphate of iron, known to the chemist as ferrous sulphate. For some centuries, this was the only known mode of making the acid, and its manufacture in this way is still carried on in Nordhausen, in Saxony, whence the name of the product, Nordhausen acid or fuming oil of vitriol.

The distillation of the ferrous sulphate is made in earthenware vessels, called, from their shape, long necks. These are set in a reverberatory furnace, with an earthenware receiver luted to each with clay. The product is a very strong fuming acid. From its oily appearance, and the fact of its being first derived from green vitriol, we have the ordinary commercial term oil of vitriol. This mode of manufacture was found to be too expensive, and inadequate to supply the increasing demand. To the French is due the next important step in the manufacture of sulphuric acid, namely, by the oxidation of sulphurous acid, which, as has been already remarked, contains one atom less of oxygen than sulphuric acid.

Now the production of sulphurous acid is a very cheap and easy matter. All we have to do is to burn sulphur in the air; and there are few of us in the habit of using the ordinary sulphur match who are not fairly acquainted with its production on a small scale, and also with one of its properties when it has reached the nostrils.

The cheap production of sulphurous acid, then, being taken for granted, means must be found, at once easy and economical, to oxidize it into sulphuric. The French endeavored first to effect this by burning sulphur in glass globes, the interior surfaces of which were kept moistened with water; but the product of sulphuric acid was found to be very small. Sulphur, when burning even in pure oxygen, will not oxidize to sulphuric acid, except to a very limited extent, neither will free sulphurous acid take up any more oxygen from the air, although there may be plenty around it and to spare.

We are indebted to the English, though the suggestion is said to have been first made by two French chemists, Lefevre and Lemery, for the next great improvement on which the present manufacture of sulphuric acid is founded. Dr. Ward, of England, found that, by introducing niter or potassium nitrate into the burning sulphur, the product of acid was



MANUFACTURE OF OIL OF VITRIOL.—THE GLASS CONCENTRATING RETORTS.

Glauber's and Epsom salts are familiar in our mouth as household words; but who would recognize sulphuric acid and soda in the one, or oil of vitriol and magnesia in the other? Plaster of Paris is a familiar substance, inert and harmless, with no trace of our corrosive acid and the caustic lime composing it. But notwithstanding this strong tendency to combine with other bodies, sulphuric acid has been found in the free state. It is sometimes discovered free in the water which drains from coal mines, evidently produced by the decomposition of the iron pyrites contained in the coal, as will be seen further on. Boussingault found it in a mountain stream, called the Rio Vinagre, in the Andes, and calculated that the waters of this torrent annually carried down to the sea 15,000 tons of sulphuric acid. In the island of Java, it exists in the waters of a stream which has its source in the crater of an extinct volcano. In all of these instances, it has evidently been produced in the way in which we shall presently see that it is now manufactured on the large scale, namely, from the oxidation of sulphur.

Sulphuric acid was first prepared by submitting, to an in-

largely increased. His apparatus consisted of large glass vessels holding from forty to fifty gallons. These were placed in two rows in beds of sand, and a few pounds of water poured into each. Stoneware pots were first introduced into the necks of these glass vessels, and afterwards a red hot ladle, into which was thrown a mixture of sulphur and niter, placed in each pot. The necks were then closed with wooden stoppers. The sulphurous acid from the burning sulphur was found to be oxidized by the nitrous fumes from the ignited saltpeter, and the resultant, sulphuric acid, was absorbed by the contained water at the bottom of each glass vessel. Sulphuric acid made in this way sold for from 30 to 50 cents per pound in our currency. Its price is now about one penny per pound in England, and with us ranges from 2½ to 2 cents. The great cost of the acid made by Ward's process, as compared with the price at the present time, was owing to the necessarily limited size of the apparatus, being made of glass, and the high price of the niter used.

It was not until Dr. Roebuck, of Birmingham, England,

(Continued on page 114.)

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THAT "DASTARDLY OUTRAGE" AGAIN.

We have been recently favored with a lengthy epistle from Mr. John Fehrenbach, the author of a letter lately commented upon by us, relating to alleged grievances of workmen in the works of Messrs. Stearns, Hill, and Co., of Erie, Pa. The present document is little more than a repetition of the personal difficulties between the above named employers and their men, which, as we before remarked, is a subject interesting solely to the parties in the controversy and in no wise to the public. The circumstances have little or no bearing on the main question of the right of employers to hire or exclude exactly such persons as they please without resorting to outside dictation or advice.

Our correspondent mistakes the position we assume in regard to troubles of this nature, and evidently infers that we desire to champion the side of the employers as against the men in all cases and even in purely personal misunderstandings. We deal with these questions with reference to their effect upon one or the other of the great classes, employers or employed, impartially, and not with regard to any particular set of men or any especial establishment. If a concern treats its workmen in a manner calculated to give a basis for the generally unfounded assertions of trades' union demagogues, we endeavor by well meant advice to point out the fallacy and inexpediency of such a course; and similarly, on the other hand, we do not hesitate to condemn any body of workmen who, by attempts at intimidation or dictation, cause employers generally to adopt stringent measures calculated to restrict their privileges or injure their interests.

The letter before us includes an extract from a speech of the President of the International Union, in which the employers in question are stigmatized as "pirates and robbers of the rights of labor." This is not the way to bring about the amicable adjustment of any trouble. In our opinion, a wiser course would be to counsel moderation and proper respect for the rights of others.

SPONTANEOUS GENERATION.

All experiments thus far made with infusions of different substances, for the purpose of producing infusorial animalcules, appeared to prove that the access of air was necessary for their formation. Pasteur, who has extensively occupied himself with these investigations, found at last that the germs of these animalcules could, under certain circumstances, resist a temperature of 212° Fahr., as he obtained bacteria from solutions which had been previously boiled and afterward came only in contact with air which had been dried and purified by passing it through red hot pumice stone.

However, in 1859, Dr. H. Charlton Bastian took the matter up, and commenced trying if he could not produce animal life in a vacuum. He experimented with various fluids, especially infusions of hay and turnips; he placed them in one ounce flasks, having narrow drawn out necks, and heated the solutions in them rapidly till they commenced to boil over, so as to be sure that all air was expelled; then he kept them boiling for from a quarter to half an hour, while the steam was escaping with some force; then the neck was sealed up by melting the glass with a blowpipe flame, while at the same time the heat was withdrawn. In this way he produced after some practice a perfect vacuum, that is to say, one where air was excluded, and only watery vapor present. The proof of this was that the water hammer effect was quite obvious; this means that the water could be made to fall with a shock from one end of the tube to the other, without passing an atmospheric bubble, as is the case when air is present. When the little flasks were thus prepared, they showed the development of bacteria and other minute moving organisms just as well as if they had not been submitted to great heat, and air had access. The time required

for this phenomenon varied from a few hours to several days. Even when the flasks, after being closed, were submitted for several hours to boiling water, the organisms appeared; and Dr. Bastian went even so far as to submit them for four hours to a temperature of 300°, and about 6 in excess, without preventing the subsequent development of the animalcules. He reasoned then as follows: As the germs cannot come from the air and pass through the glass, only one of two conclusions is admissible. 1. That the invisible germs of the animalcules are able to stand a heat of 300° without being killed; or (2) that living things can be evolved from non-living matter.

The first conclusion is that of Pasteur, and is based on the assumption of the old maxim *omne vivum ex ovo* (all life comes from an egg), deduced from the fact that it is known to be true for all the higher animals and plants, and that its extension to the lower forms of life, which are intermediate between animal and vegetable, is supposed to be a legitimate deduction on the ground of natural law.

The second conclusion is that defended by Dr. Bastian; he maintains that the doctrine of evolution, now established by an overwhelming weight of evidence, absolutely requires that living matter must at some time have arisen from that which was not living, and that, in absence of any reason to the contrary, the uniformity of natural law should lead us to believe that the process continues to take place. He says that all analogy is against the possibility of the assumed germs retaining their life after being subjected to a heat of over 300°. No living being that we know of can endure the heat of boiling water, 212°, except a few seeds of the higher plants, which are protected by a very hard and non-conducting coat. Most animals and plants, indeed, perish at a much lower temperature. With regard to the bacteria themselves, they are mere specks of naked protoplasm; they are utterly destroyed at 140°, as sufficiently proved by the numerous experiments made by Pasteur, Bastian, and others. It is unlikely, therefore, that they should have germs capable of enduring 306°.

Experiments were also made by Dr. Bastian with fluids capable, after being boiled, of nourishing bacteria when any were put into them, and of supporting their copious reproduction, though not evolving them anew when enclosed in hermetically sealed vessels. The uniform result was that 140° not only kills all living bacteria, but also prevents the further development or reproduction of any germ which might be supposed to exist. The natural conclusion is that they do not exist, and therefore these experiments exploded the germ theory.

We hope that these investigations will continue so as to obtain uniform results; as only then can a full discussion of the possible explanations ensue. In the meantime, Dr. Bastian's experiments are drawing the attention of the most eminent philosophical naturalists. For instance, Alfred R. Wallace ranks Bastian's book as equal in value to Darwin's "Origin of Species," or Spencer's "Principles of Biology," especially in regard to "curious and novel facts," "new and astounding views of the origin of life," "excellent reasoning," and "acute criticisms."

There is, however, one point to which we wish to draw attention; it is the assumption that these living organisms are evolved entirely from inorganic matter. This, we believe, is not strictly correct; the infusions all have organic origin; they are organic compounds, and it is well known that the organic compounds are not decomposed into their inorganic elements, except by actual combustion. Starch, sugar, gelatin, etc., are not destroyed, as such, by a temperature of 300°, therefore, if we attempt to generate living organisms from inorganic matter, we must not commence by using organic substances, but must confine ourselves to elements, or their simple inorganic chemical combinations.

RECENT GEOLOGICAL INVESTIGATIONS.

M. Jules Marcou communicates some interesting geological notes to the French Geographical Society, gathered from various eminent sources, while preparing a new geological map of the globe, recently forwarded to the Vienna Exposition. In Spitzbergen, M. Nordenskjöld has found (independent of the crystalline rocks) palæozoic, carboniferous, triassic and tertiary formations. An important fact, from its bearing on the history of the earth, is the discovery of terrestrial flora dating from the tertiary miocene epoch, which show that the entire arctic polar region must have been covered with vast forests similar to those which now exist in the northern hemisphere as far north as the borders of the tropic of Cancer. In Norway, peat deposits have been found in Andae Island one of the Loffoden group, which, like similar beds in Yorkshire, England, are of the jurassic epoch. The existence, in Russia, of an enormous triassic formation has been determined; this had, heretofore, by Sir Roderick Murchison and others, been attributed to the Permian system. In Syria and Egypt, continuous and extensive deposits of red sandstone indicate the homogeneous nature of the rocks of Asia and Africa. On the other hand, the most recent geological studies, made in New Zealand, Australia, and some of the Pacific Islands, prove that Madagascar, in spite of its proximity to the African continent, appears to belong to a totally distinct formation which closely resembles that of New Zealand and Western Australia. In South America, MM. Musters and Pourtales have found a group of extinct volcanoes between the Gallegos river, Cape Virgin and the eastern entrance of the Straits of Magellan.

M. Marcou considers the classification of stratified rocks, as generally laid down in modern geological treatises, as very imperfect and not justified except in a portion of the northern temperate zone. In the West Indies and California, and on the Missouri river, he states that the difficulties of classifica-

tion augment in proportion as new discoveries are made. In the first mentioned part of the globe, for example, Dr. Waagen has found, in beds of limestone a foot and a half thick, forms of fossils which are generally distributed in very different deposits, and which are supposed to belong to carboniferous, triassic and jurassic rocks. These evidences are not accidental, but are multiplied in Nebraska, Illinois, California, Australia, and even in New Zealand.

THE BASE LINE OF ASTRONOMY.

When a land surveyor wishes to find the distance between two points, separated by an obstacle to direct measurement, say an impassable swamp or a sheet of water, he resorts to triangulation. To the right or left of the line to be determined, he lays off another line, from the extremities of which he takes the compass bearings of the points whose distance from each other he wants to learn. The angles thus found, together with the length of the measured line, are all the data needed for calculating the length of the required line. In extensive surveys, this principle of triangulation is used almost exclusively. A single base line is measured with great accuracy, and all the other distances in the survey are calculated by means of a series of triangles erected on it. The correctness of the entire work depends, consequently, on the exact determination of the length of the primary line. If there be an error in this, the utmost care in all subsequent observations and calculations cannot prevent the survey from going wrong. Hence the minute precautions always taken in choosing the site and determining the exact position of the base line, in reducing it to a perfect level and in finding its length to the minutest fraction, precautions involving the utmost niceness of instrumental construction, the utmost care and patience in observation and calculation, and repeated measurement, occupying months of time.

If the exact survey of a State or a strip of coast line is worthy of so much preliminary care and cost, how much more so is the survey of the universe! In surveying the earth, it is possible at any time to test the correctness of the work by measuring a new line and comparing its length thus found with the length obtained by calculation. In the survey of our Atlantic coast, for example, such a test line was measured on an island in Chesapeake Bay. The original base line lying on Mount Desert Island off the coast of Maine; the result proved the substantial accuracy of the entire work of triangulation covering the larger part of seven or eight States. In astronomy, there is no such ever present means of testing results and ensuring correctness. Everything hinges on the determination of the primary base line, so that any error in it inevitably vitiates the estimate made of every other astronomical distance. And still more, the dimensions and weights of all the heavenly bodies beyond the moon, not less than their distances from the earth and from each other, are determined by calculations which involve the astronomical base line as a known element. It is the foundation, in fact, of all mathematical astronomy. Hence the importance of its determination with the utmost possible accuracy.

The base line in question is the sun's distance from the earth. The measurement of this distance with all attainable exactness, and the determination of the maximum limit of unavoidable error, constitute the most important problem now engaging the attention of the astronomical world. The rare opportunity which will be afforded by the approaching transits of Venus for attacking this fundamental problem, under the most favorable conditions and with all the improvements in means and methods attained by modern science and mechanical skill, very naturally raises those phenomena to the highest rank among the astronomical occurrences of the century. They cannot pass without furnishing data for greatly reducing the known inaccuracy of the current estimate of the sun's distance, and consequently for a more correct determination of all other astronomical magnitudes. "Known inaccuracy!" some may exclaim, especially those whose ideas of heavenly bodies and spaces have been gained from ordinary text books, with their positive statements and professed precision. "Is not astronomy an exact science? And are not the magnitudes it deals with known with mathematical exactness?" If they were, the coming transits of Venus, instead of being scientifically the most momentous events of the age, would be matters of comparatively small account. A few astronomers might make a note of them, but they would hardly engage the attention of all the governments of the civilized world, or give occasion for costly expeditions to the remotest parts of the globe. The figures of astronomy are, and must ever be, approximations to the truth. The question is how small can the margin of error be made.

At present the limits of error, in the measurement of the line on which all other astronomical measures depend, are so far apart that sixty worlds like ours, standing side by side, would not be sufficient to fill the gap. As a consequence, there is an uncertainty of at least four thousand miles in the exactest estimate of the sun's diameter, or some hundreds of millions of cubic miles in its calculated volume; and every other magnitude beyond the moon is proportionately indeterminate.

Ten years ago the accepted figures were very much farther from the truth. For forty years, Encke's estimate of the sun's mean distance, deduced from the observations of the transit of Venus in 1761 and 1779, that is, in round numbers 95,000,000 miles, had held its ground; but so many lines of evidence converged to prove those figures too great that astronomers could not refrain from making the enormous reduction which took the general public so much by surprise about a decade ago. Noticing this astronomical change of base, Sir John Herschel wrote: "The superficial reader (one of a class too numerous) may think it strange and dis-

creditable to science to have erred by nearly four millions of miles in estimating the sun's distance. But such may be reminded that the error of 0.33" (thirty-two hundredths of a second) in the sun's parallax, on which the correction turns, corresponds to the apparent breadth of a human hair at 125 feet, or of a sovereign at 8 miles off."

It is on such minute measurements that the approximate exactness of astronomy depends. The limit of probable error in the latest and most satisfactory determination of the sun's distance is somewhere about half a million miles, say one eighth part of the last correction. We may leave it to the reader to calculate how extremely delicate the observations of the coming transits must be to effect any considerable reduction in this apparently great but relatively minute inexactness.

EFFLUX OF STEAM.

If a fluid issues through an opening, without friction, the velocity of its flow will be the same as it would acquire in falling through a height due to its pressure. For instance, suppose that steam at atmospheric pressure flows into a vacuum. Steam at atmospheric pressure, or 14.7 pounds per square inch, will have a pressure of $14.7 \times 144 = 2116.8$ pounds on the square foot. A cubic foot of steam, at this pressure, weighs about 0.0364 pounds, so that the height of a column of steam, necessary to produce this pressure per square foot, would be $2116.8 \div 0.0364 = 58153$ feet. The velocity acquired by a body in falling through this space is found by extracting the square root of 64.32×58153 . This gives 1934 as the velocity in feet per second with which steam at atmospheric pressure will flow into a vacuum, if there be no frictional resistance. In practice, it is found that when a fluid is discharged through an orifice or tube, the actual velocity is less than the theoretical, so that a coefficient of correction is necessary in using the theoretical formula. Numerous experiments have been made upon the velocity of discharge of water, air and steam, those upon water being the most extended and reliable. It is difficult, when experimenting with steam, to maintain a constant pressure, and the velocity is so great that it is not easy to make an exact measurement. For these reasons, the results of different experiments vary greatly. In this article, we shall endeavor to give the most accurate results that have been obtained.

There is one case, in the flow of water, in which the actual velocity of discharge varies but little from the theoretical. We refer to that in which the water flows through a mouth piece shaped to the form of the contracted vein. This mouthpiece has a length about equal to the diameter, and is constructed with a bell shaped mouth, its diameter being decreased at the middle of its length to about eight tenths of its original size. Experiments with this kind of mouth piece in the case of steam, however, show varying coefficients of velocity for discharges under different pressures. The table given below will illustrate this.

TABLE OF COEFFICIENTS OF THE VELOCITY OF DISCHARGE OF STEAM INTO THE ATMOSPHERE, THROUGH A MOUTHPIECE HAVING THE FORM OF THE CONTRACTED VEIN.

Pressure in pounds per square inch above atmosphere.	Weight per cubic foot.	Coefficient.
1	0.0396	0.93
5	0.0510	0.85
10	0.0598	0.78
20	0.0815	0.71
30	0.1025	0.69
40	0.1232	0.68
50	0.1436	0.67
60	0.1636	0.66
70	0.1833	0.65
80	0.2030	0.64
90	0.2224	0.63
100	0.2410	0.62

These coefficients have been determined experimentally for orifices varying from four tenths of an inch in diameter up to one and a half inches. We will now explain how to use them, illustrating by an example.

The expression for the theoretical velocity is $v = \sqrt{2gh}$, or the velocity of discharge in feet per second is equal to the square root of twice the acceleration due to gravity multiplied by the height due to the effective pressure. The actual velocity is equal to the theoretical velocity multiplied by the proper coefficient.

EXAMPLE: With what velocity will steam at a pressure of 50 pounds by steam gage issue into the atmosphere through a mouthpiece having the form of the contracted vein? Answer: $50 \times 144 = 7200$ pounds pressure per square foot. $7200 \div 0.1436 = 50139$ feet = height due to pressure. $\sqrt{64.32 \times 50139} \times 0.67 \times 1203 =$ velocity of efflux in feet per second. Corrections can be applied to the coefficients given in the preceding table, to adapt them to other cases than that in which the steam issues through a mouthpiece having the form of the contracted vein.

For a tube having rounded edges, and a length equal to once and a half the diameter, deduct 0.03 from the coefficient for any given pressure. For a tube with square edges, and a length from once and a quarter to twice and a half the diameter, deduct 0.13 from the coefficient. For a plain tube whose length is 12 times the diameter, deduct 0.24 from the coefficient. When the length of the tube is 24 times the diameter, deduct 0.28 from the coefficient.

To find the velocity of efflux through an orifice in a thin plate, the thickness of the plate being not more than one tenth the diameter of the orifice, correct the coefficients given in the table as follows: Deduct 0.33, when the pressure does not exceed half a pound per square inch. Deduct 0.21 when the pressure is equal to one atmosphere.

We will give an example in one of these cases, as it will illustrate the method of proceeding for all: Suppose steam of 40 pounds pressure per gage issues through a pipe one

inch in diameter and twenty-four inches long, what is its velocity? Answer: $40 \times 144 = 5760$ pounds pressure per square foot, and $5760 \div 0.1232 = 46753$ feet, height due to pressure.

$\sqrt{64.32 \times 46753} \times (0.68 - 0.28) = 604$, velocity of efflux in feet per second. The preceding constants were determined experimentally by Mr. George Wilson, of England. It will be observed that they apply to orifices from four tenths of an inch to one and a half inches in diameter, and having lengths from one tenth to twenty-four times the diameter, the experiments having been made on the efflux of steam through orifices varying within these limits. Approximate formulas, for general use, have been established by the late Professor Rankine, and we will give these, illustrating them by examples.

Case 1: When the pressure of the medium into which the steam flows is less than three fifths of the pressure in the reservoir, the number of pounds of steam discharged through a pipe or orifice is found by multiplying the area of the pipe (in square inches) by the pressure of steam in the reservoir, and dividing the product by 70. Example: How much steam will be discharged from a boiler into the atmosphere, through a 3 inch pipe, the pressure per gage being 15 pounds? Answer: Here the absolute pressure in the boiler is $15 + 14.7 = 29.7$ pounds per square inch, and the area of the pipe is 7.07 square inches. Hence the quantity of steam discharged per second will be $(29.7 \times 7.07) \div 70 = 2.99$ pounds. The volume of this steam will be $2.99 \div 0.0707 = 42.4$ cubic feet, and the velocity of discharge in feet per second will be found by dividing the volume by the area of the pipe in square feet. This gives the velocity: $42.4 \div 0.0493 = 864$ feet per second.

Case 2. When the pressure of the medium into which the steam is discharged is more than three fifths of the pressure in the reservoir, the number of pounds of steam discharged per second is found as follows: Multiply the area of the pipe (in square inches) by the product of the external pressure divided by 42 and the square root of the difference of the internal and external pressures divided by two thirds of the external pressure. Example: Steam of 5 pounds pressure, per gage, is discharged through a 2 inch pipe into the atmosphere. Absolute pressure of steam in boiler $= 5 + 14.7 = 19.7$ pounds (absolute external pressure $= 14.7$ pounds). Area of pipe $= 3.1416$ square inches. Applying the rule, we find the quantity of steam discharged per second $= 3.1416 \times (19.7 \div 42) \times \sqrt{(19.7 - 14.7) \div (\frac{2}{3} \times 14.7)} = 0.785$ pounds. The volume of this steam is $0.785 \div 0.0487 = 16.1$ cubic feet, and the velocity of discharge is $16.1 \div 0.0218 = 739$ feet per second, 0.0218 being the area of the pipe in square feet.

With the formulas given above, our readers will be able to solve nearly any question that may arise regarding the efflux of steam, with sufficient accuracy for most practical purposes.

EZEKIEL PAGE.

We regret to hear of the demise of Ezekiel Page, formerly of Boston, Mass., inventor of the machine for turning oars. Mr. Page's name has been associated with this particular branch of industry for more than a generation; and at one time he possessed the only factory in the world wherein oars were made by machinery. Indeed at the present day the chief business connected with the oar trade in this country remains in the hands of the Page family. The manufacture has been so perfected that little chance remains for improvement. It is difficult to obtain a poor article from any concern where the Page machinery is used, because the mechanism never slights its work, but imparts true and exact proportions to every piece of lumber. Clumsy ill-shaped oars must be looked for in shops where the labor is done by hand.

Ezekiel Page's first improvement in this line was patented in 1842, for a new method of sawing out the oar lumber. The old method was to saw the logs into square sticks equal in size to the width of the oar blade, one oar being cut from one stick. By giving a peculiar movement to the carriage of the saw machinery, Page was enabled to get two oars out of the same block. He produced two blades where only one before was made. This gave him the oar monopoly and entitled him to rank as a benefactor of the race. His name will be for ever honored by every loyal boatman.

Page's next improvement, patented in 1845, was a mechanism for producing the swell on the oar handle. This he accomplished by means of a contrivance for moving the slide rest of the lathe, in such a manner as to compel the cutters to shape the wood to the exact form required.

Ezekiel Page, at the age of 63 years, rests from his labors. He never made much noise in the world, and yet he contributed, for the use of his fellow men, a discovery of immense economical importance. Think of the millions of oars now used in all parts of the world, and then remember that he taught us how to double the number out of the same piece of wood.

There is one other legacy that he has left us, more precious even than his useful inventions. It is the record of a generous, upright, amiable and well-spent life. Ezekiel Page was an honest man.

Friction of Water in Pipes.

In our article on this subject, on page 48 of the current volume, the formulas should have been printed as follows:

1. Prony's formula:

$$h = 0.0004085 \times (L \div d) \times [(v + 0.15412)^2 - 0.03375].$$

2. Brooklyn Water Commissioners' formula:

$$h = 0.00046749 \times (L \div d) \times (v + 0.397)^2.$$

3. Lane's formula:

$$h = 0.000625 \times (L \div d) \times v^2.$$

We republish them, as, separated from the verbal explanations given in the article, they might be misunderstood.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLACK VARNISH FOR ZINC.

Professor Böttger prepares a black coating for zinc by dissolving 2 parts nitrate of copper and 3 parts crystallized chloride of copper in 64 parts of water, and adding 8 parts of nitric acid of specific gravity. This, however, is quite expensive; and in some places, the copper salts are difficult to obtain. On this account Pascher prepares black paint or varnish with the following simple ingredients: Equal parts of chlorate of potash and blue vitriol are dissolved in 36 times as much warm water, and the solution left to cool. If the sulphate of copper used contains iron, it is precipitated as a hydrated oxide and can be removed by decantation or filtration. The zinc castings are then immersed for a few seconds in the solution until quite black, rinsed off with water, and dried. Even before it is dry, the black coating adheres to the object so that it may be wiped dry with a cloth. A more economical method, since a much smaller quantity of the salt solution is required, is to apply it repeatedly with a sponge. If copper colored spots appear during the operation, the solution is applied to them a second time, and after a while they turn black. As soon as the object becomes equally black all over, it is washed with water and dried. On rubbing, the coating acquires a glittering appearance like indigo, which disappears on applying a few drops of linseed oil varnish or "wax milk," and the zinc then has a deep black color and gloss. The wax milk just mentioned is prepared by boiling 1 part of yellow soap and 3 parts Japanese wax in 21 parts of water, until the soap dissolves. When cold, it has the consistency of salve, and will keep in closed vessels as long as desired. It can be used for polishing carved wood work and for waxing ballroom floors, as it is cheaper than the solution of wax in turpentine, and does not stick or smell so disagreeable as the latter. A permanent black ink for zinc labels is prepared by dissolving equal parts of chlorate of potash and sulphate of copper in 18 parts of water, and adding some gum arabic solution. The black polish above described is recommended as permanent and capable of resisting quite a high temperature.

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.

YELLOW GLASS FOR PHOTOGRAPHIC PURPOSES.

The following simple method of testing the actinic properties of yellow glass for dark rooms is by Le Neve Foster, and the only apparatus required is a cheap glass prism. When a strip of white paper is placed on a dull black surface and looked at, through the prism, by daylight, it has the appearance of the rainbow, showing a complete spectrum. On bringing the yellow glass in question between the prism and the strip of white paper, those colors which are absorbed by the colored glass disappear. If on looking through the prism any blue or violet rays are seen, it is certain that the glass transmits the chemical rays and hence is unfit for photographer's use. If only red and yellow be seen, it is non actinic.

TESTING SULPHATE OF ALUMINA.

Sulphate of alumina frequently contains an excess of acid which injures it for use in dyeing. Whether the sulphuric acid be present in excess is easily ascertained by stirring the pulverized salt into alcohol, which dissolves the free acid but not the salt. It is then only necessary to filter the solution and test for acid with litmus. The amount of sulphuric acid can also be obtained volumetrically. Pure sulphate of alumina produces with a decoction of campeachy wood a dark violet or purple color. If free acid be present, the color is brown.

PROGRESS OF THE HOOSAC TUNNEL DURING THE MONTH OF JULY, 1873.—East end section: Heading completed December 12, 1872. Central section: Heading advanced westward, 151 feet. West end section: Heading advanced eastward, 137 feet. Total advance of headings during month, 288 feet. Length opened from east end westward, 14,235 feet; length opened from west end eastward, 9,677 feet. Total lengths opened to August 1, 1873, 23,912 feet. Length remaining to be opened August 1, 1,119 feet.

ALBUMEN EXTRACTED FROM MILK.—Schwalbe has found that if oil of mustard be added to cow's milk in the proportion of one drop to 1.1 drams, the milk does not coagulate even after being kept for a considerable period; but that the caseine is transformed into albumen. If this discovery, says *Le Monde*, is confirmed, it will be of considerable importance in the printed fabric industry.

SQUEAKING BOOTS AND SHOES.—To prevent the soles of boots or shoes from squeaking, says the *Shoe and Leather Chronicle*, rasp, with a coarse rasp, the outsole and insole, and every other piece of leather that comes in contact in friction by the action of the foot. Then apply freely good wheat or rye paste. If this is well attended to from heel to toe, the boot or shoe will not squeak.

COLT'S FIREARMS COMPANY has just received an order for 80,000 pistols. Smith & Wesson have commenced work upon 20,000 Russian pistols, and will make about 150 daily.

[Continued from first page.]

In 1786, substituted large chambers of lead for the glass vessels used by Ward, that the manufacture of sulphuric acid on the large scale, and at a greatly reduced price, became an established fact. It was found that, in working these chambers, a comparatively small quantity of niter could convert a very large amount of sulphurous acid into sulphuric, and chemists consequently set themselves to study the reactions that took place.



THE SULPHUR BURNERS.

There is a compound of nitrogen, known as nitrogen tri-oxide, N_2O_3 , that is, 2 atoms of nitrogen combined with 3 atoms of oxygen, which will yield up at once, to sulphurous acid, one atom or equivalent of oxygen, just sufficient to oxidize the sulphurous into sulphuric acid. This nitrogen tri-oxide, having lost one atom or equivalent of oxygen, will take up its lost oxygen from the air, if mingled with it, and again deliver up its oxygen to another portion of sulphurous acid, and so on *ad infinitum*, acting as a carrier of oxygen from the air to the sulphurous acid. All that we have to do, then, is to mix sulphurous acid gas, air, and nitrogen tri-oxide with some steam, the water of which is an essential ingredient in sulphuric acid, in a suitable vessel, to obtain all the oil of vitriol needed. On the large scale this is one of the most complete and interesting operations of practical chemistry.

On entering chemical works, where oil of vitriol is made, our attention is first directed to the

SULPHUR BURNERS.

These consist of small furnaces built of brick, a section of one of which is shown in the illustration above. Their sizes and number are regulated by the amount of sulphur proposed to be burned in a given time. The bed of each burner consists of an iron plate, termed a burner plate, on which the combustion of the sulphur takes place, and underneath which there is a flue (as seen in the illustration, connected in the rear with the chimney or shaft). Through this flue and underneath the burner plate, a constant current of air circulates. Its object is to regulate the heat of the plate, which might otherwise become so hot as to volatilize the sulphur. Each furnace is provided with a door, closed with an iron shutter but sufficiently loose to allow enough air to enter to completely oxidize the sulphur which burns into sulphurous acid. Into each burner the workman throws at intervals a shovelful of brimstone, as the crude material is sometimes termed. The moment this is done, he takes up an iron receptacle about a foot long, and



NITER POT AND FORK.

4 or 5 inches wide and deep, termed a niter pot. This is rapidly filled about half full of nitrate of soda, and covered to the depth of an inch or two with oil of vitriol from an earthenware pitcher at his side. The niter pot being charged at the mouth of the burner, the workman pushes it with a two pronged iron fork into the now glowing sulphur to about the middle of the furnace. The door is closed, and the same operation repeated with each burner until all are charged.

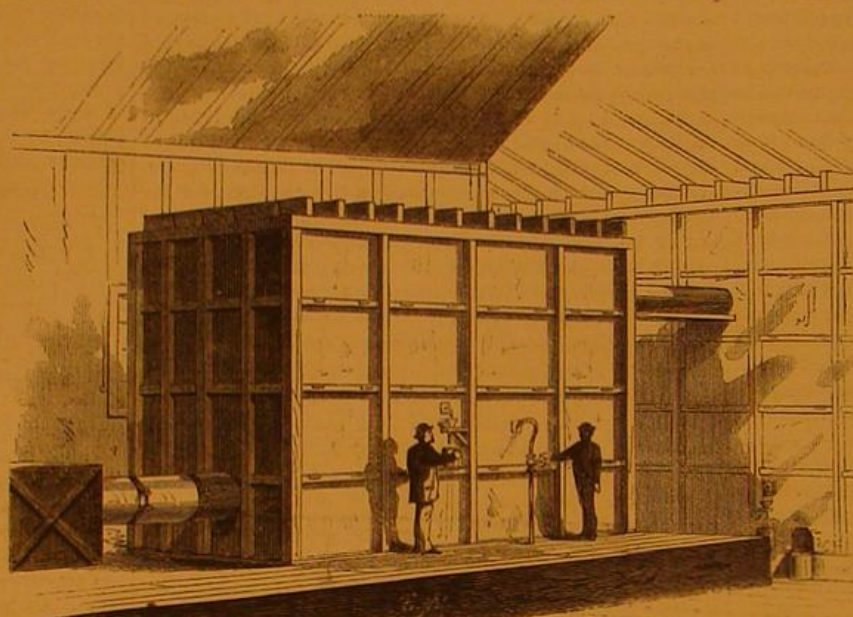
We have seen how necessary nitrogen tri-oxide is in the oxidation of sulphurous into sulphuric acid. This nitrogen tri-oxide, however, is not at once produced. The fumes from the niter pot, from the action of the oil of vitriol upon the nitrate of soda, consist of nitric acid, NO_2 . But in the chamber this nitric acid yields up nearly all its oxygen to the sulphurous acid, becoming reduced to NO, or nitric oxide. This nitric oxide, meeting with the air in the chamber, abstracts oxygen, becoming nitrogen tri-oxide, N_2O_3 , which we have considered as the carrier of oxygen from the air to the sulphurous acid.

Although sulphur is almost exclusively employed in this country as the source of sulphurous acid, in England very

large quantities of iron disulphide, known as iron pyrites, are used. The mineral being often a bright, brassy looking ore, is sometimes termed fool's gold, from the fact that many inexperienced persons are deceived by its appearance. Where it occurs in large beds or veins, and especially when it contains a small percentage of copper, it may be economically utilized as a source of sulphurous acid. This is the case at Anthony's Nose, on the Hudson river, where chemical works were erected a few years ago by Mr. G. W. Gesner, a manufacturing chemist of New York, for the purpose of utilizing an extensive bed of pyrites that occurs in the hills close by. This deposit of ore was originally developed in the hopes of finding copper, but the great mass of the ore is hard, compact iron pyrites. In the production of sulphurous acid, it is burned in high, narrow furnaces. When once kindled, the mineral contains sufficient sulphur to support its own combustion. The workman has only to keep the ore well stirred up or "tickled" at intervals, the ore being supplied to the furnace by a door at the top, and the residue, when the burning is completed, carefully raked out from the bottom. From the sulphur burners, then, or from the pyrites kiln, let us follow the mixed sulphurous and nitrous fumes, through a flue, seen on the left in the illustration, to the

LEADEN CHAMBERS.

Here we have an immense room or series of rooms, whose top, bottom, and sides, are constructed of 5 lbs. sheet lead, or lead that weighs 5 lbs. per square foot. The walls and top are sustained by a framework of wood, to which they are fastened at intervals by leaden straps, fixed to the chamber, and overlapping the wooden frame, while heavy columns of wood or iron beneath serve to support the great weight of the structure above. The room under the cham-



MANUFACTURE OF OIL OF VITRIOL. THE LEADEN CHAMBERS.

bers contains the bins for the storage of the sulphur and niter used. Lead is used in the construction of the chambers, because sulphuric acid has but little oxidizing effect on it except at a high temperature, but no solder can be employed in joining the sheets, because this soon gives way. The heavy sheets of lead must be cemented at their edges in some way that will make a tight, strong joint, and one that the acid cannot eat through. This is done by melting the edges of the sheets together by means of a blowpipe, done by men technically called lead burners. The lead burner is supplied, through long flexible tubes, with a current of hydrogen gas and one of atmospheric air. The hydrogen is generated in the usual manner, by the action of dilute sulphuric acid on metallic zinc, and the air is supplied from a pair of bellows, operated by an attendant. To avoid any risk of explosion, the gases are mixed just before combustion in the blowpipe itself. The combustion of the mixed hydrogen and atmospheric air gives rise to a very hot flame, by means of which the lead burner melts the clean edges of the soft metal together, making a joint that will last as long, of course, as the lead itself. Considerable practice and skill are required in the operation, and a horizontal joint is made more easily than a vertical one.

Steam is admitted into the chamber, by a small pipe, fitted with a stopcock, as seen with the attendant in the illustration. Finally, we have a vast space inclosed on all sides with lead, and filled with dense suffocating fumes of sulphurous acid and nitrogen tri-oxide, mingled with the more harmless vapor of water and atmospheric air. Here take place the chemical transformations previously shown, and here the production of sulphuric acid goes on uninterrupted, night and day, to the extent, in the largest works, of thousands of gallons daily.

The capacity of some of these chambers, the largest of which are found in England, is worth noting. Mr. Scholefield, of Bradford, near Manchester, has a chamber 70 feet long, 35 feet wide, and 35 feet high, with a capacity of 85,750 cubic feet. At Spence's chemical works, Newton Heath, England, there is a chamber 75 feet long, 40 feet high, 50 feet wide, containing, consequently, 120,000 cubic feet, or room enough to inclose two or three good sized houses. Muspratt Brothers and Huntley, at Flint, North Wales, have a chamber 140 feet long, 24½ feet wide, and 19½ feet high.

Fixed to the side of the chamber, and shown in detail in the illustration, we have a drip for testing gravity. This consists of a leaden receptacle, into which the acid formed

in the chamber trickles or drips, through a pipe perforating it. The acid is caught by means of a trough or spout running along the interior side of the chamber, and is tested, when received, as to its specific gravity by a hydrometer. The acid formed in the chambers falls with the condensed steam, and collects on the bottom or floor. This liquid has a specific gravity of 1.55, stands at 45° Baumé's hydrometer, and is known as 45 or chamber acid. Containing 50 per cent real acid, it is frequently used for various purposes, as the manufacture of superphosphate of lime. Its concentration, however, as we shall presently see, is generally carried much further.

We have seen how the nitrous fumes, or nitrogen tri-oxide, act the part, simply, of a carrier of oxygen from the air to the sulphurous acid. Theoretically, then, when once the chambers contained the requisite amount of nitrogen tri-oxide, this should suffice for the oxidation of an unlimited amount of sulphurous acid. Practically, however, from 6 to 10 per cent of niter, in proportion to the sulphur, is ordinarily required. This is owing to the fact of so much nitrogen tri-oxide being carried up the chimney, or stack, with which the chambers are necessarily connected to maintain a draft through them. To save these fumes we have what are called

COKE COLUMNS.

or "Gay Lussac's Towers," from the name of the illustrious chemist and inventor. These consist of high narrow chambers lined with lead, and filled with pieces of coke, down through which oil of vitriol is caused to drip from the top. The towers are connected, as seen in the illustration, the first at the top with the end of the chamber, the second joined to the first at the bottom by a leaden flue, and finally the top of the second tower connected with the stack. The waste gases of the chamber, containing the nitrous fumes, are thus compelled to pass down the first tower and up the second, before escaping. In their passage, the oil of vitriol, trickling through the coke, largely absorbs the nitrous fumes, so that by this method the amount of niter used is reduced 50 per cent; the acid containing the nitrous compounds is then returned to the front of the chamber, where the heat is sufficient to liberate the nitrous fumes again.

To effect the first concentration of the chamber acid, it is run off into

LEADEN CONCENTRATING PANS.

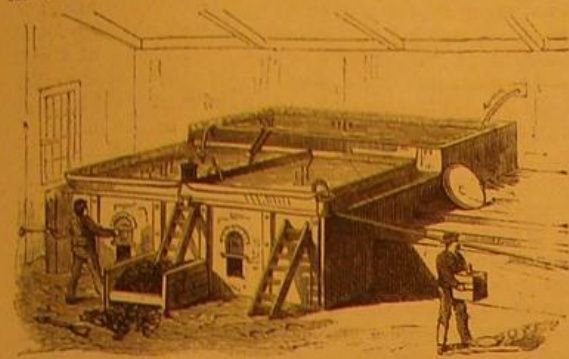
These are shallow leaden vessels, made of very stout sheet lead, and set in a furnace upon wrought iron plates, which receive the direct flame of the fuel. Three, four, or more pans are generally used, and connected together by siphons. In the lead pans, the concentration is carried up to 60° Baumé and specific gravity 1.75, at which point, at the heat necessary for evaporation, the acid begins to attack the lead. This is termed 60 acid or pan acid, and is sometimes sold and used for various purposes. Neither the manufacturer nor the trader, however, is satisfied with this degree of concentration. From the lead pans, the acid is usually run off into platinum stills, where it is concentrated until it attains the specific gravity of 1.842 and stands at 66 Baumé, when



THE COKE COLUMNS.

It is called 66 acid or oil of vitriol. These beautiful white platinum stills are very expensive. A still capable of making 100 carboys, or 16,000 pounds, a day will weigh only 200 pounds, yet cost \$20,000, or at the rate of \$100 per pound. And yet platinum is the only available metal which will withstand the action of sulphuric acid, at the high degree of heat, 600° Fah., necessary for the manufacture of oil of vitriol, or 66 acid. Even this metal, in the course of time, becomes so thin at the bottom of the still that it must be

patched or renewed. When a break occurs, it is sometimes soldered with gold. To avoid the large outlay of capital for a platinum still, various suggestions have been made as to the use of other materials, and various forms of apparatus have been devised for the final concentration of sulphuric acid.



LEADEN CONCENTRATING PANS.

Although glass has been tried, and used in England, we know of no apparatus more ingenious and effective than the

PATENT GLASS CONCENTRATING RETORTS

shown in the large illustration (front page), and now in successful use at the Phoenix Chemical Works, South Brooklyn, N. Y. Here we have eight glass retorts, each holding about five gallons, and each set in a separate sand bath, in furnaces charged from the side. The acid from the leaden pans enters by a siphon, the upper retorts of each set or series, and flows out, after attaining a certain height, by a glass tube, into the next lower vessel. By the time the acid has reached the lower retort, it is concentrated up to strength, that is, 66° Baumé. It then flows out into a leaden pipe set in a trough of running water, where it is cooled to some extent, and whence it flows into shallow leaden pans to undergo a further reduction of temperature before it is packed for the trade. The goose neck of each retort is connected with a leaden pipe, seen in the illustration between the two series. This pipe joins a flue (seen on the left, rising from the lower end of the furnace) which conveys the mixed vapors of acid and water, evolved during the concentration, to a condensing chamber, also of lead, where the acid, which would be otherwise lost, is recovered.

Although of so fragile a nature, the inventor informs us that, with care and attention, it is not very often a retort breaks; he had not lost one during the last six months. When this does happen, however, means are provided in the shape of a channel, which runs under and communicates with each sand bath containing the retorts for the purpose of recovering all the acid possible and delivering it into a receptacle in front of the furnaces.

This apparatus of concentrating retorts is far cheaper than a platinum still. The glass retorts, with their furnaces and connections, capable of concentrating 100 carboys daily, will cost about \$2,000, while a platinum still, capable of doing the same work, will cost \$20,000.

We now follow the acid from the concentrating retorts to the cooling cisterns, where our illustration shows the workman

FILLING THE CARBOYS.

This is done by means of a leaden siphon, provided with a stop cock. Care is taken not to fill it quite full, otherwise the absorption of water from the air by the acid, in the



FILLING THE CARBOYS.

course of time, will cause an overflow. A carboy is a large blown glass bottle containing eight or ten gallons, packed in hay or straw and set in a square wooden box. The mouth is closed when full, to prevent spilling and access of air, as far as practicable, by a stopper of clay, which is covered with a common canvas rag, and the whole smeared outside with tar. This makes a primitive rough-looking package, and one extremely liable to accident and breakage; but the trade seems to be satisfied with it. An opportunity is here afforded for some ingenious inventor to make an improvement.

When once the glass is cracked or broken at the bottom, there is a sudden end of the carboy, as both straw and wood soon become converted into soft charcoal. These carboys are transported all over the country, and, when emptied, returned to the manufacturer, if not too distant, to be replenished.

The quantity of oil of vitriol annually manufactured in

Great Britain amounts to about 200,000 tons, that made in the South Lancashire district alone exceeding 3,000 tons per week.

We are indebted to Messrs. Gridley & Coffin, proprietors of the Phoenix Chemical Works, and to Mr. Saunders, the superintendent, for facilities afforded in making the illustrations connected with our article.

NORWAY AND SWEDEN.

An esteemed correspondent, now traveling in Northern Europe, remarks as follows:

"Never could more dissimilar nations be united under one government than Norway and Sweden. Norway clings with the most absurd tenacity to old things and old ways of doing them, while Sweden is ready to advance with the rest of the world. The difference appears strikingly on the line of railroad between Christiania and Stockholm. The road is about 400 miles long, of which, say, 100 are in Norway and 300 in Sweden. The time for express trains is about 20 hours. Of this, something like 8 hours is taken for the Norwegian 100 miles, leaving 12 hours—really, only 11 hours—for the Swedish 300 miles, or 12 miles against 25 miles per hour. But most of the travel in Norway is by the very old fashion of carriages and post horses, the principal roads—under government care—being in good order and the speed averaging, with push, six or seven miles per hour.

The American Consul in Christiania—which is the only live part of Norway—is trying hard to get our mowers and reapers into use there, though thus far with indifferent success. In Sweden, these things are being taken hold of with something like freedom. The Swedes are, evidently, a contriving and mechanical people, and in such things very much in advance of their neighbors. They are just the kind of people to be at home in America, and the very best kind of people America could have. In both countries, as well as in Great Britain, I heard the loudest kind of lamentation over the great emigration to America. Lack of laborers causes strikes and high prices, they say, and reduces the means of the old countries and the values at the same time. Land, generally, seems to have touched its highest point everywhere on this side the ocean, and to be falling with no little rapidity, and with an ever diminishing number of purchasers. Of course, I speak generally and not particularly. What shall we do about it? seems to be an absorbing question, in each of the countries through which I have passed. The story of success in America flows back from every pen; and those who remain, having friends who have gone before, are in nearly every case anxious only to get away themselves."

Origin of Plagues.

Dr. Tholozan, physician in chief to the Shah of Persia recently read a paper before the French Academy of Sciences on the origin of pestilence. It has been generally believed, he said, that the plague or eruptive fever was exclusively engendered in low, warm, and marshy regions, especially in the north of Africa and in Asia Minor. This opinion is, however, without foundation, and a large number of facts as well as the evidence of past inflictions, prove that the disease may originate in any latitude, under all climates and in all countries, however elevated. It is not a consequence of climate or meteorologic influence, nor even the necessary concomitant of unhygienic causes, however energetic. Famine, for instance, breeds typhus fever rather than the plague. This exclusion of all physical origin leads to the conviction that the malady is due to some animal ferment; the pest, in short, is an organic fermentation.

M. Tholozan added that he considered the deadly forms of pestilence so common in Kurdistan to be principally due to the intimate contact of the inhabitants with their sheep in unhealthy and badly aired cabins.

Shocking Accident.

J. E. E., of Pa., says that Miss Craft, a young lady from Beaver Falls, Pa., while in a flouring mill, was standing near two upright shafts that were revolving at the rate of fifty revolutions per minute, one of the shafts being covered with sticky corroded oil. Her dress, being of light material, touched and adhered to it; and instantly winding around the shaft, she was drawn between the two (they are only a few inches apart) which caught her flowing hair, then tearing the entire scalp from her head, to the eyebrows. One leg was badly fractured and she was much lacerated and bruised. She lies in a critical condition and her physicians have no hopes of her recovery.

Upright running shafts are always dangerous, and owners should have them encased with wood boxing

New Photo-Process.

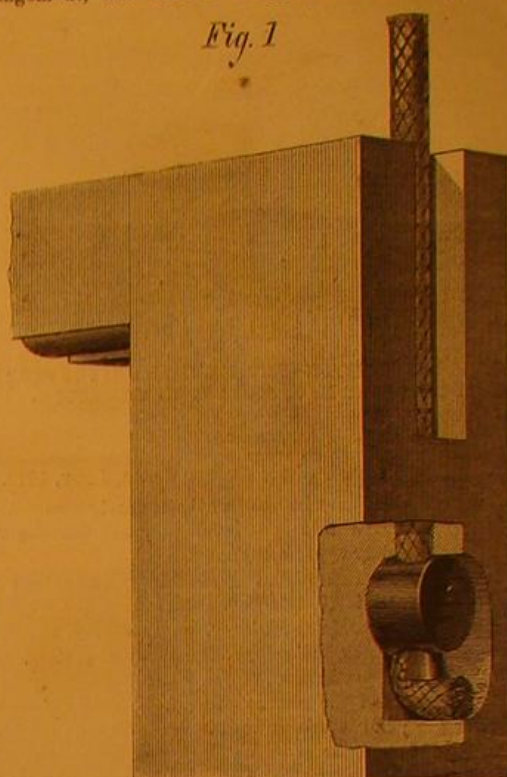
A recent improvement, announced by Mr. Burgess, a photographic artist of Peckham, England, consists in sensitizing gelatin by means of bromide of silver. The mixture is applied warm to the glass plate, and the picture may be taken with the plate either wet or dry. The time of exposure is the same as for the ordinary wet collodion plates. The alkaline-pyro developer is used, the picture making its appearance rapidly, with any required degree of intensity. The new process promises to compete sharply with the ordinary collodion process.

The reason why common salt sometimes becomes moist when exposed to the atmosphere is because it is not pure. Chloride of calcium and chloride of magnesium are impurities generally present in salt, and they absorb moisture from the air.

HARRIS & HEWITT'S PATENT SASH CORD FASTENER.

The object of the invention represented in the accompanying engravings is to dispense with the knot commonly used to fasten window cords to sashes. Any one, who has ever attempted to re-adjust the old fashioned though simple arrangement, will not fail to appreciate the utility of the

Fig. 1



new device. An old knot is very commonly drawn up into the hole through which the cord passes, and requires no small exercise of time and patience to force it out. This only begins the trouble, for the rope has become hard and jammed, and persistently refuses to untie. After breaking off his finger nails and working himself into an uncomfortable perspiration, the operator, probably with a few forcible interjections, settles the difficulty by hacking the obdurate knot off with his knife. Then he pokes the rope carefully through the hole again, triumphantly ties a new knot, and pulls down the sash with a sigh of relief. The window descends nicely until within two inches of the bottom, and declines to move any further. He pulls, and pitches his whole weight on it, and gets mad, and screams short texts not taught in Sunday schools, and finally tries to push it down with his foot, and in doing so breaks a pane of glass. Then he retires for a short distance, and sits down on a tool box and glares. Eventually he discovers that the cord, by cutting off the knot, has become too short, and the weight is jammed against the pulley; and consequently, after briefly communing with the weight and the cord and everything in any wise connected with the window, he puts on his coat, and goes down the street for a new rope, which, after considerable tribulation, he manages to adjust.

All this trouble is obviated by the little fixture herewith illustrated, the cost of which is only nominal, being, at retail, less than six cents to a window. It consists of a short cylindrical casting with a taper hole through it, through which the cord is passed after being threaded through the opening in the edge of the sash in the usual manner. There is also a serrated wedge, which is pressed into the hole in the fixture beside the cord, as shown in the illustration, fastening it very securely. This wedge is so proportioned that it is impossible to draw it through the casting, and no matter how hard it may be dragged up, a slight pull at the short

Fig. 2



Fig. 3



end of the cord will instantly release it for renewal or re-adjustment. No special preparation of the sash, different from that ordinarily made for the knotted cord, is necessary.

The expense of this fixture, it is claimed, in first hanging, is more than saved in time and cord. It has been tested or examined, and is approved, by the leading builders and architects of Newark, N. J.

Patented July 22, 1873, by Horace Harris and Frederick Hewitt, 788 Broad street, Newark, N. J., from whom further particulars may be obtained.

APPROACHING EXHIBITION AT MONTREAL.—An agricultural and industrial exhibition will be held at Montreal on September 16, 17, 18, and 19, 1873. In all departments, the competition is open to exhibitors from any part of the world. The whole fields of agriculture and manufactures, commercial and domestic, are covered by the long list of premiums. Mr. Georges Leclère is the secretary, who will furnish full particulars if addressed at Montreal, P. Q.



THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 6.

VIENNA WELT-AUSSTELLUNG, JULY, 1873.

The work of the juries has, at last, been nearly completed, and the members of the international jury are leaving Vienna for their widely separated homes.

In Group XIII, which embraces machinery and means of transport, the work is all done, even including the awards of the great *Ehren Diplom*, unless, as is almost invariably the case at such exhibitions, a few tardy or careless exhibitors have been overlooked.

The publication of the awards will not be officially made for some weeks; but it seems well understood that the distribution has been made with unusual discrimination; although the usual error of too great liberality will, very probably, be noted here, and an occasional obvious mistake may subject the jury to severe criticism.

Of these awards, the United States section is generally supposed, and probably with good reason, to have received a liberal share, and to have taken a proportion of the medals for "Progress" entirely beyond comparison with that of any other nation. The richness of our own section in original and valuable mechanical devices is thus well illustrated.

Unsatisfactory and incomplete as our exhibit in the Machinery Hall appears to every American engineer, it seems, to the European, remarkably rich in valuable novelties.

It will probably be found that, should any of our people find themselves undeservedly overlooked, or their exhibits not as fully appreciated by the juries as they should be, their misfortunes will, in most cases, be a consequence of their own errors, either in neglecting to secure good representatives here, or in the still less excusable, although extremely frequent, neglect to prepare for the jury exact and minute descriptions of their apparatus and of their claims. American exhibitors have been vastly more careless of their own interests, as a rule, than have the exhibitors of any other nation. Should the result prove that we have been kindly dealt with, it must be attributed to the conscientiousness of the juries, and to the peculiar ingenuity and the exceptional merit displayed in our machinery department, rather than to the efforts of those most directly interested in securing careful examination and thorough discussion of the merits of individual exhibits.

One of the most interesting records in our notebook is that of a day spent in looking over the

STEAM ENGINES,

of which a large number, of all sizes and varieties, are distributed throughout the exhibition. The larger examples of stationary engines are, very generally, more or less exact copies of the Corliss. The Sulzer engine, which is one of the largest on exhibition and which has attracted special attention, would be considered a modified Corliss engine—a modification also which is, on the whole, in the wrong direction. It appears in my notebook under the denomination of "the Sickels Corliss-Greene engine of the Swiss section." It has a "drop cut-off"—the invention of Sickels—and has the poppet valve which is usually found on American engines of the Sickels type. Its governor determines the point of cut-off, and it is therefore, so far, a Corliss engine. The peculiar motion adopted for engaging and disengaging is something intermediate between that of Corliss and one of the systems of Greene. The engine has a condenser, and is said to work with a creditable degree of economy.

Comparatively few of the Corliss engines seen here are precise copies of the original. Builders have usually endeavored to produce some difference of detail, which they claim to be peculiar to themselves, and to be improvement upon the standard machines. They seldom or never succeed, however, in either avoiding its defects or in introducing improvements. The defects of the Corliss engine are not numerous, and those which exist are inherent in that peculiarly typical and unique design which has grown into its most perfect shape in the hands of its originator. To eradicate them necessitates a change in every detail and the complete transformation of the whole design. To effect improvement, the engineer who makes the attempt must excel all who have yet made a similar effort.

The Corliss engine is a quarter of a century old, and is, to day, very nearly as it was then, one of the most complete illustrations of a mechanical type that can be found. It affords, to the student of mechanical "comparative anatomy,"

one of his most interesting studies. But the Corliss engine cannot be claimed to be a perfect machine. English builders, who usually exhibit quite a different style of engine, while forgetting that an effective expansion (variable by the governor) can only be obtained, so far as engineers have yet learned, by the use of a detachable valve gear, unless at the sacrifice of delicacy in regulation, have persistently adhered to the use of the steam jacket, a detail never seen in the Corliss engine. The best

ENGLISH EXHIBITORS

have usually presented a type of engine which is quite different from the Corliss. The bed is usually flat and broad, and carries the cylinder, the guides, and the shaft pillow-blocks, as was formerly the universal practice with horizontal engines. The steam cylinder is jacketed, and the jacket is fitted with independent pipes to supply it with steam and to drain off water of condensation. The valve gear is that of Meyer: two blocks united by a screw with right and left hand thread, riding on the back of the main valve. In at least one instance, the designer has shown his appreciation of the importance of allowing the least possible clearance by dividing the valve and making of it two, which cover ports at either end of the cylinder, instead of adopting the ordinary form with its necessarily long steam passages. The governor moves a valve in the steam pipe and the degree of expansion is determined by the engineer, who, by use of the screw, separates or draws together the cut-off blocks as occasion may seem to require.

One English firm exhibits an engine in which this is done by a link motion, the link being moved by a Porter governor. The Porter governor, it may be remarked, is to be met with in every part of the Machinery Hall and its annexes. Even the rough and awkward looking engines which drive the machinery of the breweries and the sugar mills are frequently supplied with this American regulator.

The crank is usually given up for engines of short stroke, and a disk, carrying a counterbalance, takes its place. The workmanship of these standard British engines is usually excellent, and several firms present machines of the best of workmanship and having a most magnificent finish. Such a style of finish I have never been fortunate enough to see at home, even on engines "gotten up for the occasion," as these evidently are. One English engine, of considerable size, has a plain steam valve at each end of the cylinder, and, on the top of each, is an expansion valve, apparently of the "gridiron" sort, sliding transversely. The time of its movement, relatively to that of the main valve, is determined by an ingenious system of ponderous gearing, intermediate between the valve motion shaft and the main shaft, whose axes are varied in position by the action of a large fly ball governor. It may work well, as a number of certificates exhibited by the builder claim that it does; but the first impression of the stranger is that such a weight of gearing must add seriously to the cost of the engine, even if it does not impede the action of the governor, and add perceptibly to the resistance of the machine itself. It looks like a monstrosity of engineering.

Two compound stationary engines are exhibited. One, in the British section, by Galloway, has cylinders of 14 and 24 inches diameter, respectively, and a stroke of 2½ feet. Its cranks are set opposite each other. Regulation is effected by a peculiar governor, resembling Porter's in being weighted and running at high speed, which adjusts the link operating the main valve. The steam jacket is not used, this important defect being supposed to be compensated by the resulting simplicity of the cylinder castings, and by the convenience with which the intermediate valves may be reached. This engine is rated at 100 horse power, is well made, and moderately well finished. The

FRENCH

exhibit no stationary engines worthy of special notice, except, perhaps, in one case, where an engine has been built with crank shaft bearings spread far apart with no other apparent object than that of placing the eccentrics inside. The awkwardness of the arrangement is something remarkable and not at all to the credit of the designer. The

SWISS,

beside the Sulzer engine already noticed, exhibit two Corliss engines, and a fourth engine which combines the Corliss and the well known device known among our engineers as the "French cam." In this example, the condenser and air pump are contained in the engine frame.

The other engine, which would generally be considered the best of all from the fact that it least departs from the standard design, is well built and prettily finished. Its balance wheel is a mortise gear, and a very common feature of those foreign built engines. The only stationary engine presented by

BELGIUM

is that of the great firm of Bede & Co., which seems, in the opinion of engineers here, to divide the honors with that of the *Gebrüder Sulzer*. It is a "mixed Sickels-Corliss," and is one of the least objectionable of the new departures from the familiar American design. The steam valves are moved by two separate heart-shaped cams. The trip and the regulating apparatus are essentially the forms of Sickels and Corliss respectively.

GERMANY AND AUSTRIA

exhibit several Corliss engines, usually with useless changes, misnamed "improvements," and also a few engines of less creditable form.

The Dingle compound engine is one of the quietest engines in the Exposition, and attracts attention by its noiselessness and its rapidity of rotation. It seems to be fitted

with continuously revolving valves, and to possess many peculiarities which will require further investigation.

On the whole, it may be said that the now well established principles of steam engine economy: dry steam, high pressure, a maximum expansion, high piston speed, efficient steam jacketing, and perfect regulation: are not fully recognized in the design of any one steam engine exhibited here, and that the best machines, of considerable size, which are found in the exhibition, are more or less exact copies of a well known standard American engine. Of this, or of any other of the several leading forms of steam engine which are so familiar at home, no single example is to be seen in the

UNITED STATES SECTION.

Of a smaller class, the two beautiful little vertical engines of the New York Safety Steam Power Company, which are in operation in the American department, are excellent examples. Their elegance of design, fine workmanship, and high finish attract attention and elicit many compliments from visitors. The neat horizontal engine of the Norwalk Iron Works represents also another of our best efforts in small powers, and another small engine, furnished by Pickering & Davis, is always under inspection. This latter engine has been designed especially for the use of the Underwood angular belting. Its fly wheel is in line with the piston rod and is driven by a pair of rods and cranks, one on either side. The narrowness of the face of the wheel which is allowed by the cord like belt permits this arrangement to be adopted without too great lengthening of the crosshead.

Judging by what is to be seen here, it must be concluded that the building of stationary steam engines for general purposes has made very little progress during the interval which has elapsed since the Paris Exposition, which last permitted a similar international competition, and indeed, it may perhaps be said, during the last score of years. Correct principles are but little more completely, although much more generally, applied now than many years ago, notwithstanding the fact that the great scientific principles which underlie all successful engineering practice have, during this same interval, received their most wonderful and essential development.

It is to be hoped that the same observations may not be called forth by the study of the American International Exhibition of 1876. Yet it rarely happens that marked changes in engineering practice take place in so short an interval of time as that which separates us from that event.

R. H. T.

Correspondence.

Boilers and Boiler Owners.

To the Editor of the Scientific American:

Your article on "Boilers and Boiler Owners," on page 38 of your current volume, reminds me of a specimen I saw three or four weeks ago. While in an engine room near here, the engineer showed me a piece of the feed pipe and mud drum taken from under his boiler. Two weeks previous to the time of taking the mud drum out, the boiler had been tested to a pressure of 125 lbs. per square inch, the pump and boiler gage agreeing. By examining I found that a hammer could be driven through the pipe and drum at any place, while, in some places, the blade of a pocket knife could be thrust through.

Query: Why is it that boilers and mud drums are enabled to sustain so high a pressure, in such a condition as the above, and the one at Bay City, Mich., were in? A. J. Austin, Texas.

Jumping from Railway Trains.

To the Editor of the Scientific American:

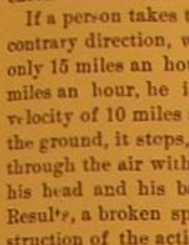
The query of J. B. T., on page 27 of your current volume: "Why is it that engineers, etc., jumping from moving trains, invariably jump in the direction of the moving train?" induces me to write a few words on the subject; a subject that every one who rides, whether by horse or steam power, ought to fully understand for all such are liable to be sometime exposed to danger. They should know what is best to be done at the last moment of an emergency, never before; for jumping is so dangerous that it is only when the case is desperate that it should be attempted. The reason for jumping forward is that that course is the safest; the experience of engineers confirms this, and it is easily demonstrated by theory. Your correspondent argues that it is the most dangerous. If every one could, like him, jump with the velocity of 15 miles an hour, = 21 feet per second, the difference might not be so great, but I consider only the case of average humanity. But in his case, if the velocity of the train is 30 miles an hour, and he jumps in the opposite direction 15 miles an hour, he will then move 15 miles an hour with the train, and strike the ground with a force that will almost certainly be fatal.

In the hope that some lives or limbs may be saved by a more general understanding of what should be done in such cases, permit me to explain this; I have not yet seen it in print.

The comparative safety of jumping from a moving vehicle does not depend on the velocity of the jump, which should not exceed the velocity of the vehicle, if it can be helped, but entirely and solely on the anatomical build, if I may use the term, of man. The jump should be made facing, as nearly as possible, in the direction of the motion; select if practicable the place; turf is best, sand is next. Never jump on a pile of stones, for a collision with stone is as dangerous as any possible casualty. One foot should be in advance, so that it will come in contact with the ground first. Follow it instantly with the other foot, and each will receive a part of the blow, and each will check the speed.

little. Then first one hand, then the other, will take a part of the force, and serve to protect the head and trunk. If the patient is then alive, he may pick himself up, if he can, and count his broken limbs and contusions.

A diagram will, perhaps, best explain the succession of events that the jumper should endeavor to procure, for the greatest safety to his person. He should try to have his limbs act like the spokes of a wheel. One foot, *a*, in advance touches the ground, the other foot, *b*, will pass by and touch, then the hands, *c* and *d*, and the head will follow. The momentum may be enough to cause the feet to turn over the head in a somersault; but this is the best that can be done, that is, to check the momentum a little at a time.



If a person takes the advice of J. B. T., and jumps in the contrary direction, what follows? If the vehicle is moving only 15 miles an hour, and he jumps with the force of 5 miles an hour, he is actually moving backwards with the velocity of 10 miles an hour; and as soon as his foot touches the ground, it stops, but his head and body describe a curve through the air with a force due to the speed, the back of his head and his back strike the ground simultaneously. Result, a broken spine, a cracked skull and a general destruction of the action of the internal organs.

Not many years ago I was the involuntary witness of an experiment of this kind. A horse car was being driven pretty rapidly by me, on the opposite side of the street. I noticed a passenger, with an apparently heavy bundle in his hand, preparing to get off; the conductor was looking another way; I saw the man's danger, but was too far off to interfere. He deliberately stepped off the car as if it were motionless, but the instant his foot touched the pavement, his body and head, retaining the speed of the car, were thrown down with great force on the stones; his hat and bundle flew in different directions, accompanied with the unmistakable sound of breaking of iron castings. The man, for a wonder, did not appear to be much injured, but picked himself and his property up, a much astonished and probably a wiser man.

Let every one remember that the only safety in leaving a moving vehicle is to face in the direction of the motion.

Boston, Mass.

CHARLES STODDER.

Explosive Projectiles.

To the Editor of the Scientific American:

I have read in your volume XXVIII., page 394, a description of a compound explosive projectile, which is, in my judgment, similar to one I invented in the year 1868. I offered it to the British Government in that year for trial, but it was refused. On September 2, 1869, I sent one to the Emperor of Russia for his approval; it was received, but the answer is not yet returned. I offered it to the present British Government, accompanied by a drawing, November 25, 1870. It was politely refused, and the drawing kept.

My projectile contained three bullet chambers attached to the main cylinder, grooved from top to bottom in center of chambers to one half the thickness of metal in main cylinder, and also grooved all round the center of the main cylinder. Each chamber contained 106 bullets, or 318 bullets in all. Outside size of projectile was eight inches; the chambers were tapped, screwed, and plugged air tight. It can be filled in chambers with small shells and liquid fire, bullets and powder, fulminate, or other materials, as wished. A brass time fuse was fitted inside the powder chambers, and screwed in.

My projectile was considered by many to be the most destructive known. When proved with only a minimum charge of powder, 13 lbs. of the main cylinder could not be found. This distribution of bullets and fragments took place without either fuse or plugs being in the chambers. The difference between my projectile and F. A. Morley's, according to the account, is that he has a separate fuse for each chamber, and possibly more chambers.

On page 368, same volume, on "Electrical Fire Arms," by Professor S. Gardner, you wish him to drive the bullet by electricity. I presume that can easily be accomplished. There is yet one further stride: to kill by electricity itself, at any distance, paralyzing those who may not be killed outright.

Liverpool, England.

J. T. FRASER.

Composite Lenses.

To the Editor of the Scientific American:

F. H. R. (see page 100 of your current volume) does not show the flint lens in his section drawing, and the central lens may be made thinnest; but his views are eminently sound. As inventor of the composite object glass, I will call attention to its main defects.

First, the diffraction around the edges of the lenses will slightly injure the definition, as may be seen by placing a network over the glass of an ordinary telescope. Secondly, the segment lenses are harder to correct by hand than the zones of a single lens, and the local polisher machine will spoil their extreme edges, which must be cut off, reducing their size. The third difficulty is the adjustment of the parts. The iron frame must be protected from unequal expansion; and the lenses must not differ in focus the one hundredth part of an inch. The heliometer with its divided object glass, and the success of Mr. Sellack, at Cordoba, in mending a broken eleven inch photographic objective, show the plan is a feasible one.

We have consulted oracles on the subject with the follow-

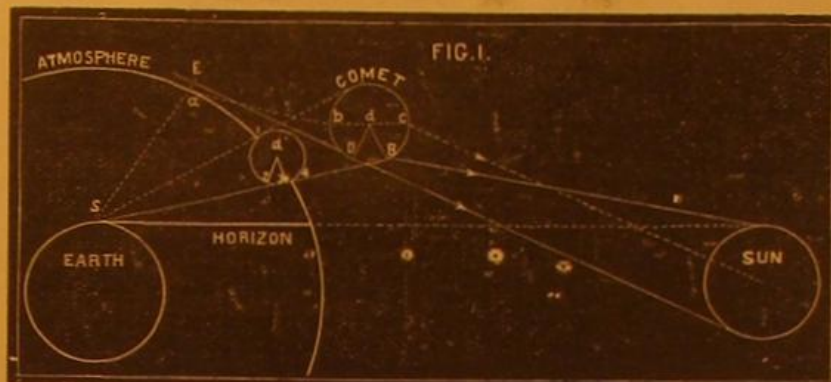
ing responses: Professor Winlock thinks that a solid object glass would be the best, if we could get one. Clark & Sons believe it possible to build an equatorial with solid object glass five feet six and a half inches clear aperture, less than seventy-five feet focus, with a useful power of 3,325 (50 for each inch of aperture) for the sun mentioned. They think it would be easiest to mount it between walls, allowing a movement of only two or three hours in right ascension. They recommend importing the glass makers, as they had to wait three years and paid \$12,000 for their pair of glass disks from Birmingham. Henry G. Fitz considers the adjustment of the composite lenses difficult, but that, if this were attained with sufficient accuracy, the telescope might readily be corrected photographically by the addition of a third lens, and thinks this a better plan than using monochromatic light for the purpose.

S. H. M., Jr.

(For the Scientific American.)

The Composition of the Tails of Comets.

At the conclusion of my communication on the subject of the cause of the zodiacal light, I suggested the question whether the tails of comets might not be accounted for upon similar principles. As I believe that the application of the optical principles concerned in this case (as well as in the other), to account for the appearances observed, is new, I have since considered the subject more fully; and as a result, I submit these explanatory diagrams for the consideration of those who may take an interest in the subject.



The proposition which I have here attempted to demonstrate is that the tail of a comet is an optical phenomenon, caused by the reflection of the sun's rays from the surface of the comet to the earth's atmosphere and thence to the spectator.

Fig. 1 is a section, in the common plane (which, for convenience, we will call the ecliptic) of the earth, comet and sun (the sun being in the direction of the arrows); S is the spectator; D B is the portion of the illuminated surface of the comet which is visible to the spectator. All the space comprised between the points E, D, B, S, would be illuminated by reflection from that portion of the surface of the comet between the points D B. But the atmosphere which renders the light visible only extends to a, 1, 4; therefore the spectator would only see that included between the points a, 1, 2, 3, S. The comet would therefore appear to him to be at 1, 2, 3. The line a, 1, 2, 3, would appear as the line E, D, B; and the line S, 3, would appear as the line S, B. It will be observed that the line a, 1, does not touch the illuminated portion of the comet, but is interrupted by the interference of the dark portion of the surface between the points 1 and 2. That space, therefore, would appear darker than the rest of the illuminated space. This fact will be noticed among our conclusions.

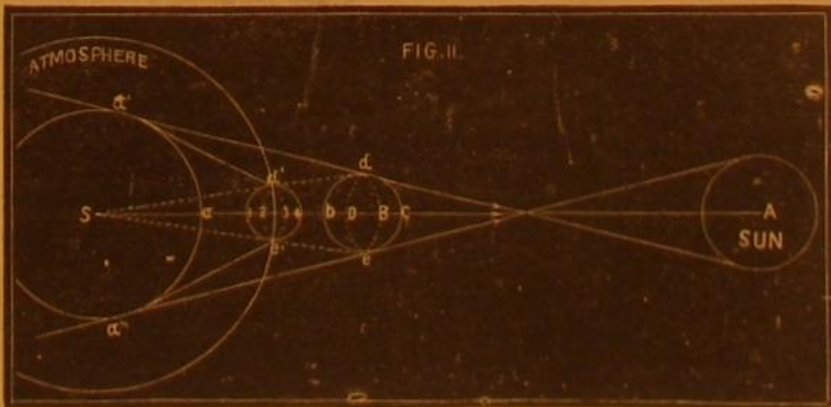


Fig. 2 is a section perpendicular to that of Fig. 1, on a line drawn from the point S (Fig. 1), through a, b, c, and thence to the center of the sun. S, A, (Fig. 2) represents that line, the letters and figures indicating similar points, as in Fig. 1, and the sun being in the direction of the arrows. With regard to the spectator at S, all the space comprised between the points a', d, B, e, a'', would be illuminated by reflection from that portion of the surface of the comet between the points D, d, B, e; but for the reason assigned in describing Fig. 1, the spectator would only see that part included between the points a', d', e', a''. The comet would appear to be at d', e'; the line a', d' would appear as the line a', d; and the line a' e' would appear as the line a', e. The appearance therefore to the spectator would be that of a crescent-shaped comet on the confines of the atmosphere, with a tail spreading out from the nucleus, e', 2, d', 3, in a direction opposite to the sun, having at its extremity a width equal to a' n' (Fig. 2) and a depth equal to S, a (Fig. 1).

The following conclusions may, I think, be drawn from

the foregoing explanation: 1. When the spectator, comet and sun are in the same plane (which, in this case, we have supposed to be the ecliptic), the tail of the comet would be straight, and divided through its axis by the plane of the ecliptic. 2. If the comet's position were south of the ecliptic, the tail would incline towards the south, and would be curved convexly to the south, on account of the spherical shape of the atmosphere; and if the comet were north of the ecliptic, the inclination would be to the north, and the curve would be convex to the north. 3. The length and breadth of the tail would vary inversely as the angle between the comet, sun and spectator increased or diminished; that is, it would appear longer and broader as the comet approached the sun, and shorter and narrower as it receded. 4. In this position of the comet, there would appear to be a lun-shaped, darker space between the brightest part of the tail and the nucleus of the comet; that is, the brightest part of the tail would appear to be attached to the nucleus only at the two horns of the crescent. This is caused by the interruption of the line, a, 1, (Fig. 1) by the interference of the dark portion of the surface between the points 1 and 2 (Figs. 1 and 2). (See explanation of Fig. 1.)

The reason why the planets have no tails, when in the same relative position (with regard to the earth and sun) as the comet, is that they are, comparatively, so large that the reflection embraces nearly the whole of the atmosphere, and therefore no part is brighter than another. Comets on the contrary are, comparatively, exceedingly small; the diameters of some of them do not appear to exceed thirty miles. This is why, in the diagram, the tail appears so disproportionately broad.

If the principle of this theory be understood, it will be evident that the shape and direction of the tail may be varied almost infinitely, as they depend upon the relative positions of the three bodies, the earth, the comet and the sun.

T. R. LOVETT.

Mount Airy, Philadelphia, Pa.

Bisulphide of Carbon Engines.

To the Editor of the Scientific American:

An Irishman, on being told that an addition of quinces improved an apple pie, remarked that an apple pie made entirely of quinces would be better still. I am not an Irishman, but it strikes me that, if the attachment of a bisulphide of carbon engine to a steam engine is a great improvement, it might be better still to apply the heat directly to the bisulphide. The boiling point being lower than that of water, and the specific heat and latent heat of vaporization, perhaps, also less, it would require less fuel to produce a given quantity of vapor of given tension; and, as the products of combustion could be allowed to pass off at a lower temperature, the heat of the fuel would be more fully utilized. Also, it would seem that a second vapor engine might be driven by the waste heat from the fire flues of the first engine.

In your article on the loss of power in steam engines, it seems to me that you have overlooked two important points, in fact the most important. In your calculations, you start with steam instead of water, neglecting entirely the enormous quantity of heat required to convert water into steam, which is only very imperfectly utilized in heating the feed water, one pound of steam sufficing to heat five pounds, nearly, of water to the boiling point. That this "latent" heat can be utilized to a very great extent by the use of an easily vaporized fluid seems to be proved by the bisulphide of carbon engine, which has already effected a saving far beyond your estimate of possibilities.

The second point is the large quantity of heat which necessarily (under present conditions) goes up the smoke stack. I have already suggested one remedy for this waste in the use of a second vapor engine. Another plan which may be worth considering would be to burn charcoal, petroleum, or anthracite in an airtight chamber, surrounded by water, under such pressure that the escaping products of combustion would have, when released, the same or nearly the same temperature as the surrounding air, the question being whether the heat which passes up the chimney represents more power than would be consumed in forcing air into the furnace.

Another way to save a portion of this heat would be to apply it, as in Siemens' regenerating furnace, to heat the air which supplies the fire, unless indeed it is all required to produce draft.

Of course all these things present certain difficulties, but, to quote my Hibernian friend again, "if there was no trouble, sure there'd be no work for us."

Benton, Cal.

C. H. AARON.

R. A. M. states, from his personal experience, that an application of spirits of turpentine is a certain relief for the pain of a bee sting.

A NEW DOMESTIC MOTOR.

A short time since we published an illustration of a combined rocking chair and cradle, an ingenious plan the utility of which was obvious. The inventor of the device which we now present has gone several steps further, and not only employs the hitherto wasted female power to oscillate a cradle, but at one and the same time to vibrate the dasher of a churn. By this means, it will be observed, the hands of the fair operator are left free for darning stockings, sewing, or other light work, while the entire individual is completely utilized. Fathers of large families of girls, Mormons, and others blessed with a superabundance of the gentler sex, are thus afforded an effective method of diverting the latent feminine energy, usually manifested in the pursuit of novels, beaux, embroidery, opera boxes, and bonnets, into channels of useful and profitable labor.

The apparatus, as represented, consists of a lever, A, suspended from the ceiling or other suitable support by a swiveled hook and staple. In the extremities of the lever, A, are formed slots through which pass bolts and nuts which secure the adjustable arms, B. To the eyes of the bolts are attached the ends of two ropes, which pass around double guide pulleys fastened to the floor and then to two single pulleys, arranged one beneath the forward and the other beneath the rear part of a rocking chair. The ends of the ropes are secured, as shown, to the rungs of the latter.

Near the extremities of the arms, B, sliding weights are placed, by moving which the lever can be properly balanced. Just inside the weights is secured on one arm the dasher of the churn, and at the other a cord communicating with a cradle rocker. As the chair is oscillated motion is communicated to the lever, and thence to both cradle and churn.

Necessarily this device may be put to a great variety of applications, and may supply motive power for washing machines, wringers, and other articles of household use, as well as for churns and cradles. At all events it opens a new field for "woman's labor," and one in which she is not likely to be disturbed or encounter competition from the other sex.

Patented through the Scientific American Patent Agency, April 15, 1873. For further particulars address the inventor, Mr. Gustavus Meyer, New Richmond, Allegan County, Mich., or the New York Exposition and Manufacturing Company, 52, 54, and 56 Broadway, New York city.

PERAMBULATING COT.

Invalids and persons who are afflicted with loss of powers of locomotion will, according to the statements of the inventor, find the apparatus herewith illustrated a great convenience and comfort. The device is called a perambulating cot, and is made with a pair of large wheels on an axle, upon which rests a light curved iron frame supported in the rear by a pair of pivoted caster wheels which follow the main wheels in any direction. On the iron frame are four curved springs, extending up to the middle section of a light wooden cot frame. There is a joint in the latter, just back of the hips of the occupant, arranged with ratchets, so that he can sit at any desired angle; and from the knee, forward, is a light tapering board and half circle foot piece. At the rear of the cot is a handle, adjustable, so that it may be made high or low, by a rod in the center of the cot frame; and there are two rods from the ends of the handle and attached to the frame at the swivel wheels, for propelling the apparatus. The feet are raised or lowered by turning a small crank on the foot board, and there is a hinged drop leg for use when necessary. Other conveniences, incidental to invalids' uses, are suitably and ingeniously provided for.

The inventor, Mr. A. W. Richards, who may be addressed at Indianola, Iowa, is a crippled United States soldier of the late war, and devised this apparatus in conformity to his own needs. He states that, although unable to sit erect, he can propel himself with ease by placing his hands on the large wheels, and thus travel from room to room. He also is enabled to be pushed around the streets by a child, in order to attend to business, etc. Numerous testimonials are submitted to us by Mr. Richards, which confirm his opinions of the efficiency of the device. It seems to us well adapted for its purpose, and particularly suited for employment in hospitals and other medical uses.

The Largest Steam Engine in the World.

Pittsburgh claims to have in progress of construction a pair of engines which will be the most powerful in the world. Reducing the capacity of some of the largest pumping engines to a uniform lift of one foot in twenty-four hours, it is found that the one at the Lehigh zinc mines will lift 3,456,000,000 gallons; the pair at the Chicago water works, 4,500,000,000 gallons; the pair at Haarlem, Holland, 10,000,000,000 gallons; while the new Pittsburgh engines will lift 14,240,000,000 gallons. The pair will weigh 1,500 tons, and will cost \$423,550. The following dimensions will serve to give some idea of the magnitude: Cranks nine tons; shaft, twenty-four tons; four sections of the two valve chambers, one hundred and twenty tons; fly wheel, seventy tons. The four plungers will weigh upwards of four hundred tons. Cylinder, sixty-four inches diameter; stroke, fourteen feet. Plungers forty inches diameter; eleven feet stroke. This ponderous piece of

machinery will be used to raise water into Highland avenue reservoir in Pittsburgh, a height of three hundred and fifty-six feet. It is estimated it will raise seventy million pounds of water for each hundred pounds of coal consumed, the cost being at the rate of one cent for every 8,070 gallons.

Water Boilers upon Stoves.

A brass or copper vessel tinned upon the inside, holding several gallons, is usually found connected with cooking stoves used in families. As this vessel is kept full of hot water, which is used for ordinary culinary purposes, it is important that no deleterious agent should be connected



A NEW DOMESTIC MOTOR.

with the metal employed in its construction. A recent analysis has been made of a specimen of tinned brass plate used for making these boilers, and it was found that the tin contained 26 per cent of lead. How far this may serve to cause injury, it is impossible to say. It is certain, however, that lead is an objectionable metal to be brought in contact with culinary utensils, and hence its use must be condemned. An iron boiler lined with porcelain would be much safer, and perhaps not more costly. We understand such a vessel is constructed, and if so, it would certainly

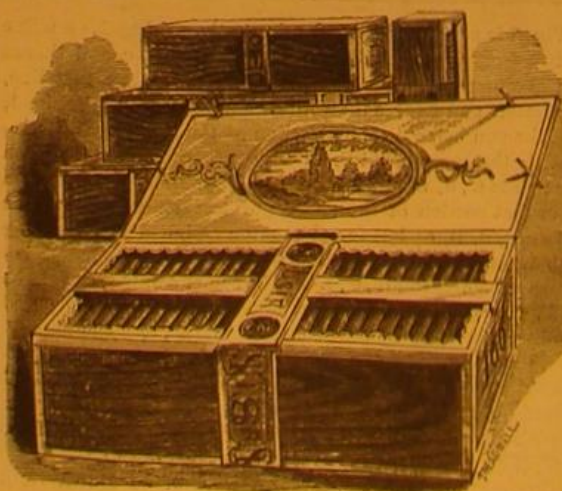


PERAMBULATING COT.

be a much safer one to employ as a reservoir of hot water for constant household and culinary use.—*Boston Journal of Chemistry.*

THE PATENT REVENUE CIGAR BOX.

Quite a stir has recently been created among the cigar manufacturers on account of the proposed requirement, by



the Government, of the use of a patented form of cigar box. The object of the invention, an engraving of which we here, with present, is to prevent the fraudulent re-employment of stamped boxes. A dealer, in purchasing his stock, naturally desires to inspect in advance the quality and flavor of the article. To do this, boxes must be opened and stamps torn, so that, if the cigars be not sold, they remain on the maker's hands in cases which, so far as the mutilation of their stamps is concerned, are in precisely the same condition as if their contents had been once disposed of. It is plain that an excellent opportunity is here offered for fraud upon the revenue by packing cigars in old stamped boxes, and, in event of detection, asserting that the latter were innocently opened as above described.

The present device, lately patented by Mr. Thomas A. Wiley, of Lancaster, Pa., consists simply in fitting two cross slats, as shown, into the edge of the box, forming a dovetail connection therewith; or a single broad longitudinal strip may be employed to answer the purpose. These slats are put in place after the cigars are packed, when the stamp is pasted partly on the transverse bar and partly over the side of the box. The usual ornamental paper is affixed in the ordinary way. By raising the lid, an opportunity is afforded for examination of the contents through the ample apertures left; while not a single cigar can be abstracted without first raising the slats and thereby rupturing the stamp.

The introduction of the plan is vehemently opposed by the cigar makers, who assert that it is of no greater efficacy than the present mode, while it will prove a serious detriment to their trade.

CEMENTING METAL TO GLASS.—Take two parts finely powdered white litharge, and one part dry white lead, mix intimately, and work up with boiled linseed oil and lac copal to a stiff dough. One part of copal is taken to three parts boiled oil, and enough litharge and white lead added to make a dough similar to putty. The underside of the metal is filled with the cement, and then pressed upon the glass, the excess of cement being scraped off with any sort of instrument. It dries quickly and holds firmly.

Location of Standard Compasses.

For determining the deviation, due to ferruginous materials in their construction and cargoes and to other causes, of the steering compasses of vessels, a so-called standard compass is usually arranged on the upper deck, and at as high an elevation as convenient above the hull.

The position of the instrument is as nearly neutral as can be found—that is, at a point where the local attractions are evenly balanced. By causing the ship to swing in different directions, and noting the variation between the indications of the standard and that of the binnacle compasses a table is formed from which the deviation of the latter for various points is used as a correction to be applied when steering such courses.

M. Gloesener, in referring to this subject in *Les Mondes*, suggests placing the standard compass out upon the bowsprit, at a distance previously determined to be without the sphere of attraction of the iron in the vessel. By this means, instead of the attracting substances being grouped around the instrument, perhaps unequally, they necessarily are all upon one side of the compass and symmetrically placed in regard to it. The latter is, of course, so fixed that the lubber's point and the foot of the needle pivot are in a line parallel to the longitudinal axis of the ship. To reflect a portion of the card, an inclined mirror is arranged above it, in which the indication is read from the deck by means of a spyglass.

BUTTER AND FATS.—Dr. J. Campbell Brown says that the proportions of the chemical constituents vary so greatly (from zero upwards) that no reliable evidence of purity or impurity can be obtained by estimating the different fats obtainable by decomposing butter. In fact, the distinction between pure butter and butter mixed with flesh fats is no more a chemical one than the distinction between different animals or different plants. The physiologist distinguishes one kind of tissue from another more readily by their microscopic characters than by their chemical composition; and microscopic examination with polarized light is the most reliable means of distinguishing pure butter from that which contains an admixture of less easily digestible and less palatable fats.

LEMONADE FROM CURRANTS.—Citric acid may be prepared from ripe currants in the following manner: The currants are first broken up by pounding or squeezing; the juice is then pressed out and allowed to ferment. When fermentation ceases, the alcohol is distilled off and the residue neutralized with fine chalk. In this way citrate of lime is formed, which is afterward decomposed by sulphuric acid and the citric acid set free. From 110 pounds of fruit there should be obtained about one pound of citric acid, beside a considerable quantity of alcohol. A dilute solution of citric acid furnishes a pleasant and healthful drink, and, although lemonade is usually made from lemons, we would not, says the *Journal of Applied Chemistry*, be far wrong in calling this drink lemonade, although prepared from currants.

THE COOPER PORTABLE ENGINE.

In our illustration is shown one of the latest designs of portable engines, composed of an engine, pump, heater, fixtures, and connections, all mounted on the boiler; the last being supported on side timbers which form the foundation for the whole structure. The apparatus comes complete from the shop, having been previously tried by actual tests with steam, and is ready for work. All that is required is to place it in proper position and connect it to such machinery as it is to drive.

The boiler is then filled and the fire started. This arrangement, it is claimed, saves all the expense and time required to build the engine foundations, set the boiler in brick work, and make the connections, as would be the case with stationary engine and boilers, while it adds greatly to the facility with which the machinery can be moved from place to place.

The construction of the device merits particular attention. The engine consists of a bed piece supported on lugs attached to the boiler. This piece contains the shaft, pillow block, slides, and cylinder head, and to it the cylinder is so attached as to allow of the expansion of the latter without strain on the joints. The valve gear connects directly, doing away with the rock shaft, and the valve is proportioned to use the steam expansively. The pump is a vertical plunger of short stroke, driven by direct

attachment to the crosshead, obviating the use of a belt and making the feed positive, with easy work on the valves. The heater is of wrought iron, with cast iron sleeve and slip joint, proportioned to give a large heating surface to a thin sheet of water, thereby insuring a high degree of heat to the feed. All the moving parts are balanced so as to give steady motion at high speed. The journals and wearing surfaces are supplied with self-oilers, and the boiler with glass water gage, cocks, whistle, steam gage, etc.

The internal arrangement of the boiler and tubes, it is claimed, has been thoroughly studied, so that the highest degree of evaporation is obtained with the least consumption of fuel. A jet blower is supplied for increasing the draft, and the chimney is provided with a spark catcher.

We are informed that when the Japanese Government (in 1870) ordered samples of machinery, the agents, after examination and tests, gave the preference to this engine over all others, and ordered a twenty horse power machine, with circular saw mill, to be sent to Japan. Letters since received show that the apparatus gave perfect satisfaction.

The engine represented in our engraving is of twenty horse power, and is mounted with a slide throttle valve, in place of the governor as used with circular saw mills.

For further information address The John Cooper Engine Manufacturing Company, of Mount Vernon, Ohio.

Lawn in Midsummer.

We have touched the renewing and improving of lawns time and time again, says the *Cleveland Herald*, yet every now and then we are button-holed on the street with: "I wish you would tell me what to do with my lawns." Well, we ask about it. "Why, somehow, the grass seems to have got thin, and don't look good and strong; the soil is rather light, although every year I have given it a top dressing of manure in the fall and raked it off in the spring."

Yes, we say, just as many another man, void of the knowledge of the wants of the grass roots, has done. You have supplied a little stimulus, and a very little one, to enable the plant to make a first start in the spring, by reason of the ammoniacal alkali obtained from the leaching of the manure during the winter; and as soon as that is exhausted, which generally is ere the heated season comes in, the plant has nothing but the poor old soil and its broken roots to sup-

port it. Now, if you would first sow over your lawn fine bone meal at the rate of eight bushels to the acre, then plaster at the rate of one bushel to the acre, then cover the whole half an inch thick with fine garden soil, leaf mold, or fine chip mold from an old wood yard pile, and then sow clean blue grass seed at the rate of two bushels to the acre, and rake the whole with a fine tooth iron rake, finishing by rolling, we guarantee a lawn that will stay fresh and green all summer, no matter how dry the season. We hope that

To the vast array of quaint devices, with which the earlier archives of the Patent Office are replete, belongs the invention illustrated herewith. Our engraving, derived from the patent drawings, represents an individual not suffering under any painful malady, as might be inferred from his prostrate position, but "laying off," if the apt vulgarism be admissible, while calmly enjoying the luxury of a breeze raised by the oscillation of the fan above him. The latter, with its mechanism, is the first device of its kind ever patented in this country, and the inventor was Commodore Jas. Barron, of the navy, a name famous for gallant service in the war of 1812. The date of the patent is November 27, 1830, and from its specification we extract the following brief description of its operation: Within the box shown near the head of the couch is placed a train of clockwork, which moves a crank, shown in the left hand lower corner of the case. This crank actuates a pitman which, by means of a vertical arm, oscillates a rock shaft, supported as shown by two horizontal rods projecting from the box. To the upper arm, extending from the rock shaft, is connected the fan, which is thereby freely vibrated, while suspended from the ceiling, by suitable means.

In an old volume of the *Journal of the Franklin Institute*, we find an abstract of this patent, accompanied by editorial com-

THE COOPER PORTABLE ENGINE.

ment to the effect that "it is certainly a very complex mode of attaining the proposed object. We should find no difficulty in making a much more simple instrument for the purpose," a view which, perhaps, some scores of inventors have, since the date the above was written, demonstrated to their own, if not to the public's, perfect satisfaction. We need not add that, in this case, for obvious reasons, we omit our usual peroration beginning "for further information," etc.

THE FIRST AUTOMATIC FAN.

There is a peculiar interest which attaches to the first crude embodiment of any well known device, which renders it almost as much an object of curiosity as the most recent ap-

plication of the same idea improved, altered, and carried apparently to perfection. The one, indeed, indicates the higher attribute, originality; the other, in its relation thereto, forms but a mark on an onward path which, while serving as a limit of present advancement, attained through the aid of past experience, must, in its turn, be left behind and forgotten, as that experience, augmenting, enables the engraving, upon the pristine stock of newer, better, and more useful conceptions



Discovery of America—Columbus Anticipated

Interesting relics of the early discovery of America occasionally turn up. At a late meeting of the Mexican Geographical Society, Mr. Bliss stated that some brass tablets had been lately discovered in the northern part of Brazil, and not far from the coast, which careful examination had shown were covered with Phœnician inscriptions, telling of the discovery of America five centuries before Christ. The tablets had been acquired by the Museum of Rio Janeiro, with whose director he was personally acquainted, and the connection of this gentleman with the discovery of the tablets was in itself a guarantee of the correctness of the report. The inscriptions, so far as yet deciphered, relate that, from a port on the Red Sea, a Sidonian fleet sailed, and, following the east coast of Africa, doubled the Cape; thence following the African west coast, probably with the southeast trade winds of the southern latitudes, until the northeast trades, preventing further progress northward, forced the prows of the vessels across the broad Atlantic. At any rate, according to Mr. Bliss, the tablets record the fact of the Phœnician fleet having reached the Americas five centuries before Christ, at some point now known as northern Brazil; that the tablets give the number of vessels, the number of the crews, the name of Sidon as their home, and, indeed, various very interesting particulars. Mr. Bliss has promised, when he acquires further particulars, to hand them to the Society.

A GIGANTIC passenger depot, the largest in the world, is now in process of erection at Jersey city, N. J.

The Preservation of Wood.

When a country is first cleared, and timber is plenty, the only desire of the settler in regard to it seems to be to destroy as much as possible with the least amount of labor. Afterwards, however, the opposite course is taken, and endeavors are made to preserve it, and prevent waste and decay.

Many methods have been proposed for preserving timber, varying somewhat according to the use to which it is to be put, and the situation in which it is to be placed. These may all, however, be divided into two great classes; namely those which preserve the wood from external influences by forming an impervious coating on the outside, and those which consist in impregnating the wood with some substance which will enable it better to resist the action of fermentation and decay.

The first of these classes includes all paints and similar substances. In order to render paints effective, it is necessary that the wood shall be well dried before their application, as paint applied to the surface of wood which is filled with sap will tend to hasten, rather than retard, its decay. This it does by confining the juices of the timber and preventing the drying of the wood that would otherwise take place. The first paint that was used was most likely the native bitumen and asphalt that oozes from the ground in many parts of the world, and to this day we have not found any more effective substitute. But this is objectionable from its odor, the long time it occupies in drying, and its dark color; so that in the course of time other substances were substituted for it. Prominent among these are the so-called drying oils. Certain oils, such as linseed and poppy, have the property of drying when exposed to air, and forming a gummy mass. This protects the wood from the action of air and rain. But oil alone has but little covering power, and a substance painted with it retains almost its natural color or at most is only darkened. In order to vary the color and more thoroughly cover up any defects in the work, and at the same time hasten the drying of the paint, it is customary to mix certain earthy substances with the oil. Chief among these is ceruse, or white lead. This gradually combines with oil and forms a hard mass. In order to hasten the drying of the oil, it is frequently boiled before being mixed with the lead. The lead paint made by mixing proper proportions of carbonate of lead with boiled and raw oil is undoubtedly one of the best and most permanent substances that can be applied to the surface of wood; but unfortunately it is expensive, and the use of the lead is objectionable on sanitary grounds, the workmen employed in putting it on being subject to severe colic and paralysis from the poisonous effects of the lead. On the ground of cheapness, sulphate of baryta is frequently substituted for part of the lead, and, in fact, in some cases for almost the whole. This, while it is not poisonous to use, possesses an inferior covering power; that is, it takes more coats to produce the same effect, and as it does not combine with the oil, it is liable after a time to chalk off.

Another substitute for lead is oxide of zinc. This is also not poisonous to the workmen, when free from arsenic, but it possesses little more covering power than baryta.

Quite frequently a mixture of lead, baryta, and zinc, is employed. Its chief recommendation is its cheapness. For painting in localities that are exposed to sulphuretted hydrogen, such as houses on the docks of large cities, a zinc or baryta paint is superior to one containing lead, as it does not blacken. Many attempts have been made to utilize various chemicals for painting purposes, and there is an endless variety of so-called chemical paints in the market. Prominent among these is the "Averill" paint, in which water glass or silicate of soda is a leading ingredient; but the general fault of all these paints is that, when made thin enough to work with ease, they do not possess sufficient body, so that what is saved in the original cost of the paints is expended in the labor necessary to put them on.

Paints of different colors generally depend upon white lead for their body, and derive their color from mixtures of various earths and oxides. For almost all the shades of red and brown, oxide of iron is used, under the various names of Venetian red, umber, terra di Sienna, brown ocher, yellow ocher, red ocher, etc., the various colors being due to the way in which it is prepared.

Oxide of chromium furnishes chrome green; oxide of copper, combined with various acids and with arsenic, gives various greens; lead combined with chromic acid forms the chrome yellows, the different shades being due to the manner in which they are prepared. For blue, we have Prussian blue, which is not very permanent, and of late years ultramarine, which is the best and most permanent of all colors.

Red lead, or oxide of lead, and sulphide of mercury give the most brilliant red; while for black, nothing is superior to carbon in the form of lamp black. For special purposes, such as painting the bottoms of ships or piles exposed to the action of the water, coarser kinds of paints are employed. The base of many of these is tar dissolved in naphtha; this is mixed with some substance such as oxide of copper, arsenic, or an alloy of copper and antimony, which is supposed to prevent the adherence of barnacles and other marine animals and plants. India rubber, dissolved in naphtha, has been used for the same purpose; lime soaps have also been proposed for this use. No substance has, however, been discovered that will resist the action of salt water more than a few months without requiring renewal; nothing that is known to chemists being absolutely insoluble in water. Lately there has been quite a flourish of trumpets over a certain compound invented in England by Count Szelimsky, and called *zopissa*. This is essentially a paint composed of boiled linseed oil, brown umber, lime

water, sulphate of copper, Prussian blue, copperas, burnt clay, calcareous silice (whatever that may be), litharge, asphalt, red lead, gum animi, and turpentine. It was probably through mere modesty that the inventor stopped after adding these ingredients and did not continue through the drug shop. The paint is no better and no worse than one containing an impure oxide of copper for pigment, and linseed oil and asphaltum for the menstruum. It will no doubt protect the wood to which it is supplied in sufficient quantities, from external action, so long as it lasts.—*Boston Journal of Chemistry*.

Recent Researches on the Physiological Action of Light.

The arrangements by which the mind is brought into relation with the outer world are—(1) a terminal organ, such as the retina, or the intricate structures of the internal ear, or the touch corpuscles of Wagner, for the reception of impressions from without; (2) a nerve, endowed with a special sensibility peculiar to the sense for the conveyance of influences from the terminal organ to the brain; (3) a sensorium or brain in which, on receiving these influences, changes occur which give rise to the phenomena of consciousness.

The nature of the specific change produced on the terminal organs by the action of external stimuli has not hitherto been experimentally examined. Let us take the case of the eye. Numerous hypotheses have been advanced. The action of light on the retina has been conjectured to be a mere communication of vibrations, an intermittent motion of portions of the optic nerve, an electrical effect, a heating effect, or a photographic effect like that produced by light on a sensitive surface; but up to this time there has been no experimental evidence in support of either of these views.

The result of investigations made by Mr. Dewar and Dr. McKendrick, of Edinburgh, communicated to the Royal Society of Edinburgh, has been to show that the specific effect of light on the retina and optic nerve is a change in the electromotive force of these organs. They have been able to demonstrate this by the use of the well known arrangement of Du Bois-Raymond for collecting electric currents from animal structures.

From each of the troughs a wire passes to a key so as to enable the experimenter to stop the current at pleasure, and thence the current passes to the galvanometer. They then lay the eye on a glass support between the cushions, and carefully adjust the points so that the one touches the cornea and the other the transverse section of the optic nerve, or the one may touch the surface of the nerve and the other its transverse section. When the optic nerve of the eye to be operated upon and the cornea are brought into connection with the galvanometer, and light is passed through the eye, there is at first an increase, then a diminution, and on the removal of light there is another increase, of the electromotive force.

The amount of change in the electromotive force by the action of light is about 3 per cent of the total. There has been no difficulty in demonstrating the effect in the eyes of the following animals, after removal from the body: reptiles, snakes; amphibia, frog, toad, newt; fishes, gold fish, stickleback, rockling; crustacea, crab, swimming crab, spider crab, lobster, hermit crab. The greatest effect was observed in the case of the lobster, in the eye of which Messrs. Dewar and McKendrick found a modification in the electromotive force by the action of light to the extent of about ten per cent. With the eyes of birds and mammals, they had great difficulty. It is well known that, in these animals, the great source of nervous power is abundant supply of healthy blood. Without this, nervous action is soon arrested. This law, of course, holds good for the retina and optic nerve. When, therefore, they removed the eyeball with nerve attached, from the orbit of a cat or rabbit recently killed, and placed it in connection with the clay points, they found a large deflection of the galvanometer which quickly diminished, but all sensitiveness to light disappeared within one or two minutes after the eye had been removed from the animal. This fact of itself shows that what has been observed is a change depending on the vital sensibility of the part. It was therefore necessary to perform the experiment on the living animal under chloroform. By so fixing the head that it could not move, and by removing the outer wall of the orbit so as to permit the clay points to be applied to the cornea and nerve, the same results have been obtained in the case of the cat, rabbit, pigeon, and owl.

Without going into minute detail, which the space allowed for this short article will not admit of, the results of this inquiry have been as follows:

1. That the specific effect of light on the eye is to change the electromotive force of the retina and optic nerve.
2. That this last applies to both the simple and to the compound eye.
3. That the change is not at all proportional to the amount of light in lights of different intensities, but to the logarithm of the quotient, thus agreeing with the psycho physical law of Fechner.
4. That those rays, such as the yellow, which appears to our consciousness to be the most luminous, affect the electromotive force most, and that those, such as the violet, which are least luminous, affect it least.
5. That this change is essentially dependent on the retina, because, if this structure is removed while the other structure of the eye lives, though there is still an electromotive force, there is no sensitiveness to light.
6. That this change may be followed into the optic lobes.
7. That the so-called psycho physical law of Fechner does not depend on consciousness or perception in the brain, but

is really dependent on the anatomical structure and physiological properties of the terminal organ itself, inasmuch as the same results as to the effect of light are obtained by the action of the retina and nerve without the presence of brain.

The method of investigation pursued by Messrs. McKendrick and Dewar is applicable to the other senses, and opens up a new field of physiological research. The specific action of sound, of the contact of substances with the terminal organs of taste and of smell, may all be examined in the same manner; and we are in hopes of soon seeing results from such investigations.—*Nature*.

Saddle Trees.

A correspondent, R. C., of Texas, remarks that his State has always been famous for the production of saddle trees; and although California and other States have been rivals, Texas has always stood first on the list. "The ordinary plan of making a saddle tree is not only tedious but incorrect, owing to the want of an accurate plan, and the consequent use of guesswork. I claim to have produced a simpler plan, by which a man, using patterns, can make a good saddle tree. Within the last few years, several makers have conceived plans to make saddle trees that would allow the fastenings to rest on the front end of the side boards, and the front part of the seat on the side boards and on both sides of the prongs of the horn piece, forming not only the fastenings but a part of the rig also.

The tree was a desirable one on its claims; but there was a serious objection to it. The projecting part of the side board in front of the horn tapered down straight with pointed or square corners so as to admit of the fastenings; and so the bottom part of the side boards had to be made straight, with a straight twist, and the ends in front would hurt the horse's shoulders. To remedy that defect, I cut the side boards tapering back towards the seat far enough to receive the prongs of the horn and the fastenings. This flaring or tapering twist also enabled me to change the entire shape and bearings of the tree, making a general improvement on the whole arrangement."

Uses of Waste Paper.

A writer in one of our exchanges (we have forgotten which) says that few housekeepers are aware of the many uses to which waste paper may be put. After a stove has been blackened, it can be kept looking very well for a long time by rubbing it with paper every morning. Rubbing with paper is a much nicer way of keeping the outside of a tea kettle, coffee pot or tea pot bright and clean, than the old way of washing it in soda. Rubbing them with paper is also the best way of polishing knives and tin ware after scouring them. If a little soap be held on the paper in rubbing tinware and spoons, they shine like new silver. For polishing mirrors, windows, lamp chimneys, etc., paper is better than dry cloth. Preserves and pickles keep much better if brown paper instead of cloth is tied over the jar. Canned fruit is not apt to mold if a piece of writing paper, cut to fit each can, is laid directly upon the fruit. Paper is much better to put under carpet than straw. It is thinner, warmer, and makes less noise when one walks over it. Two thicknesses of paper placed between the other coverings on a bed are as warm as a quilt. If it is necessary to step upon a chair, always lay a paper upon it, and thus save the paint and woodwork from damage.

Watering House Plants.

The English Garden is inclined to dispute the rule that water "should be given in moderately small quantities, and supplied frequently." If the causes of failure where plants are cultivated in windows were minutely investigated, the dribbling system of watering would be found to be the principal cause. A plant ought not to be watered until it is in a fit condition to receive a liberal supply of that element, having previously secured a good drainage, in order that all superabundant water may be quickly carried off. Those who are constantly dribbling a moderately small quantity of water upon their plants will not have them in a flourishing condition for any length of time. This must be obvious to all, for it is quite evident that the moderately small quantity of water frequently given would keep the surface of the soil moist, while at the same time, from the effects of good drainage, which is essential to the well being of all plants in an artificial state, all the lower roots would perish for want of water, and the plant would become sickly and eventually die.

A FRENCH writer, in estimating the future of science, points out that in fifty or a hundred years' time the English language will in all probability be spoken by eight hundred and sixty millions of individuals, while the German will be the language of one hundred and twenty millions and the French of sixty-nine millions only, and that in consequence science is likely to seek English channels of publication, scientific books having at best a limited sale and necessarily seeking the widest audience.

NARROW GAGE passenger cars, as generally constructed, stand thirteen inches nearer the rail, and have about fifteen inches less overhang at the side; hence, the center of gravity is considerably lower than on the standard gage, making the car ride very steadily, and with less oscillating motion than is usually observable upon the wide gage. The seats, thirty-six to a car, are arranged double on one side and single on the other, with the order reversed, midway of the car, to distribute the weight equally.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT MAGIC RUFFLE—ELM CITY COMPANY VS. GEO. H. WOOSTER.

WOODRUFF, Circuit Judge.

The testimony in this case is very greatly conflicting or very much of it is not entitled to credit, either because, in my opinion, the witnesses exaggerate their asserted achievements, errors, or, state the time, or describe the inventions which did not in fact embrace the patented invention, or refer to crude or imperfect endeavors to imitate the "Magic Ruffle", which appears to have been popular at the time when, according to the evidence, many were seeking to compete with the one engaged in its manufacture.

After a thorough examination of the evidence my conclusions are: First, the patentees were the first inventors of the plaiting attachment mentioned in the patent described in the bill of complaint, and on which the suit is founded.

Second, the defendant has infringed the rights of the complainant, as assignee of the said patent, as alleged in the bill of complaint, by the use of a plaiting attachment embracing the said patent invention.

Third, the said patent is not void on the ground that there was any fraudulent misrepresentation in the specification annexed to the patent. No such fraudulent misrepresentation is proved. Nor is the patent void upon the ground that the invention was not the joint invention of the patentees. The testimony proves such joint invention most clearly and distinctly.

There was no such sale of the patented machine or apparatus two years before the application for a patent as renders the patent void. An agreement for the transfer of the patent for the joint benefit of the inventors and those who will advance money for the manufacture or use of the machines invented, not carried into execution, and unaccompanied by any public use of the machine, but being prospective in its character, not consummated until within the said two years, does not in my opinion affect the validity of the patent.

Fourth, I find no ground upon which to hold that a corporation, created by the law of a State without the limits of this federal judicial district, may not maintain a suit here for an infringement of their rights committed there.

These conclusions necessarily require a decree in favor of the complainant, according to the prayer of the bill.

It is obvious that the defendant has introduced testimony which was not admissible as a defense, relating to the knowledge and use of the invention by persons not named in the answer, to some or all of which objection was made by the complainant on the taking of testimony. I have not, however, regarded the objection in any consideration, because the briefs submitted do not involve a motion to strike such testimony, and my conclusions are therefore founded on all the proofs.

Let a decree be entered for the complainant awarding the relief prayed for.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From July 19 to July 21, 1873, inclusive.

DISTRIBUTING FLUIDS, &c.—C. G. Wheeler (of Chicago, Ill.), London, Eng.

LIFE PRESERVER.—E. R. Coylewell, New York city.

SPINNING WOOL.—J. G. Avery, New York city.

NEW BOOKS AND PUBLICATIONS.

CHIMNEYS FOR FURNACES, FIRE PLACES, AND STEAM BOILERS. By R. Armstrong, C. E. No. 1 of "Van Nostrand's Science Series." Price 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren Street.

We are pleased to see an issue of handbooks on practical subjects commenced with so excellent a specimen as the work before us. The chimney has always been the builder's puzzle and the occupier's torment; and some practical, well digested reason on the subject, by a thoroughly capable writer, will be found in this neat little volume. The reputation of the publisher will guarantee the continuance of the series with similarly excellent treatises.

THE CANADIAN ORNITHOLOGIST, a Monthly Record of Information relating to Canadian Ornithology. Edited by Dr. A. M. Ross. Price 15 cents per month. Toronto: Willing and Williamson.

An excellent little magazine, entertaining to many who live beyond the borders of the British Provinces. It appears to be written by contributors well versed in the most interesting branch of natural history.

THE ART OF SHOOTING ON THE WING, with Hints and Recipes for the Use of Sportsmen. By An Old Game-keeper. Price 75 cents. New York: The Handicraft Publication Company, 37 Park Row.

A practical and well written handbook, especially adapted for the use of young sportsmen, as it gives sensible advice on the manipulation of fire arms and the rules and etiquette of the field.

Recent American and Foreign Patents.

Improved Metallic Clasp.

Charles Marshall, Lockport, N. Y.—The object of this device is to furnish ready and convenient means for holding or supporting drawers or overalls when a button fails, for hanging up hats and other articles of clothing, or for supporting ladies' dresses, etc. The clasp is attached to the article by putting the teeth against the cloth to be fastened, when the slide is turned one side, and then back over the teeth. There is a slight spring to the slide, which holds it in place and makes the attachment secure. As manufactured for use, the clasp does not exceed the weight of an ordinary metal button.

Improved Sewing Machine.

John Albert Smith, Columbus, Ohio.—This improvement consists in a new combination of machinery, by which rotary motion is imparted to the shuttle. A rotary disk for carrying the shuttle carrier is mounted on the end of the pulley shaft and is arranged with its face, to which the carrier is pivoted, in the plane of the needle, so that the carrier will pass the needle close to its side, suitably for passing the shuttle through the loop. The carrier is connected to it by a pin which is fitted into the disk so as to turn therein, and is connected by a universal joint with a rod, which is similarly jointed to the frame so that it can swing with the pin around the axis of the shaft, but not turn itself, and thus prevent the carrier from turning as it swings around with the disk.

Improved Harvester.

Elgin M. Awrey, Calmar, Canada.—This invention has for its object to furnish an improved device by means of which the table or finger bar may be raised, when desired, by the advance of the machine, thus dispensing with the ordinary levers and keeping the machine free for the operation of the self rake.

Improved Hog Trap.

Aaron B. De Vore, Taikington Township, Ill.—This invention is an improvement in a crib or stocks for holding or confining hogs. The bottom facilitates downward toward the head lock and falls considerably below the front beam, so as not to afford a foot rest by which the hogs can push back and pull out of the lock. For small shots a secondary pen or crib is arranged in the large one to contract the space suitably for them.

Improved Washing Machine.

John W. Conroy, Terry, Miss.—By suitable construction, by adjusting a nut, a jointed rubbing board may be held up against a corrugated cylinder with any desired pressure, so that the said cylinder may carry the clothes along the rubbing board, and at the same time rub them, thus washing the clothes quickly and thoroughly.

Improved Rotary Hog Scraper.

Robert Fyfe, New York city.—This invention consists of a rotary scraper with blades adapted for scraping off the hair, bristles, etc., of sealed boxes, with handles by which to hold it when it is revolving, and a jointed driving shaft worked by a pulley or other driving gear. It is very simple in construction and said to be useful and convenient in action.

Improved Self Closing Faucet.

Alexander B. McKinnon, New York city.—This invention relates to improvements on faucets of the kind having swivel discharge tubes, which tubes, when in one position, are closed and stop the outflow of water, while in the other position they communicate with the water supply, are open, and allow the water to flow out. Whenever it is desired to have the water flow out, the horizontal tube is turned by hand to open the aperture, and is held so as long as necessary; but as soon as this tube is let go, the pressure of water against another piston immediately causes the vertical tube to swing closed.

Improved Manufacture of Wadding.

Andrew Chambers, Providence, R. I.—It is proposed to manufacture waddings of old celaines, and other part cotton and part wool goods, by picking the stock into sufficiently fine and soft particles to form a soft fine lap, and then passing it directly from the machine in which it is made through a bath composed of a solution of resin, caustic soda, and also coloring matter. The solution saturates the lap throughout and secures the fiber so as to make as good and strong an article as the ordinary long fiber and yet does not injure the fiber in respect to the light, crisp nature which it is necessary for all good waddings to possess. It is also proposed to apply a dressing of plaster of Paris to the surfaces of the wadding as it passes out of the bath, to glaze it and prevent it from sticking, by passing it between a couple of boxes containing the plaster, and brushes for throwing it on the wadding as it passes along. The claims cover both the manufactured article and the mechanism by which the wadding is made.

Improved Clothes Dryer.

Almeron Graves, Roscoe, Ill.—The central vertical standard upon which the device for drying clothes revolves has feet pivoted to a sliding socket collar and braces. The braces are also at their upper ends pivoted to a similar socket collar, which moves loosely upon the vertical standard. The lower ends of the feet are made fast to the ground by suitable pins driven through loops. The number of braces is equal to the number of feet employed. A series of semi-vertical brace arms, which at their base are pivoted to a socket collar similar to those above described, form a base for the drying apparatus. These brace arms are also at their upper ends pivoted to an equal number of radial arms which also are at their inner ends pivoted to another similar socket collar. The whole series of arms are provided with a network of clothes lines. Cords pass over pulleys having their outer ends attached to one of the radial arms at opposite sides of the dryer, and are used to fold up the dryer like an umbrella.

Improved Device for Manufacturing Jewelry Bases.

Shubael Cottle, New York city.—This invention consists in a peculiarly constructed former combined with a die banisher and mandrel. A blank has a bottom and barrel at a sharp angle to each other. The former is made in sections. The female die is made with a detachable bottom for convenience in removing the blank, and with a shoulder in its cavity, leaving a space around the barrel of the blank, when said blank is inserted in said die. A plunger is made with a square edge, and a recess having a rounded angle. The former is placed in the blank and the blank is inserted within the shoulder of the die. The plunger is then brought down upon the edge of the barrel of the blank, turning the said edge inward over the former, producing the blank. The blank is now placed in a hollow mandrel, and while the mandrel is being rotated in a lathe, a burnisher is held against the turned over edge, which is thus pressed down upon the former until it has a sharp angle. The blank is now taken out of the mandrel, and the middle section of the former is removed, and subsequently the others, after which the bottom is cut out so as to produce a blank which consists of three curved strips, two being horizontal, and the other, which connects them, vertical.

Improved Tobacco Transplanter.

Clement E. Bates, South Deerfield, Mass.—This invention has for its object to furnish an improved machine for transplanting tobacco plants. In using the machine, one of the pans, a number of which have been previously supplied with plants, is placed upon the upper platform, the handle is grasped by the left hand, and a lever pushed forward so that a plant is dropped through a tube to rest in a cup formed by plates. The instrument is then pressed down upon the ground and the lever drawn to the rearward. This forces the plates outward and edgewise through the soil, and at the same time moves the paddles inward and sidewise through the soil, pressing said soil around the roots of the plant. The instrument is then raised from the ground, the lever pushed forward, another plant inserted in the tube, and so on.

Improved Vise.

Daniel S. Coe, New Hartford, Conn., assignor to Chapin Mac'Ine Company, of same place.—This invention has for its object to furnish an improved bench vise. Upon the inner ends of screws are secured small gear wheels, the teeth of which mesh into each other, so that by turning the right screw the left screw will be turned in the opposite direction, and the two screws will work together to carry the movable jaw back and forth, exactly parallel with the stationary jaw.

Improved Dress Protector.

Adolph Herrmann, New York city.—This invention is designed to furnish an improved dress protector which shall be so constructed that when an edge becomes worn it may be reversed, and thus made to do double service. The invention consists in folding the material longitudinally so that its edges may meet or overlap each other along the central line, plaiting it transversely, and securing the plaits by two rows of stitching about equally distant from the edges of the protector and from each other.

Improved Iron Railway Tie.

Charles W. Gulick, New Brunswick, N. J.—This invention furnishes an improved cross tie and fastening for railroad rails, which shall support and firmly secure the rails in place. The invention consists in wrought iron ties for railroad tracks, having transverse flanges formed solid upon them to form grooves to receive the rails, and having holes formed through them to receive the clamps.

Improved Dies for Plain Finger Rings.

George Kremenitz, Newark, N. J.—This invention is an improved device for enlarging and finishing plain finger rings. The lower or stationary die, which has a hole formed through it of such a size as to allow a plunger to pass through it freely. In the upper end of the hole is formed a rounded recess to receive the ring. The plunger is made tapering or conical, and with its upper part of exactly the size required for the ring. Upon the upper end of the plunger is formed a tenon to enter a hole in the lower end of the holder, by which the said plunger is forced through the ring. In using the device the ring is placed in the recess of the die, and the plunger is forced through it by the holder, bringing the ring to exactly the required size, and leaving it perfectly true. The same inventor has also patented an improved mode of making plain finger rings without a joint. The invention consists in two sets of dies for forming a jointless ring from a solid ring plate. The half round ring plate is laid, rounded side downward, in the flaring upper end of the cavity of a die, and the plunger brought down upon it, which forces it into the lower part of the cavity of the die, giving it a somewhat conical form, and producing the conical ring. The latter is placed, larger edge downward, in the cavity of the die, and the tapering part of the plunger forced into it, which forces the smaller edge of the ring outward, while the taper of the cavity of the die forces its longer edge inward, and produces a ring convex upon its inner surface and half round upon its outer surface. The ring may then be finished, enlarged, and sized in the ordinary manner.

Improved Pencil Case.

Samuel S. Rembert, Memphis, Tenn.—This invention is an improvement in calendar pencil cases; and consists in providing the case with a perforated cap and a scale of lines measurement, whereby the same is adapted to be applied to pencils of any length and to be used as a rule or measure in determining the length or other dimension of any object.

Improved Machine for Sawing Laths.

Alexander Bodgers, Muskegon, Mich.—This invention consists of a gang of circular saws on a horizontal arbor, in different sizes, with an inclined table and feed rollers so arranged that lath and other like stuff may be sawn obliquely to the sides, to produce bevel edged strips by saws on a horizontal arbor. The invention also consists of one or more feed rollers made slightly conical, and provided with spiral ribs arranged to force the piece to be sawn to the guide and keep it there, as well as to feed it to the saws.

Improved Glove Fastening.

Horace P. Carter, Binghamton, N. Y.—This invention is intended to produce a new fastening for kid and other gloves, and it consists of a pin supported firmly by the projecting parts of a plate attached to one side of the glove, which catches between coiled parallel springs of a plate attached to the other side of the glove, so that they, in combination with the action of the supporting side plate of the pin on the ends of the springs, firmly hold the parts together.

Improved Adjustable Scaffold.

John S. Tilley, West Troy, N. Y.—For adjusting the scaffolds of wall plasterers and ceiling decorators, high or low, according to the height of the room, it is proposed to have short trestle heads mounted on three legs, with a vertically adjusting standard in each head having a fastening to hold it at any height, and having a couple of plates clamped to it at each side near the top, so that they can be readily adjusted to form, with the standard, a T head, wherein the scaffold trestle heads may rest, fastwise, when, as in the case of decorating ceilings, it is desirable to build broad scaffolds by laying the scaffold boards or planks, extending from one trestle head to another, and arranged edgewise to support the scaffold boards. In order to pack the benches the legs are jointed to them so as to fold over on the sides. When in use the ends of the legs bear against the walls or shoulders of the notches, and so transmit the force directly from one to the other without injury to the joints.

Improved Box Scraper.

Abraham Tester, Brooklyn, N. Y., assignor to himself and John Cunningham, of same place.—This invention has for its object to construct a scraper which is used on packing boxes, ships, etc., with a movable blade, so that the same may be sharpened when worn, and adjusted to a suitable angle for use in any desired position. The invention consists in pivoting the blade to the bifurcated handle of the instrument and in connecting it therewith by means of a pivoted brace, so that it can be swung into suitable position and rigidly held therein.

Improved Invalid Bedstead.

John Robinson, Madison Station, Miss.—This invention consists of an improved bedstead, which is so constructed that the head part of the bed bottom may be raised and lowered gently and gradually to any desired extent, so as to change the position of the person lying upon the bed. To the head parts of the slats is secured a cross bar, to the lower side of the ends of which are attached sockets to receive the upper end of rods, the lower ends of which are pivoted to nuts, through which pass the end parts of another rod, upon one half of which is cut a right screw thread, and on the other half a left screw thread, so that when the latter rod is turned in one direction the nuts may move toward each other; and when the said rod is turned in the other direction, the said nuts may move from each other, thus lowering and raising the head part of the bed bottom as may be desired.

Improved Metal Window Sash.

John D. Moran, New York city.—This invention consists in making the oval headed T shaped moldings for show windows by first forming an oval or semi-elliptical bar of lead with a groove in the flat side for the base of the head of the molding, by forcing the head through a die of suitable form in the manner of forming lead tubes. Second, in drawing the silver plated cover of sheet metal upon the said lead bar, by forcing a flat strip of the covering metal and the lead bar through a die plate together. Third, in soldering the lead on bar which constitutes the vertical portion of the T to the lead bar by heating one edge of the iron bar in a bath of solder and tinning it at the same time, and then laying the tinned and heated edge in the groove of the lead bar, whereby they become united. The iron bar heating the lead bar sufficiently to cause the union of the lead with the tinned surface of the iron when they become cool. Fourth, in making a cheap bar or molding for interior work, where the plated molding will be too expensive, by uniting the lead and metal bars, as above described, without the plated metal covering for the lead bar.

Improved Mirror Holder.

William Simpson, Berlin, Canada.—The object of this invention is to supply a neat and simple device by which a mirror may be suspended at any desirable inclination toward the wall. The invention consists of a V shaped holder, of strong wire, bent forward and attached to the sides of the frame of the mirror in such a manner that the same may be inclined at pleasure.

Improved Apparatus for Scraping Hogs.

Orison McNeil and Peter W. Dalton, Jersey City, N. J.—This invention consists in an arrangement of carrying rollers with scraping blades and a chain, the last being used for drawing the hogs over the rollers and between the blades.

Improved Heating Stove.

Jacob L. Ring, Mt. Pleasant, Ill.—This invention consists in a novel mode of combining the main parts of a heating stove. A central upright tube extends from beneath the stove hearth into the hot air chamber, which is surrounded by the drum, leaving a space between the two, from which the smoke and gaseous products escape to the chimney. On top of the air chamber is a perforated cylinder covered by a cap, surrounded by a perforated ring. A lag is on this ring, by means of which it is turned to allow the discharge of air from the chamber. The air tube may extend up from the hot air chamber and conduct a current of heated air to any part of the dwelling. It is surrounded by the fuel in the fire box, and an active current, through it and through the chamber, is produced by the intense heat to which it is exposed.

Improved Paper File.

John F. Winter, Brooklyn, N. Y.—The object of this invention is to furnish an improved paper file for blading letters, bills, newspapers, pamphlets, sheet music, etc., in a simple, elegant, and quick manner, without tearing, defacing, or otherwise injuring the papers or documents. This invention consists of a square, round, or polygonal piece over which strings are longitudinally stretched in suitable manner, which, in connection with lateral binding strings placed over a grooved or recessed part of the main piece and a thread and needle, bind the sheets in a manner similar to that of binding books.

Improved Cotton Gin Knife Roller.

Thomas H. Rushon and William Dobson, Bolton, England.—This invention consists in a cotton gin knife roller provided with blades having two or more angles arranged in line with each other in the direction of the shaft, their inclined parts being parallel to each other.

Improved Sap Protector.

Henry C. Cole and Edgar D. Sabie, Wallingford, Vt.—The object of this invention is to provide means for protecting maple sap, as it is caught in buckets from the tree, from snow, rain, leaves, etc.; and it consists in a screen or cover attached to the tree and to the sap bucket, and covering the latter.

Improved Toy.

Laurance Bryan, New York city.—This invention is a toy for children, which will furnish not only amusement but exercise; and it consists in what is known as the "child's wheel runner" combined with a whistle, the wheel being made to operate and blow the whistle as the child propels it.

Improved Apparatus for Moistening the Atmosphere.

James G. Garfield, Biddeford, Me.—For moistening the atmosphere in weaving and other rooms, it is proposed to employ an atomizer, air chamber, and condensing pump, a water cistern, reservoir, and an automatic apparatus for supplying the cistern and the atomizer from the reservoir regularly and uniformly, to be expelled to the atmosphere by the air from the air pressure chamber, in which it is condensed by the pump. In combination with the reservoir and cistern is a filter to separate from the water any solid particles that might obstruct the pipes of the atomizer also to purify it. The pump will, in practice, be run by power, and as many atomizers will be applied to one air chamber and cistern as may be demanded by the capacity of the room to be charged.

Improved Machine for Cutting Tobacco.

Francis S. Kinney, New York city.—This invention has for its object to furnish an improved machine for cutting tobacco, the same being constructed with a single knife working upon inclined bearings, and operating with a sliding shear cut upon the tobacco, which is placed in a box with sides at right angles and bottom parallel with said knife.

Improved Die for Making Watch Case Caps and Backs.

Usher C. Lewis, Brooklyn, N. Y.—This invention consists of a die of the usual form and material, but having, instead of a flat surface, an elevation, which gradually increases from the circumference toward the center adjusted to the elasticity of the gold and the thickness of the covers, producing a perfectly flat even plane, more accurate than if spun out. It is an important improvement in the manufacture of gold caps and backs to watches.

Improved Double Acting Force Pump.

John P. Flanders, Vergennes, assignor to himself, Eli B. Hayes, of same place, and H. M. Mitchell, Burlington, Vt.—The cylinders are arranged on each side of a wide bed frame, and between them suction pipes are arranged, rising vertically from the well and connected to the cylinders by horizontal branches at the upper ends above the check valves. Four discharge pipes rise vertically a short distance above the cylinders, and there continue by curves above the check valves into a discharge box at the bottom, where the check valves are arranged to prevent the back flow. These pipes support the discharge box and the air chamber. For packing the pistons, the barrels in which they work are divided in longitudinal parts with lap joints at the edges, so that they can contract and expand a little without opening seams for the escape of water. A small annular channel surrounds the barrel, in which is maintained a high degree of pressure by water admitted through a pipe connection. To hold the barrel in position and allow them to be free to expand and contract, notches are formed in the shell in the cylinder, and lugs in the barrels, which project into the notches and hold the barrels against the end motion.

Improved Table Dish Stand.

Florin Grosjean, New York City.—The essential feature of the invention is a stand or tray for dishes, of which the top or plate is composed of metal with a porcelain cover or enamel, the enamel being to conceal the iron or give it a fine finish, and form the ground work for fine picture ornamentation by the decalcomanic or other process.

Improved Stop Valve.

George W. Eddy, Watford, N. Y.—This invention relates to that class of stop valves in which two disks are arranged to move forward and backward at right angles to the water channel in a chamber through which the channel passes at openings on opposite sides whereat the seats are formed for the disks, and on which they are caused to press tightly when moved upon them.

Improved Egg Carrier.

John A. Beam, California, Mo.—This invention consists of a strong wood box in ten compartments, or tiers of paper cells, adapted to hold an egg upright, on the large end, the cells being formed of a paper cylinder and pasted or otherwise fastened together at the sides. Between each tier of the cells, also between the upper and lower tiers and the box sides, are cushions to soften the shocks. The rows of cells along the sides of each tier are protected from the shocks against the side walls by springs. The sides of the box are provided with projections, which prevent the box from resting on them, so that the eggs are secured against lying on the sides while in transit. Some of the end projections of the case constitute handles for handling it.

Improved Horse Power.

William Gillilan, Spicer, Minn.—The object of this invention is to furnish a horse power for thrashing grain and other purposes. The cogs of a bed wheel are on the upper side and engage with vertical internal and external gear wheels, which are on a horizontal cross shaft. The power is applied, to a revolving frame attached to the cross shaft by stands, by means of levers. Arms connect the rim of the frame with the central cap. Traverse wheels attached to the frame revolve through slots in the rim of the frame and rest upon the top of the bed wheel, and thus prevent friction. The internal part of the vertical wheels engage with other wheels. The exterior cogs of the vertical wheels engage with the cogs of the bed wheel, and thus impart motion to the central vertical shaft.

Improved Washing Machine.

Moses L. Hawks, Kinderhook, Mich.—This invention has for its object to furnish an improved washing machine of that class in which the washing is done by passing the clothes back and forth between rollers, and which shall wash the clothes quickly and thoroughly and without injuring them, and without becoming clogged. A large upper roller is corrugated longitudinally, and to it is attached the crank by which the machine is operated. Four small rollers are placed beneath the large roller. By suitable construction, as the clothes pass in, the upper roller and outer small rollers yield so as to accommodate themselves to the thickness of the clothes. As the latter pass out, the outer small rollers upon that side yield, thus preventing clogging. By proper devices the machine is held in the tub in which it is desired to operate.

Improved Washing Machine.

Jacob Sheffer, Des Moines, Ill.—In using the machine, the clothes are placed upon a false bottom around a rotating vertical cylinder. The handle is grasped in the left hand to apply pressure, and a vertical roller, held between pivoted bars, to which the handle is attached is revolved with the right hand by means of the crank. The cylinder holds the clothes out so that they will be in proper position to be operated upon by the roller, the flange of the said cylinder pushing the lower part of the clothes in beneath the mass, so that they will be continuously turning over. The outer part of the bottom, as it is rotated by the roller, moves faster than the inner part, so that the clothes will be rubbed as well as pressed.

Improved Last Block Fastener.

David Huard, Ashland, Wis.—This invention consists of a clasp-like fastener, pivoted to the main block of the last, which closes over the other block in connection with pin fastenings of the same.

Improved Water Elevator.

Sylvester Bennett, New Orleans, La.—This invention consists of a stationary case in the form of a hollow inverted truncated cone, inside of which is a revolving inverted cone with one or more spiral flanges extending from bottom to top, and apparatus for revolving the inner cone for raising water short distances in large quantities, for draining purposes and the like.

Improved Seed Planter.

William J. Saffery, Bremen, Ohio.—This invention consists in combining a furrow opener, a seed dropper, a rolling coverer, and a guano or manure dropper, so that, between the seed and the guano, there will always be a small layer of fine dirt to prevent the destruction of the vitality of the seed.

Improved Pump.

Charles D. Rathbone, Belpre, Ohio.—This invention consists of a novel construction and mode of applying a bush or lining of glass or other hard and durable wearing substance in the pump cylinder or stock to sustain the wear of the sucker or pump barrel.

Improved Bed Bottom.

Jonathan V. Taylor, La Cygne, Kansas.—This invention consists of two pairs of bars about half as long as the bed, fixed at one end on a transverse pivot at the middle of the bed, one pair extending to the head and the other to the foot, and connecting with cross bars thereat. One cross bar at the head and one at the foot are each connected by several tension straps of strong flexible material arranged above the pivot, and sufficiently short to support the arms and cross bars, and any weight that may be placed on them above the horizontal plane of the pivot. At each end there is a stop bolt which limits the height to which the end may be raised, and thus prevents the other end from falling too low. In connection with the above are the arms provided with springs at the pivot to increase the range of the springing action of the bottom.

Improved Floor.

Levi B. Wood, Marion, Iowa.—The object of this invention is to provide means for strengthening floors, roofs, etc., and it consists in truss rods passed through the joints of the floor or rafters of a roof in combination with bridge blocks fitted between the joists on one or both sides of each rod. Nuts on the rod are turned up, giving the rod any required degree of tension, and binding the blocks and joists firmly together.

Improved Sharpening Machine.

James P. Kealy and Joseph Bigney, Bridgeport, Conn.—This invention is a machine for dressing lathe centers, and consists of a traversing grinder actuated by an automatic feed screw and placed in a frame adapted for being supported in the tool post of a lathe.

Improved Equalizing Attachment or Plows.

David H. King and William M. Hulse, Palmyra, Ill.—This invention consists in an improved metallic loop attachment for holding the equalizing apparatus of a plow, and also in applying a guard bar to the chains used in equalizers.

Improved Fireproof Shutter.

Isaac B. Mettler, Jersey City, N. J.—The object of this invention is to protect buildings from fire, and it consists in a metallic shield composed of sliding sections formed of an inner and an outer sheet of metal secured together at top and bottom by plates. The sections are confined in grooves on the inner sides of the casings, each section having grooves of its own. Across the top of the shield, beneath the cap of the cornice, is a shaft having a pulley near each end, over which are cords attached at one end to the lower section and at the other end to a weight. An inwardly projecting flange extends from each section into the groove of the adjacent section, so that, when the lower section is raised, its top strikes the flange of the next above and raises that, and so on, each section being raised by the section below, so that all may be securely packed beneath the cornice and back of the frieze plate. The weights are intended to balance the sections in that position. At night, or whenever there is danger from fire from the burning of adjacent buildings, the shield is drawn down, thus forming a fire protector to the window or door.

Improved Waste Removing Device for Carding Machines.

George W. Cruser, Darby, Pa.—This invention consists of a brush and an endless carrier for it combined with the burr box of a carding machine, in such manner that it brushes out the burrs, and, by keeping it clear of them, prevents it from filling and the burrs from overflowing upon the main card.

Improved Insect Destroyer.

John A. Finney, Nashville, Ohio.—An axle is turned by drive wheels, and by suitable gearing actuates an endless belt which carries the insects forward. From the belt the insects drop into a hopper placed beneath a roller to receive them, and which has a slot or opening in its bottom, through which the insects drop into the angle between the revolving axle and the roller, where they are crushed and drop through an opening in the bottom of the box to the ground. A reel operated by the advance of the machine pushes off the insects. As the reel arms come in contact with the plants, the ends of the hammer handles slip from a stop bar, and the hammer heads are drawn by springs against the reel arms with a sudden blow, knocking the insects from the plants upon the inclined apron whence they pass to the endless belt.

Improved Dredging and Ditching Machines.

Hyacinthe Gonellaz, Vermillionville, La.—In the dredging machine, a bucket wheel and discharging pan similar to those represented in patent of same inventor, No. 130,213, dated August 6, 1872, are arranged so that the wheel mounted at the bow of the boat revolves in a plane at right angles to it, and delivers the earth at one side, and the pan carrying it in the same direction delivers it on the bank of a canal or river. They are by virtue of such arrangement specially adapted for dredging rivers and canals. In this case also the colters used for cutting and loosening up the earth preparatory to the taking of it by the buckets are arranged on the advancing side of the wheel, and so inclined as to draw the boat forward at the same time that they loosen the earth. The ditching machine, the subject of a separate patent, consists of a series of intermittently rotating colters preceding a rotating wheel with spoons or buckets, behind which is a receiving and discharging pan, combined in a portable machine, and provided with operating devices, all so contrived that, as the machine advances along the ground, the colters loosen and even up the ground, the buckets raise and discharge it into the pan, and the pan discharges it on the bank at one side of the ditch.

Improved Furniture Spring.

William T. Doremus, New York City.—This invention has for its object to furnish an improved spring for application to other parts of a chair, spring bed, or other piece of furniture where a yielding connection is required. Upon the lower side of one edge of two plates are formed inwardly projecting flanges, in which are formed a number of holes to receive the screws by which they are secured in place. In the plates are formed holes to receive the bar, which has a pin in a recess formed in the upper side. A rubber block, of any suitable form, is interposed between the plates, through which is a rod which forms the hinge, and which is provided with a nut to regulate the tension of the spring. The same inventor has also patented another form of chair spring which consists in flanged plates, hinged together by a transverse bolt passing through suitable lugs. An India rubber block is placed beneath the axis of the hinge. These are only two patents out of more than one dozen applications, all of which have been granted to Mr. Doremus through the Scientific American Patent Agency within the past five weeks.

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, Hee, 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 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 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, 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.

Design Patents.

Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

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A. M. C. asks: Is there anything which will as effectively protect iron from rust, etc., as the galvanizing process, but which is less expensive?

H. J. H. asks: What is the best composition to preserve pickets set in the ground?

T. B. C. wants a recipe for sticking emery on tin. "There is a constant jar on the tin, and glue will not hold."

H. F. U. asks for the exact proportion of ingredients requisite to make a wholesome self-raising flour.

M. C. asks: What is the process of grain-ding oak root, and what colors are used by painters in doing it in distemper?

W. H. R. asks: 1. How great a vacuum can be produced with an air pump with one inch bore and 3 1/2 inch stroke? 2. Can an article be held on a trap by such vacuum fast enough to lift 15 lbs.?

C. T. S. can preserve his composing stick or other steel articles from rust by following the directions on p. 27, volume 25.—F. can attach leather or cloth to galvanized iron by using the recipe given on p. 167, vol. 25.—J. W. J. should try the method described on p. 406, vol. 25, for preserving eggs.—F. A. will find a recipe for shoe-maker's ink on p. 15, vol. 27.—R. H. L. will find his question as to the weight on a safety valve answered in the reply to W. A. S. on this page.—E. R. D. should consult the makers of windmills. His query about slip of belts is answered on page 390, vol. 28.—J. L. H. can try the much recommended tannate of soda in his lime water.

W. C. F. asks: At what velocity will steam issue through a round hole, one eighth inch long and one sixteenth of an inch in diameter, under a pressure of 100 lbs. to the square inch; and what would be the difference in the velocity provided the diameter of the hole be increased to one eighth inch, the pressure and length of hole remaining the same? Answer: See editorial pages of this issue.

W. H. S. asks how to precipitate gold, silver, copper, nickel, and platinum from solutions. Answer: To precipitate gold, add a strong solution of ferrous sulphate, or sulphate of iron, to a solution of any salt of gold, as the chloride, prepared by dissolving gold in aqua regia. The gold is precipitated as a brown powder. Silver is precipitated in the metallic state from the chloride, made by dissolving silver in aqua regia by iron. Add clean pieces of iron to a solution of the chloride of silver. For copper, add clean scrap iron to a solution of blue vitriol, sulphate of copper. For metallic nickel, first add a strong solution of oxalic acid to a strong solution of sulphate of nickel. Collect the pale bluish green precipitate. Heat the precipitate in a covered crucible, lined with charcoal. For platinum, dissolve the metal in aqua regia (a mixture of muriatic and nitric acids), precipitate with a solution of sal ammoniac, and heat the precipitate red hot. The result is spongy platinum.

N. J. N. asks: 1. How can I calculate the difference between the steam pipe and exhaust pipe of a stationary engine? Is a three inch exhaust large enough for an engine of 12 inch bore and 20 inch stroke, with a 2 inch steam pipe, running at 104 revolutions per minute, 60 lbs. pressure to the square inch in the boilers? 2. What is the accompanying specimen composed of? 3. Will it affect the water in the boiler to put in the carcass of a dead mule, in pieces? 4. How can I compute horse power? Answer: 1. Consult "Link and Valve Motions," by W. B. Auchincloss. 2. Some compound of lime, probably the carbonate. 3. We never heard of the plan before. 4. See answer to M. C., on this page.

J. R. K. asks: 1. We want to carry the condensed steam from an engine into a tub eight feet deep, for the purpose of boiling straw. What per centage of power do we lose on the engines? 2. We have a tubular boiler 42 inches in diameter, 80 two inch tubes, 14 feet long, with stack 18 inches diameter and 50 feet high, with very poor draft. The boiler is situated in a hollow; the hill on one side is about as high as the stack, the other twice as high. Can you suggest a remedy for the bad draft? Answer: 1. None, if the condensed steam does not have to be raised, to be put into the tub. 2. Probably a mechanical draft, by a blower, will remedy the trouble.

J. P. C. says: I use a small vertical portable engine and boiler, and sometimes I have to carry 100 lbs. steam to do the work. The boiler is 36 inches high, 28 outside diameter, with 24 one and a half inch tubes. The firebox is 18 inches diameter x 22 inches high. The middle gage is 39 inches from bottom of boiler, and the steam best with water at that height. I use fir wood for fuel, which makes an intense heat. Am I safe from heating the tubes too hot with the firebox full of wood, and water at middle gage, 18 inches above crown sheet? Evaporation is rapid and steam is pretty wet if carried higher. The boiler foamed so badly that I could not tell anything about the height of the water. I fancied that the oil which got in around the plunger of the force pump had something to do with it. I got the idea from something I once saw in the SCIENTIFIC; since then I have been very careful to keep all oil out, and have never been troubled with foaming in the least, at any pressure from 30 to 100 lbs. Answer: If when the engine

is in motion, the water issues solid from the lower gage cock, there is no danger. It is only when boilers have such a bad circulation that the tubes or crown sheet are left bare that there is danger from heavy firing.

H. B. & K. ask what kind of dryer is best to put in coal tar, in making a gravel roof. Answer: Try boiled linseed oil, or litharge.

T. S. S. asks how to make and bleach skel-tonized or phantom leaves. Answer: Boil the leaves in a weak solution of caustic soda for some hours, wash thoroughly and then expose to the fumes of burning sulphur.

E. C. C. says: I want to make springs 4 inches long x 1/4 inch wide by one thirty-second thick, to be pressed from sheet metal or otherwise. They are required to spring 1/4 inch and not to rust, and to be as cheap as possible. Is there any metal cheaper and better than sheet spring steel? They can be tinued or galvanized to prevent rust. Answer: Spring steel will probably be the best material for you to use.

G. says: Some bins containing soft crushed sugars are full of little red ants; I would like to know why they select that sugar from the other kinds, and how we can get them out? Answer: A plentiful supply of what is known as Persian powder, around (not in) the sugar bins, will prevent the inroad of ants. Sugar bins should be made of hard stout plank, with closely fitting covers, and kept perfectly clean. If they could be lined with earthenware or stoneware, and made airtight, so much the better. The only way we can suggest to you, for getting rid of the ants already in the sugar, is to spread it out in thin layers and pick out the ants by hand. The ants prefer the brown sugar, probably on account of its greater sweetness and moisture.

R. W. W. asks how to clean a carpet which has been soiled by accident. It was washed with soap suds; and to remove a sour smell, it was washed with soda water. "The color remained good until, to remove further odor, I poured on bay rum; that operation turned it a light green color. The original colors are two shades of brown, red, green and black, on a white ground." Answer: We advise you by all means to discontinue the use of soda water and bay rum on the carpet. The alcohol in the bay rum has probably so dissolved and spread the colors that there is no remedy. To remove the smell, try a very dilute solution of carbolic acid.

W. H. R. asks: 1. How great a vacuum can be produced with an air pump with one inch bore and 3 1/2 inch stroke? 2. Can an article be held on a trap by such vacuum fast enough to lift 15 lbs.?

A. S. asks how to bleach and cure palmetto grass. Answer: Steep or boil the leaves in a weak solution of caustic soda, wash thoroughly, and then expose them to the fumes of burning sulphur in a close chamber; or instead of the sulphur fumes, soak in a weak solution of chloride of lime and rinse well afterwards.

H. R. asks: Is there such a thing as scagliola? If so, where can I get it, how can I make it, and what is it used for? Answer: Scagliola is a species of stucco made with the best plaster of Paris and a weak solution of Plaster glue; it is colored according to taste. This composition is often applied upon hollow columns of wood, and the surface, when hard, can be smoothed in a lathe or polished.

A. H. C. asks: What is the cause of white sugar flashing like a glow worm when you run the scoop into it? Answer: The cause of sugar flashing, as you describe, is probably owing to the electricity developed by the friction between the scoop and the sugar.

C. E. asks: What is the difference between true north and magnetic north in the city of New York for the year 1873? Answer: The magnetic north is 7° W. of the true north.

P. D. asks: By what means flowers, leaves and other vegetable matters are deprived of their colors, that is, bleached or whitened, for introduction into what I think are called "skeleton bouquets"? Answer: Expose the flowers for a few minutes to the fumes of burning sulphur in a close vessel, care being taken to prevent the heat from reaching them.

W. A. S. asks: 1. What formulae are used in measuring safety valves of different sizes? 2. How do you go to work after you get the figures? Answer: 1. Measure the diameter of the valve, in inches—square this and multiply it by the decimal .7854; this will give the area of the valve in square inches. Find the weight of the lever, and the distance of its center of gravity from the fulcrum. This can be found by balancing the lever on a knife edge. We call the distance, the lever arm of the lever. Weigh the valve, and measure the distance from the center of the valve stem to fulcrum, noting that all distances are to be measured horizontally. This is the lever arm of the valve. Find the number of pounds in the weight. The distance of point of suspension of weight from fulcrum is called the lever arm of the weight. 2. Having obtained these figures, make an equation, thus: Pressure of steam in pounds per square inch x area of valve in square inches x lever arm of valve = (weight of ball x lever arm of ball) + (weight of lever x lever arm of lever) + (weight of valve x lever arm of valve.) It is evident that if all the parts but one are known, this equation will determine that part.

E. M. K. says: 1. How quickly can a 35 horse power engine be stopped if it is making 75 revolutions per minute with 75 lbs. steam? 2. How can I habbit a governor on a high pressure engine? 3. The oil or tal-low cup that was on the cut off chest was changed and put above the governor in the steam pipe; is that right? 4. How can I reverse an engine? 5. The boiler is to carry 75 lbs. steam. There is a 1 1/2 lbs. iron weight added to the safety valve. When it is off, steam blows off at 75 lbs. by steam gage. Is this right? 6. Is there water or oil used on emery stones and wheels, and how are they turned off? 7. Are the loads that stay around gardens poisonous? Answer: 1. It depends in a great measure on the weight of the moving parts, but under ordinary circumstances such an engine could be safely stopped in 15 seconds. 2. If it is a box, closed at both ends, heat the journal, cover it with a piece of oiled writing paper, place it in the box, and pour in the molten

metal. If the place is open at the bottom, after putting in the journal stop the opening with clay, and proceed as before. 3. Yes. 4. Arrange stops for the eccentric so that it will be loose on the shaft, between the positions for forward and backward motion. 5. We think you had better remove the extra weight. 6. There are emery wheels made to run in oil and water. Unless they are specially prepared, they should be run dry. 7. So far as we know, such loads are not poisonous.

J. K. S. asks: 1. How can I construct a storm glass? 2. How can I expel fleas from a cat that is filled with them? Answer: 1. Put the following ingredients into a long and narrow bottle: one quarter ounce camphor, one sixteenth ounce niter, one sixteenth ounce muriate of ammonia, dissolved in 2 ounces of alcohol. Cover the mouth of the bottle with a piece of bladder, containing a puncture made by a fine needle. 2. Boil tobacco leaves in water, and wash the cat in the decoction.

M. W. H. asks: 1. What is nitro-glycerin made from? 2. Does it, when ignited, leave any sediment or ash? 3. Can gunpowder be ignited by a current of electricity without the conducting wire touching it? 4. What will be the pressure of one ounce of common gunpowder, when ignited in a cubic foot of space? 5. What is the pressure of nitro-glycerin per ounce, in a cubic foot of space? 6. What the pressure of white or fulminating powder per ounce, in a cubic foot of space? 7. How many cubic feet will one ounce of common gunpowder fill, if exploded in a cylinder or tube one foot square, it standing upright, so that there will be only the atmospheric pressure of one square foot to sustain? 8. Will sulphuric acid keep ink from molding? 9. Will a pocket compass lose its magnetic power? If so, how long will it take, and can it be made good again, and how? Answer: 1. Made of nitric acid, sulphuric acid and glycerin. 2. No. 3. Yes, if the powder be confined. 4. One ounce gunpowder equals about 1 cubic inch space, and expands at the moment of explosion, as estimated by competent chemists, 2,700 times, or to about 1 1/2 cubic feet. Therefore the pressure in a confined cubic foot space, will be 2700 lbs. above the atmosphere per square inch. 5. Nitro-glycerin has 15 times the explosive force of gunpowder, therefore the pressure of one ounce may be estimated at 2700 lbs. per square inch above the atmosphere. 6. No known experiments have determined. 7. At moment of explosion 1 1/2 cubic feet. After the gases have cooled, however, probably from 1/4 to 1/2 of this. 8. The effect will be to corrode steel pens. 9. It will not, if not tampered with. When lost, the magnetic power is easily restored by rubbing on another magnet.

C. G. G. says: I wish to dig an ice cellar near my well of excellent water. If I drain the cellar through a filter, into the well, will the water be affected hurtfully? Answer: We would advise you by no means to drain your ice house, even through a filter, into your well. Filtered water may look perfectly clear and taste pure, and yet be poisonous, though that from your ice may be harmless. Let no drain come near your well.

M. C. asks: 1. How can I find the power of a steam engine by plain arithmetic? 2. I want a plain rule for finding the horse power of a tubular boiler. 3. Will the same rule apply to all boilers? 4. Is there a rule for finding the capacity of a plunger pump? 5. Which would be the proper place for an air chamber of plunger pump, on suction or force side? I propose to attach it to relieve a very heavy thumping. 6. What causes a vacuum in steam cylinder, and how can it be prevented? Answer: 1. Multiply the diameter of the cylinder in inches by the decimal .7854; multiply this by the number of revolutions per minute, and by twice the length of stroke in feet, and divide the result by 33,000. 2. Divide the number of square feet of heating surface by 13. 3. Only approximately to any. We do not know of any absolute rule, except a practical test. 4. Multiply the diameter of plunger in feet by the length of stroke in feet, and by half the number of strokes per minute, and you will get a rough approximation of the number of cubic feet delivered per minute. So much depends upon the construction and location of the pump that it is difficult to give a general rule that is reliable. 5. On delivery side generally. 6. The condensation of the steam. It can be destroyed or prevented by letting in air.

J. H. says: You repeatedly advise young mechanics to study mathematics. Will you tell me how long it will take to make a person sufficiently posted on the subject, provided that he has an average amount of brains, a good general knowledge of arithmetic, no knowledge of algebra (or very slight), a fair amount of perseverance, his nights only to study, and no funds to employ a teacher? What work would you advise me to commence with? Answer: A great deal depends upon making the right kind of start, so as to know how to study, as well as what to study. In algebra, we would recommend Davies' "Bourdon," and in geometry, trigonometry, and the use of logarithms, Davies' "Legendre." Each book costs from \$1.50 to \$2.00, and to master their contents thoroughly will require, with the limited time afforded you for study, from nine months to a year. But you will have gained a recompense; for avenues of great benefit to your business will be opened to you, which would otherwise have been as sealed chambers. In commencing your studies, remember that it is not so much rules, as methods, that you wish to acquire. Always proceed on the principle that the book is wrong and must be proved right; and get practice continually in the interpretation of formulas and results.

A. A. D. says: I am constructing a rotary engine with 4 vanes, each of which has 2 1/2 square inches area; it is constructed on the eccentric principle, and is to work on expansion, with 30 lbs. steam pressure, and to make 200 revolutions per minute. Would more vanes create more power? What sized boiler would it require, and what kind of boiler, of plate iron or copper for efficiency and cheapness? How much fire surface ought it to have to make the most steam and be the most economical? Please rate the power of the above engine, and give a reliable mode of calculating power of rotary engines. Answer: We cannot answer these questions without receiving more data. To calculate the power developed by a rotary engine, multiply the piston area that is acted on continuously by the mean pressure of the steam throughout the stroke. Multiply this by the mean piston speed in feet per minute, and divide by 33,000.

E. A. W. asks: How is the black varnish or iscker applied to small articles of wire, such as fish hooks, hair pins, etc., and of what is it composed? Answer: Add to 2 lbs. asphaltum (fused in an iron pot) 10 boiled oil 1 pint; mix thoroughly, remove from the fire and when cooled a little add 2 quarts oil of turpentine. Apply with a varnish brush.

F. B. T. asks: What should be the size of a water wheel, and of the stream of water to run a sewing machine? The water is supplied through hose to a tank 8 feet above ground. Answer: There are a number of sewing machine motors, driven by water, in the market. Correspond with their manufacturers.

Answers to Correspondents.

W. R. H. asks: How can I make India rubber impervious to kerosene oil? Answer: You cannot prevent kerosene attacking India rubber where it comes in direct contact with it. Still good rubber, well vulcanized, ought to last long enough to make its renewal at intervals not very expensive.

G. A. H. asks: Is nickel plating a success as a preservative, and can zinc be successfully plated with nickel? Answer: Nickel plating is a success, but there is no known method of plating zinc. The acid bath used is an obstacle, the acids attacking the zinc at once.

A. P. G. asks: If the dry heat of the Turkish bath is less penetrating than moist heat. Answer: The human body can withstand for some time a heat far above that of the Turkish bath, 200° Fahr., if the medium be that of hot dry air. The rapid evaporation from the surface of the body prevents the internal heating of the blood. If the air be moist, however, or the medium of heat be steam, a temperature considerably below 120° Fahr. would be sufficient to, in a short time, effectually kill a man.

G. F. A. asks: 1. How can I melt old composition printers' rollers, so as to pour into molds for casting plates in? 2. What are the exact proportions of the ingredients used in making the composition rollers now in use? 3. Can you inform me how the composition used by decorators for looking glass frames, etc., is made? Answer: 1. You can melt composition rollers by placing them in a vessel surrounded by boiling water, as in the ordinary glue pot. When melted, you can pour it into molds. 2. Dissolve, in two pounds of molasses (pure) at least not above that of boiling water, one pound of good glue, previously soaked over night in cold water. 3. Decorators use for gilding, what is known as "mosaic gold," a bluish-purple of tin. This is mixed with varnish and applied to wood.

W. S. R. asks how to recover diamonds from the debris of a fire. Answer: You can get rid of plaster and lime, or any substance that will remain for a length of time suspended in water, by the following means: Provide a large tank, fitted with a stirrer at the bottom. Let a stream of water enter the tank at the bottom; and when the tank is full of water and the stirrer in motion, add the debris in as fine powder as possible. Let a pipe carry off the surplus water at the top of the tank. In this way, with plenty of water, you can wash free from plaster and lime.

A. E. would like to know the rule for finding the speed of shafts or pulleys. Suppose a 22 inch pulley is making 40 revolutions per minute with a belt running on a 10 inch one; what would be the number of revolutions of the smaller one? Answer: The speeds of two pulleys, under such circumstances, are inversely proportional to their diameters. In the case menioned, the speed of the smaller pulley, if the belt did not slip, would be $40 \times 22 \div 10 = 88$ revolutions a minute.

W. H. D. asks: 1. Is an engine shop the best place in which to learn the machinist's trade? 2. If so, what manufacture would you recommend? 3. Would you recommend me to work at what my mind and heart is set upon, in preference to anything else? Answer: 1. Probably a large machine shop would be best for acquiring a general knowledge of the work, on account of the great variety of machinery constructed in such a place. 2. We cannot recommend any particular establishment. Try and get in a shop where the men are encouraged by the owners to study and improve themselves. 3. If you are so situated that you can follow your favorite pursuit, by all means do so. That is one of the greatest steps towards success in life.

T. S. L. F. asks: Can you refer me to any book that will tell me how to ascertain the exact power it will take to force water up 250 feet high, at the rate of 100 gallons per minute? Answer: See article on "Friction of Water in Pipes," on page 45 of our current volume. The power required in your case will be that used in lifting the water, and overcoming the resistance due to friction.

G. C. C. asks how to take off window glass that bluish appearance is'd be caused by using creosote and sulphur. It makes its appearance while the glass is going through the tanning process. Answer: The bluish appearance on your glass is probably caused by some defect in its mode of manufacture. Too much potash would be apt to cause it. If only on the surface, dust well with whiting and rub off with a linen cloth.

O. B. C. asks: Will a railway head, constructed to run a section of six cars, run a section of nine cars without alteration? Answer: It will probably be necessary to change the trough and gearing.

G. O. S. says: I have a small sailing boat and wish to convert it into a steamer. She is 22 feet long and of 8 feet beam. What number of horse power do I want to run her 12 or 15 miles an hour? What should be the size of wheels and what the length, width, and number of buckets? Answer: See dimensions published in SCIENTIFIC AMERICAN for May 10, 1873.

L. I. O. says: We had a new engine cylinder put in this spring, 14 by 24 inches, with circular valve of a new pattern. The supply pipe and governor are 2 1/2 inches in diameter, or about 10 inches area, and the steam passages between the ports and cylinder are about 5/8 inches area, but the passages above the ports are only 5/16 inches area, and still the designer of the valve persists in saying that the valve and passages are exactly right. We carry 70 pounds of steam and run 96 revolutions per minute. I claim that the steam is wire drawn, and that we cannot obtain the full power of engine. Please say if the valve is properly constructed. Answer: We think the ports are sufficiently large, and that the cylinder ports have more area than is absolutely necessary to prevent wire drawing.

L. F. I. asks: What is the effective power of a 10 by 24 inch cylinder stationary engine, running at 100 revolutions per minute with 50 pounds steam pressure in boiler as shown by gage? By effective power, I mean the power that would be available for driving other machinery after deducting that necessary to run the engine itself. Answer: We could not answer this question otherwise than approximately without a practical test, but we think the engine would develop from 50 to 55 horse power.

R. K. says: The joint between the cylinder and valve jacket of my engine is badly eaten away, so that I am unable to make a tight joint with rubber cloth. I have tried red lead and iron borings, but it will stand but a short time. It appears to be eaten away by the steam or tallow. How can I make a joint that will hold? Answer: You can probably make a permanent joint by cutting a groove and driving a rust joint, but it will be difficult to break the connection if this is done. If you wish to make a joint that can be readily broken, have the parts filed off. If you think the tallow causes the trouble, try some other lubricant; but we have an idea that, if you will get the joint perfectly tight, you will have no further trouble.

J. H. H. says: I am using a horizontal cylinder boiler, 4 feet in diameter, 12 feet long, with mud drum across back end, 22 inches diameter. Said boiler drives a compound engine, working high pressure in upper cylinder and condensing in lower. Feed water is taken from condenser for boiler. The inside of mud drum deteriorates by something eating holes in the surface, some of which are large enough to place the end of a finger in, and the bolts which protrude into drum from check valve, blow-off, etc., are eaten off. The boiler makes a moderate amount of scale which becomes a monthly detached when about 1/4 inch thick. Pressure of steam is 20 pounds. Please give your opinion as to the cause of this corrosion or deterioration of mud drum. Answer: We have known cases of this kind in which the trouble was caused by the lab leaving material used in the cylinder, which passed into the condenser and thence into the boiler. We cannot say positively that the corrosion in your boiler occurs in this way, but it is quite probable.

T. E. C. asks: How much resistance is required to stop an ordinary full steam car going at 25 miles an hour? 2. Which is the best patented steam car brake, the cost of the same, and the cost of keeping it in running order? 3. In how many seconds can a car running at the rate of 20 miles an hour be stopped by the best brake? Answer: 1. The moving force of the car can be ascertained by multiplying its weight by the square of its velocity, in feet per second, and dividing by 64.8. Suppose a car, moving 20 miles an hour, weight 8000 pounds. A speed of 20 miles an hour corresponds to 44 feet per second, and the power required to stop the car will be sufficient to raise $(8000 \times 44^2) \div 64.8 = 1,442,981$ pounds one foot high. 2. With so many competitors for public favor, it would be out of place for us to name any one as the best. We advise you to correspond with the different manufacturers. 3. In about 10 seconds.

A. W. I. says: I differ from J. E. E. in his reply to H. R., concerning the power required for different sized circular saws. He says that "a saw just large enough to cut through a board will require less power than a saw larger, the number of teeth, speed and thickness being equal in each." Now I am running three saws, one 48 inches with 44 teeth, one 52 inches with 42 teeth, and one 64 inches with 36 teeth, all 8 gauge in thickness; and I find the 64 inches saw will cut through a 12 or 14 inches cut with less power than either of the others. I differ with him concerning the saw with few teeth cutting the easiest, as my 32 inches saw with 42 teeth takes more power than either of the others; and I run the same hook in the teeth, and file them all exactly alike. My engine is small and timber large, so that I have every facility for finding out which cuts with least power.

W. E. H. says, in reply to S. N. G., who asked for a recipe for crystal gold for dental uses: Take any gold, the purer the better, roll into thin ribbons and dissolve in aqua-regia, or 1 part nitric acid and 3 parts hydrochloric acid, by measure. After action has ceased, pour off into a deep glass jar, leaving the silver alloy in form of a chloride. Dilute the clear solution of gold with an equal quantity of water, and slowly add a saturated solution of protosulphate of iron in water, which precipitates the gold as a brown powder. Pour off the water, etc., wash the powder with several waters, dry it and amalgamate it with mercury to the consistency of thick cream. Wash out the oxide found during amalgamation with alcohol or salt water, and put the mixture into pure nitric acid, setting the dish into a hot sand bath. The acid dissolves the mercury, leaving the gold in form of a sponge, which wash with water and anneal at a red heat for half an hour to expel any traces of acid or mercury. The porosity will depend on the thickness of the amalgam. The softer the amalgam, the lighter the sponge. There are difficulties attending the process, owing to impurity of chemicals, mercury, etc., which are so great as to make it impracticable for an amateur to make the gold as cheaply as he can buy it in the market; but the above directions are reliable, as the writer has made several lots from this formula.

A. M. asks for an explanation of the word "penny" as used to describe the size of nails. Answer: In the early history of our country, all nails were wrought (forged by hand); our currency then was pounds, shillings, pence and farthings. Each sized nail was sold by a number of pennies per hundred. The usual way was to ask for ferropenny nail, sixpenny, tenpenny, etc. Hence in mercantile circles, the sizes are designated by the price in pennies per hundred. When cut nails were introduced, the sizes were still designated by pennies; and this has been continued and in all probability will be, as long as nails are used.—J. E. E., of Pa.

C. F. B. says: In filing hand saws, the majority of mechanics file toward the handle; that leaves the teeth with more bevel on the back side than on the front, which is caused by the taper of the file. A few persons file their saws towards the point, which gives more bevel to the front or cutting side of the teeth. I think that the back side of the teeth should be filed nearly square across; the saw will cut equally well and remain sharp much longer. The front side of the teeth should be beveled to suit the timber; soft wood requires more bevel than hard wood. Answer: The correspondent is perfectly correct in his idea of filing a hand saw, as it is only intended to cut one way.—J. K. E., of Pa.

COMMUNICATIONS RECEIVED.

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

- On Steam and Compressed Air. By—
- On Retrogression of the Sun. By J. A. B.
- On the Patent Right Question. By R. H. A., by M. J. by T. W., and by L. G. J.
- On a New Motive Power. By H. P. J.
- On the Nebular Hypothesis. By E. H. P.
- On a Shocking Accident. By J. E. E.
- On the Case of Stearns, Hill, & Co. By J. F.
- On a Diagram of the Months. By E. B. W.
- On the Multiplex Telegraph. By J. T.
- On Steam on the Canals. By S. W. H.

Also enquiries from the following:

- F. J. H. Jr.—R. D. L.—P. A. M.—P. J.—Z. S.—P. R.
- Y. Z.—E. B.—J. L. McL.—P. A. S.—T. P. P.

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

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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:

25,874.—BRONZING MACHINE.—G. H. Babcock. Oct. 8.
25,883.—GLASS COFFIN.—J. R. Cannon. Oct. 8.
25,973.—TACKLE BLOCK.—J. E. Palmer. Oct. 15.
25,984.—BIT STOCK.—N. Spoford. Oct. 15.

EXTENSIONS GRANTED.

74,903.—FLOUR PACKER.—S. Taggart.
41,915.—CANTING COPPER CYLINDERS.—F. Adams.
24,725.—ELEVATOR.—A. Betteley.
24,952.—MEAT CUTTER.—J. G. Perry.

DISCLAIMERS.

24,963.—FLOUR PACKER.—S. Taggart.

DESIGNS PATENTED.

6,776 to 6,778.—CURTAIN.—H. Root, Philadelphia, Pa.
6,779.—HANDLE TIP.—G. W. Bunnell, West Meriden, Ct.
6,780.—HAND ROLL.—E. G. Cone, East Hampton, Ct.
6,781 to 6,781.—CHAIR S.—V. Draper, N. Attleboro, Mass.
6,784.—CARPET.—J. Powell, Kidderminster, England.

TRADE MARKS REGISTERED.

1,371.—SAWS.—E. C. Atkins & Co., Indianapolis, Ind.
1,372.—SCARFS, ETC.—Brownson Bros., Chicago, Ill.
1,373.—MEDICINE.—D. Dick, New York city.
1,374.—MINERAL WATER.—C. & E. E. Dunbar, Waukegan, Wis.
1,375.—STOVE POLISH.—Fletcher & Co., Lynn, Mass.
1,376.—BRANDY

RUPTURE.

7. Lombardine, a composite with a gold-colored

SCIENTIFIC AMERICAN

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IN ADVANCE

IMPROVED FEED WATER HEATER AND PURIFIER.

It is a well known principle of physics that a liquid boils when the tension of its vapor is equal to the pressure it supports. Hence, as this pressure increases or diminishes, the

tension of the vapor, and therefore the temperature of ebullition, must correspondingly vary. Under a pressure of 1 atmosphere, water boils at 212° Fah.; if the former be augmented to 2 atmospheres, ebullition is retarded, and occurs at 250°. Similarly, if we continue and increase the pressure to 50 atmospheres, the elastic force of the vapor will not be equal thereto until the liquid be raised to a temperature of 510°. It is evident, therefore, that to elevate the boiling point of water to a temperature corresponding to a given pressure of steam, the heat of the liquid at the outset is an important element in determining the quantity of fuel to be consumed in the operation. Thus, to illustrate, if a steam pressure of 5 atmospheres, or 75 lbs., to the square inch, be required, the boiling point of the water in the boiler must be at 320°; if the temperature of the feed be 212°, then there are 108 degrees to be supplied by the combustion of fuel; if 250°, 70 degrees, and so on. Every apparatus, therefore, having for its object the heating of the feed water of boilers, should, both in principle and practice, be doubly economical; first, through supplying the feed at the highest possible temperature; secondly, by effecting this result through the most thorough utilization of the heat generated by the fuel that is employed.

The device which we herewith illustrate is claimed to completely fulfil the requirements of the above propositions. Briefly described, it is a feed water heater and purifier, in which not only the heat of the exhaust steam, but that given off by the products of combustion in passing through the uptake, is utilized. Our engravings represent: Fig. 1, the application of the invention to a stationary boiler, and, Fig. 4, a somewhat different arrangement of the same principle in connection with a portable engine or locomotive.

Two cylindrical shells, A and B (Fig. 2), are made of boiler iron, and, at their extremities, are provided with flanges, by means of which they are bolted together. When required, by removing the bolts the outer shell can be taken off, thus giving access to parts inside. In the inner shell, B, are perforations in which cross tubes, C, are expanded. These are arranged at different heights and in a spiral line, as indicated in the plan view, Fig. 2. The apparatus being placed at the end of the boiler and secured directly over the receptacle, the heated gases from the furnace necessarily pass up within the inner shell and around the cross tubes.

The exhaust steam from the engine enters through the large pipe, D, at a point about six inches from the top of the heater,

and passes into the circular tube, E, Fig. 2. Thence it descends through the vertical pipes, F, into a second annular receptacle, G, from which it exits by the conduit, H. The steam does not circulate around tubes, E and G, because they

as well as so much of the steam as is necessary, is conducted to the cistern in order to warm the water therein to such a degree as may not interfere with the operation of the pump. From the cistern the water passes to the heater by the pipe,

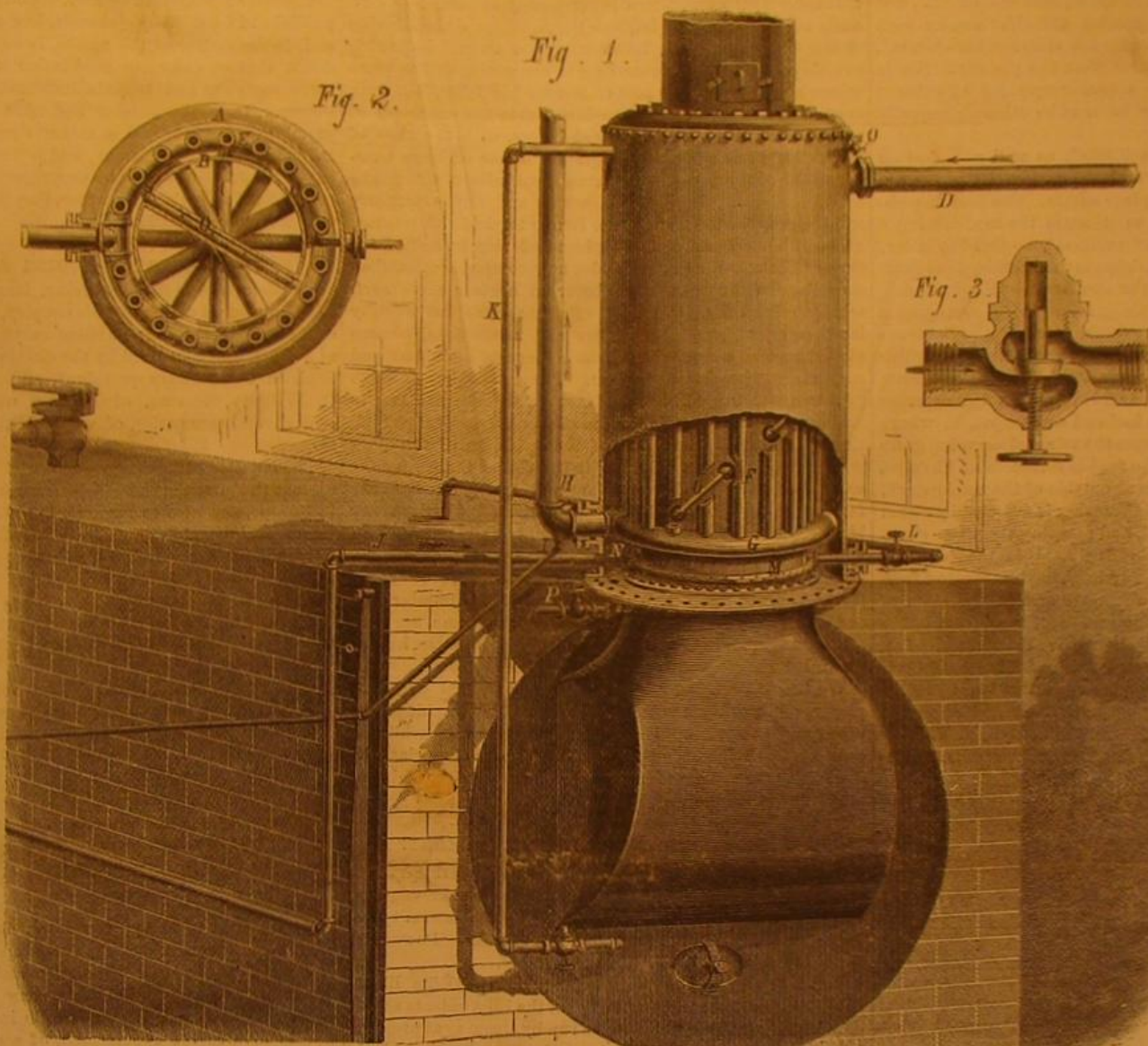
J, entering as shown near the bottom of the apparatus and filling the tubes, C, and intermediate space between the shells, A and B. There, as is evident, it becomes heated by both exhaust and gases, and finally escapes into the boiler by the tube, K.

For cleaning the apparatus, a very ingenious and, it is claimed, efficient arrangement is provided. The heater is first filled with water, and then the valve on pipe, L, is opened. Steam directly from the boiler is thus conducted into a perforated circular tube, M, through the orifices of which it escapes, breaking up whatever sediment or mud may have accumulated at the bottom of the intermediate space; and thence it passes through a system of pipes beginning at N, and leading through all the tubes, C, as shown at O (Figs. 1 and 2). These pipes are closed at the further end of the system, and are also perforated, so the steam, emerging, acts upon the impu-

rities packed on the inner surface of tubes, C. The blow out cock, P, is then opened, through which the water in the heater escapes, and also the sediment driven out by the steam.

In filling the apparatus the steam from pipe, L, is shut off and the cock, P, closed. The small jet cock, at Q, is then opened to allow the air to escape, and the valve at the bottom of pipe, K, raised. The construction of this valve is represented in section in Fig. 3. When the feed water emerges from the heater in the direction of the arrow, it lifts the valve from its seat, but, as is evident, is prevented from flowing back. On raising the valve, however, by the screw and hand wheel shown, the steam pressure within the boiler forces the water up through the pipe, K, and thence into the heater. When full, the valve is closed, and the air cock, Q, shut, and the cleaning process already described repeated if desired.

The feed water, entering by the pipe, J, at the bottom, comes in immediate contact with the cooler portion of the contents of the heater, and does not reach the hot metal above until thoroughly mixed. The exhaust, on the other hand, entering at nearly the top, meets at once with the most heated part; for so long as there is fire under the boiler, the water in the apparatus can be kept warm independently of the steam from the engine. This is of especial advantage in firing up in the morning, for by the time the engine is ready to start, the contents of the heater will be sufficiently elevated in temperature to prevent the sudden expansion due to the hot exhaust being instantly turned upon the cold metal. Similarly in machines which lay by three or four times daily, in-



FRANCE'S FEED WATER HEATER AND PURIFIER.

have closed extremities at points respectively opposite those of inlet and outlet.

To the elbow of pipe, H, is connected a tube, I, through which the water due to condensation of the exhaust steam,

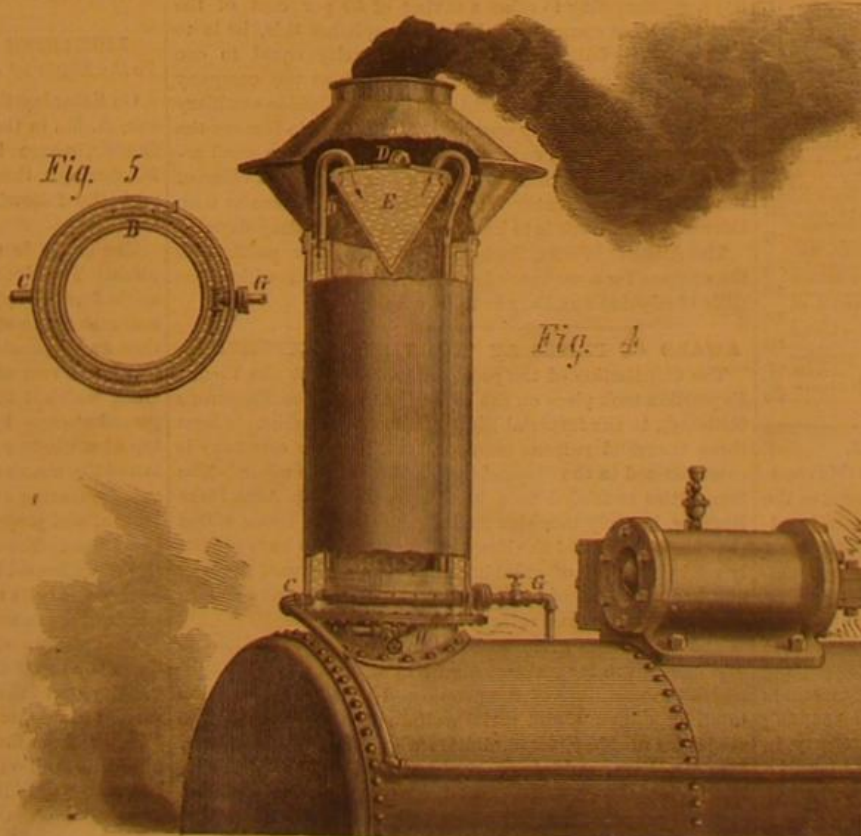


Fig. 5.

Fig. 4.

stead of cold feed being passed through to the boiler, as it might be, were the water dependent for its heat upon exhaust alone, the reverse is the case. Moreover, it is claimed that, from the relative points of entry of steam and water, a uniform temperature of the feed is kept up, which can be maintained through the regular working of the pump.

The inventor lays particular stress upon the point that this device furnishes water to the boiler at a hotter degree than can be attained through using exhaust steam singly. Thus, we stated already that the temperature of water or steam, due to a pressure of 75 lbs. to the square inch, is 320°. After this steam has passed through the engine it has probably a pressure of not more than 4 lbs. to the square inch, which corresponds to 225°, nearly. This communicates its heat to the feed; and were the latter dependent upon this source only, it is evident that the temperature thus reached would be the highest attainable. But, in addition, must be considered the effect of the hot escaping gases, which, if the boiler be properly set, pass through the inner shell at a heat equal to that within the flues or tubes, or of at least 325°, and act on the contents of the apparatus. Clearly, then, by such means the temperature of the feed is still further elevated, so that the claim of the inventor, that the present device is superior in this respect to a heater operated by exhaust alone, appears, supposing the latter to be otherwise equally efficient, to be well founded.

The cleaning process is facilitated, as well as a further economy of fuel effected, through the purification of the water, which, it is stated, takes place within. The feed, in passing out from above, expands as it nears the top, causing a separation and precipitation of sediment, so that the latter, instead of entering the boiler, drops to the bottom of the heater, and is thence removed by the means already described.

In Fig. 4, the same principle is followed in arranging a heater in combination with the smoke stack of a portable engine. A and B are the outer and inner shells, between which feed water is admitted from below by the pipe, C. Thence passing in the direction of the arrow, through two or more pipes, D, the water enters an inclosed conical pot, E, where it receives still further heat from the mingled escaping gases and exhaust. From pot, E, the feed is forced down the pipe, F, which may be either inside or outside of the smoke stack, and thence into the boiler. Cleansing is effected by steam admitted through the pipe, G, and escaping from the circular perforated tube shown in Fig. 2. H is the blow-out valve. The same claims, already explained, regarding freedom from sudden expansion of metal and precipitation of sediment, are made for this application of the device.

Patented August 6, 1872, by Mr. S. W. France. For further information, address Messrs. Heron & France, 40 Cortlandt street, New York city; or the apparatus itself may be seen in operation at the boiler works of Smith Brothers, 40 Jay street, corner of Plymouth street, Brooklyn, N. Y.

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THE POOR MAN'S REPRESENTATIVE.

We note with gratification the projected visit to this country of Mr. Joseph Arch, a man who may be considered as the embodiment of a principle, of which we have frequently advised the observance. We allude to moderation and a respect for mutual rights in conflicts between employers and employed.

Mr. Arch was an agricultural laborer, a representative of the peasant class of England. Unaided, he taught himself to read and write, and afterwards joined the Methodists, coupling his duties as a workman with those of a preacher to others of his sect. By thrift and energy, he succeeded in amassing sufficient funds to purchase a small freehold property in Harbury, Warwickshire; and having thus assured himself a substantial home and certain means of livelihood, he turned

his whole mind to the advancement of the interests of the class to which he belonged.

Mr. Arch is not a demagogue, nor does he aim to maintain the rights of labor by extreme measures. Neither is he allied to any political creed or faction. He simply strives to secure, for a disorganized, scattered and down-trodden class, a just return for its toil. To this end, he has traveled around England, diffusing information; in some cases leading men in direct opposition to employers, in others counseling co-operation or compromise, but in every event enforcing his views with such reason and moderation as to convince even the most ignorant that his work was for their advancement and benefit. The result is that at the present day he is the recognized leader of 100,000 men, organized in a powerful and growing movement.

The agricultural labor difficulties in England are perhaps the legitimate results of the surplus of population crowded within the narrow limits of that country. There are far more people seeking work than there are places to be filled, so that individual competition is necessarily so strong as seriously to retard efforts to improve the condition of the laboring classes through gaining better wages for them. Following out his precept of demonstrating to the workman the place where he can obtain the best return for his labor, Mr. Arch crosses the ocean in order to investigate the condition of agricultural affairs in the United States, with the view of ultimately counseling the emigration hither of large numbers of his countrymen. His errand, we believe, will not be a fruitless one. He will find a vast and fertile territory waiting only for the labor of the farmer to yield rich returns, and will learn that acres by the hundred may be had of the Government for the asking, under no recompense other than the tillage of the soil. The laborer, at home a mere serf, wholly reliant for a means of existence upon the wealthy land owner, will, under our laws and institutions, become almost at once a freeholder, drawing a certain support and sustenance from his own farm. The emigration of such men to our shores will be of advantage to both nations; to England, through the diminution of her overgrown population, and hence the bettering of the condition of the other workmen that remain at home; to the United States, for the valuable acquisition of several thousand strong, sturdy farmers in now unsettled and uncultivated districts. To Mr. Arch, the benefits to be derived will be fully pointed out, while every facility will be afforded him for a thorough examination of the immense agricultural resources of the country. Whether productive of direct result in immigration or not, his visit will be both timely and welcome, for just such sound, practical views and advanced ideas as he has promulgated across the ocean are sadly needed here.

We trust that he may speak publicly, and that both employers and workmen will listen to him. His teachings are broad and general, applying to every trade; and while he counsels justice and the rights of labor to the one class, he as earnestly advises moderation and respect for the rights of property to the other.

THE BISULPHIDE OF CARBON AUXILIARY.

The Peters Manufacturing Company, of Newark, N. J., at present derive their power from a pair of steam engines, working one on each end of a main shaft. The steam cylinders are 20 inches in diameter and 4 feet stroke. Power 200 horses. Consumption of coal, 4 tons a day.

This Company has lately contracted with the Ellis Bisulphide Engine Company, for the use of the Ellis patents as follows: One of the cylinders is to be run by steam as at present; the exhaust therefrom is to be sent through the Ellis bisulphide of carbon boiler, and employed to convert the liquid into vapor, which is to be used in the remaining cylinder. Thus one cylinder will be operated by steam, and the other by the vapor of bisulphide of carbon, heated by the steam exhaust. Mr. Ellis, at his own expense, puts up and attaches the bisulphide of carbon apparatus, and runs the engines for 60 days, guaranteeing to effect a saving of 50 per cent of the coal at present consumed. If he accomplishes this, he is to receive \$8,000 dollars in cash, and a royalty equal to one sixth of the value of the coal saved, so long as the company continues the use of his patents. If the bisulphide auxiliary fails to effect the saving specified, Mr. Ellis is to remove the apparatus at his own expense. This seems to be a good arrangement, and promises to afford a fair test of the value of the Ellis improvement. We shall look for the results with interest. The work is to be completed within sixty days.

The Atlantic Works, Boston, Mass., are now putting in the engines for a tugboat of 400 horse power, in which the Ellis bisulphide auxiliary is to be employed.

AWARD OF PRIZES AT THE VIENNA EXPOSITION.

The distribution of the premiums awarded at the Vienna Exposition took place on the 18th of August (the Emperor's birthday), in the Imperial Riding School, in Vienna. About three thousand persons were present, but the ceremony is characterized in the dispatches as a rather tame affair. The formalities consisted in a brief speech by the Arch Duke Regnier, in reply to which Arch Duke Charles Louis stated that he had received the Emperor's command to have publicly read the names of exhibitors to whom diplomas, medals, etc., had been allotted by the jurors. Baron Schwartz-Senborn then read the list and returned thanks.

The distinctions granted are as follows: 1. The diploma of honor, given for eminent merits in science, and its application to the culture of the people and advancement of the intellectual, moral, and social welfare of mankind. 2. The medal for progress, for exhibitors who, by new inventions, etc., can show notable improvement over former exhibitions. 3. The medal for merit for perfection of work and general

superiority of produce. 4. The art medal, for contemporaneous fine art produced since the London Exposition of 1862. 5. The medal for good taste, for those who distinguish themselves in articles in judging which, form and color are in the first line decisive. 6. The cooperative medal, for managers of factories, foremen, designers and other assistants who contribute to the excellence of products or extent of consumption. 7. Honorable mention, given to exhibitors who show merit, but not in a sufficient degree to warrant the bestowal of a higher award.

The medals are in bronze, 2½ inches in diameter, bearing on the obverse a portrait of the Emperor of Austria with the inscription in German, "Francis Joseph I, Emperor of Austria, King of Bohemia, etc., Apostolic King of Hungary." The reverse side contains emblems and artistic designs according to the respective classes. The medal of merit has, in addition, another inscription, of which the following will serve as an example. "Welt-Ausstellung, 1873. Wien. Für Verdienste," or "World's Fair, 1873. Vienna. For Merit."

The list of American awards, recently sent per cable and published in the daily journals, has so many inaccuracies and, in the matter of the names, is susceptible of so much doubt that we defer its publication until the reception of more complete and reliable information. It would seem, however, from the number and wide field covered by the premiums, that it would be rather singular if any exhibitor failed to receive some honor; and hence it may perhaps be safely inferred that none of our representatives will return empty handed, unless, of course, they have voluntarily withdrawn from competition.

THE PATENT CONGRESS AT VIENNA.

The delegates to this gathering, from the various States of the continent and from this country, assembled on the 4th of August, in the Jury Pavilion in the exhibition grounds at Vienna, and organized by the election of Baron Schwartz-Senborn as honorary president, and a council, of which C. William Siemens, of London, was chosen president, with several secretaries, of whom Mr. Black, of New York, is one.

The object of this Congress, it will be remembered, is to discuss the propriety of establishing a uniform patent law in Europe, and also to suggest, to the several governments, the general principles and features which such a law ought to embrace. According to *Galignani's Messenger*, the following resolutions have been adopted:

"1. Only the inventor himself or his legal successors shall obtain a patent. The granting of a patent cannot be refused to foreigners. 2. The donation of a patent for an invention to be for fifteen years or for a shorter term with the option of extending it to that period. 3. The complete publication of the patent to be obligatory. 4. The expense of granting a patent to be established on a moderate but progressive scale. The amendment proposed by the American delegates, to introduce a graduated tax upon patents according to the condition of each respective country, was withdrawn after repeated doubtful votes had been taken. 5. A specification of all patents in force must be accessible to the public."

The Congress is to continue the debate upon the sixth resolution, whereby it is made obligatory on the holders of patents to place their inventions at the disposal of everybody wishing to use them upon payment of a fitting remuneration.

The first five resolutions appear to be practicable enough, and are based upon existing laws, now in vogue in most of the continental States. The proposed sixth resolution is a novelty in patent legislation and in legal jurisprudence. It is a suggestion from some of the addled heads of Great Britain, we believe. It is intended, in that country, to involve the appointment of a commission of lords, dukes, or barons, who shall establish the price at which an inventor may sell his device after the grant of a patent. Such an enactment would be absurd as well as unjust to the inventor. If it is right and desirable for government to fix prices for the inventor, why not in like manner establish rates for authors, merchants and dealers in commodities of all sorts?

LIGHTNING RODS.—A FEW PRACTICAL HINTS.

To the Editor of the Scientific American:

On Saturday the 26th of July last, at about a quarter to one, A. M., in the village of St. Michel, some 15 miles below Quebec, where I have my country residence, the lightning fell during a thunderstorm on the house of one Boulanger, with the following effects, which I believe are worthy of note:

The house is a two story one with a hip roof of ordinary pitch. The electric fluid struck the vertex of the triedral angle formed by the plane of the hip and those of the front and rear slopes of the roof. It there divided into three distinct and separate parts, one of which went northward or towards the rear of the house, following the line of rafter, along which it traveled, and tearing up the shingles as it passed along. From the foot of the rafter, it jumped to the top of a window situated immediately below it, and followed the center of the window along the iron bolts or fastenings, tearing away strips of the woodwork several feet in length, and projecting them to considerable distances within the house. From the bottom of the upper window, the lightning leaped to the top of the window below and, following the bolts as before, with the same effects, passed into the earth or foundation.

That portion of the electric fluid which went westward down the hip did not follow a rafter, there being none in its vicinity, but followed the tongued and grooved joint of the roofing boards, and, as in the other case, tore up the shingles all along from the apex to the eaves, passing down as before along the mullion or center of two windows situated in the end of the building, one below the other, again following

the window bolts and tearing away long strips of the wood-work, one of which, four feet long, was projected through an interior door to a distance of fully 30 feet.

The third branch or portion of the divided fluid went southward along the rafter (but in this case without tearing up the shingles) from the foot of which it jumped to the window bolts of the uppermost of the front windows; and, as the window below is a shop window, with no mullion or bolts, the lightning jumped from the bolt of the upper window to the hinge of the blinds, and thence passed down between the frame and architrave of said lower window, which architrave was torn away and projected a distance of 40 feet to the opposite side of the roadway.

The man, Boulanger, who had risen during the storm, stood, at the moment the thunder fell, about midway between the fore, aft and end windows above mentioned, or very nearly under the apex of the roof or point where the lightning struck. He was knocked senseless and fell in the doorway where he stood, but soon recovered and is just as well as ever, while his wife and children, who were near him at the time, were unaffected by the shock. A sulphurous odor pervaded the house, so says the man.

Now, Mr. Editor, has it ever happened before that the electric fluid has thus divided into two or more separate branches, and if so, would it not be advantageous that lightning rods or conductors be bifurcated or trifurcated at the base, the separate branches thereof passing down from the apex of each of the hips of isolated buildings, or down the front and rear roof slopes of buildings in cities, to the ground, by two or more outlets?

One query, Mr. Editor: What is it that projects the large splinters of woodwork to such distances, as in the present case? The ignition and explosion, I suppose, of the gases within the pores of the wood; but how explain the projection of the architrave of the lower front window to some 40 feet, where the frame itself was not in any way splintered or destroyed, and where the electric fluid appears to have merely passed down between the architrave and the lower frame of the window? Is the action merely mechanical or is it chemical, that is, can the fluid in its passage, and by its immense velocity, so condense the air itself, or the oxygen it contains, as to cause an explosion capable of accomplishing the phenomenon alluded to?

C. BAILLAIRGE.

REMARKS BY THE EDITOR.—It would be hard to find a more beautiful illustration of the principles laid down in the paper on "Lightning Rods," published in our issue of August 16 (page 98 of our current volume), than that furnished in the above communication.

It appears that this house, with its Mansard roof: with more or less of metal on its exposed angles and edges, and its window bolts standing vertically, no doubt: offered three tracks of nearly equal resistance to the electric discharge.

The one, however, over the shop window, which had no bolt, being the worst track of the three, carried the least quantity of the discharge, and thus the shingles in this line were not disturbed.

The mechanical effects of lightning are usually purely physical and due to the expansion of air by the heat, or the development of steam from moisture, where that is present. The present writer has in his possession an induction coil giving sparks of 21 inches in air, with which many of the actions of lightning may be imitated on a small scale. Thus if the spark is taken across the surface of a piece of pine wood, slightly moist within but well dried on the surface, fine splinters or fibers will be torn off at each flash and projected to the distance of several inches. These are torn out by the explosive force of the heated air and steam, developed by the passage of the spark between the fibers near the surface.

Lightning flashes breaking into numerous forks or "derived circuits" are by no means uncommon, although much less usual than the single "streaks." We have repeatedly seen them, and the phenomenon may also be beautifully imitated by taking the flash of the coil above mentioned across a crumpled sheet of metallic paper, such as is often used in packing coffee or spices. The tracks will here be five or six feet long and sometimes single, double, triple, or indefinitely multiple. Multiple lightning conductors are useful because each one helps the others, and if the discharge is too great for one, they will be able to carry it between them, but what is more important is this: The less the total resistance of the conductor to earth, the more certain is it that no other, undesirable line will offer an approximately good path to the earth, and so get a part of the flash. Thus, suppose a single rod whose resistance is 1, and that a series of bolts, hangers, gutters, stove pipes, etc., offers another line (passing perhaps through the walls of the house or the body of its occupant) whose resistance is 2. Now, under these conditions, a flash would be likely to divide itself, and while $\frac{2}{3}$ would go safely down the rod, $\frac{1}{3}$ passing along the other line might burn the house or kill the man. But if two rods were connected, the resistance in this line would be but half, hence $\frac{1}{2}$ would take this road and but $\frac{1}{2}$ tend to go by the other. Again, the less the resistance of any line, the higher the opposite charge developed in it by induction, and hence the greater its attractive influence, leading the discharge to prefer it as a path. This bears upon the importance of connecting all accidental lines of conductors, such as gas and water pipes, with the lightning rods. Insulated, these are opposition lines, soliciting the lightning to come into the house and traverse them; connected, they help the rod as we have seen, to get and keep the lightning outside.

THE price of quicksilver on the Pacific coast has risen to \$1.10 per pound.

CAOUTCHOUC—WHERE IT COMES FROM, AND HOW IT IS PREPARED.

The extensive and rapidly increasing employment of caoutchouc in the arts has, within the past few years, raised this uniquely useful substance from its humble estate as a mere rubber-out of pencil marks to the front rank among vegetable products. Thousands of tons are already required to meet the annual consumption, and almost every part of the tropical world has been laid under tribute to supply the demand.

The plants which yield caoutchouc are restricted to three natural orders, namely: 1. *Euphorbiaceae*, represented by several species of lofty trees (*hevea* or *siphonia*) inhabiting the hot and humid valleys of the Amazon, and the Rio Grande do Norte. 2. *Artocarpaceae*, comprising several varieties of Ule trees (*castilloa elastica*, etc.) ranging from the Gulf of Mexico to Guayaquil; a number of species of fig trees (*ficus elastica*, etc.) occurring in North Eastern Hindostan, Farther India, Java and Northern Australia. 3. *Apocynaceae*, represented by *hancornia*, in Southern Brazil; *landolphia*, in Equatorial Africa; *vahea*, in Madagascar, and *urceola* in Malacca and Borneo, all except the first named being climbing vines and shrubs.

The finest quality of caoutchouc is the Pará, the trade name of the Brazilian products from that port.

The collection of Pará caoutchouc begins in August and continues until January or February; in the wet season the milk or sap is too watery for profitable working. When it flows from the trees, the milk has the consistency and color of cream, but it soon curdles by the separation of the caoutchouc from the whey-like liquid in which it is suspended. The trees are usually tapped in the evening, and the milk collected in the morning.

The native method of preparing the caoutchouc for market is to evaporate the milk over molds of wood or clay, by means of artificial heat tempered by the smoke of roasting nuts. The milk is poured over the mold and hardened in successive layers; then, when a sufficient thickness has been obtained, the mass is cut through on one side and the mold removed, leaving a pouch, the parent of the original rubber shoe. By European manufacturers, the milk is coagulated by the use of alum water or ammonia, and the caoutchouc hardened by pressure; a better way, in that it allows the manufacturing to be done away from the scene of collection, which is always unhealthy.

The export from Pará is now about 5,000 tons a year, half of which comes to this city. It appears in market in several forms: "biscuits" or flat pouches, made by dipping and smoking with round molds; "bottles," made in the same manner over molds of corresponding shape; "nigger heads" or solid balls, sometimes a foot in diameter, made by rolling small pieces together; and lastly, as loose scrap.

Pará caoutchouc, being stronger, purer and more enduring than any other, is indispensable for articles requiring great strength and elasticity, such as springs for railway cars and the like.

An article of similar quality, but less pure, is that known commercially as Ceará scrap. It comes in the form of balls or blocks, made up of reddish brown string, like pieces rolled together. Like the Pará, it is the product of *hevea*. The same trees also abound in French Guiana, Venezuela and Eastern Peru, in the dense moist forests along the river valleys.

The second in rank among the producers of caoutchouc is the Ule tree, which abounds throughout Central America and Western South America as far south as Peru. Two, perhaps three, species are tapped. They thrive best in thick, damp, warm forests, growing to perfection in the basins of Lakes Nicaragua and Managua. The milk flows at all seasons, but is best in April. A tree eighteen inches in diameter, skillfully tapped, will yield about 20 gallons of milk, giving 50 pounds of caoutchouc. The milk is usually coagulated by the addition of the juice of certain plants, the caoutchouc separating as a soft brown mass, smelling like new cheese. It is then taken out of the brown liquid in which it was suspended, and pressed into cakes weighing about two pounds each.

Sometimes the caoutchouc is allowed to separate spontaneously, which occurs after the milk has stood half a day or so, and is then left to dry for a fortnight before pressing. At other times the milk is simply poured upon prepared ground, when the watery part is absorbed or evaporated. It is sent to market in cakes called *tortillas* or *meros*, in balls or *cabezas*, and in *bolas* formed by the natural drying of the milk in the cuts made in the tree. The last variety is especially prized.

Six or eight hundred gatherers are employed in the San Juan district (Nicaragua), and as many as two thousand in the neighborhood of Panama, where the trees are cut down to obtain the caoutchouc. The New Granada product, known to the trade as Carthagena, comes in sheets three fourths of an inch in thickness, and is of good quality, though sometimes tarry from admixture with gum from the wood, the result of unskillful tapping. Guayaquil caoutchouc is very irregular in quality. The best kinds are of a whitish color, and come in large flakes or lumps. The poorer varieties are spongy, and saturated with a disagreeable black liquid, which stains the hands and sickens the workmen who use it. The best of the Central America brands is that known as West India, though not a product of the islands. The finest quality comes in blocks made up of thin sheets, and is of great purity. Guatemala caoutchouc is the poorest. It is prepared like the West India, but is spoiled by tarry matter.

The remaining caoutchouc region of America comprises the high plateau of Southern Brazil, between 18° and 12°

south latitude. It affords a good quality known as Pernambuco, obtained from several varieties of *hancornia*. These trees grow to the size of the apple tree, with small leaves and drooping branches, which give them the appearance of the weeping birch. The milk is not much collected, the trees being more valued for their fruit, which is held in high estimation.

The principal caoutchouc tree of Asia is the *ficus elastica*, which flourishes chiefly in Assam, Farther India, Java, Sumatra and Australia, north of the isotherm of 70° Fahr. In many parts of the Assam district, the trees have been destroyed by reckless tapping, and a still more reckless felling of them to render the operation of tapping more convenient. When properly bled in the month of August, an average tree yields about 15 ounces of pure caoutchouc. During the cold season, from October to March, the milk is scantier but richer than during the warmer months. That which flows from the branches is allowed to dry on the tree; that from the trunk and roots is collected in holes in the ground and in large leaves rolled funnel-wise and prepared artificially. The milk is either poured into the boiling water and stirred until it is stiff enough to be handled, or it is mixed with water in a tank and allowed to stand until the caoutchouc separates and floats like cream on the surface. It is then boiled over a slow fire until it coagulates, when it is taken out and pressed, after which it is boiled again, pressed, dried in the sun and washed with lime. It is sent to market in baskets of split rattan, holding about three hundred weight. Assam caoutchouc has a peculiar mottled appearance, the color ranging from cream color to a bright pink. It is seldom pure, the admixture of bark and earthy matter amounting sometimes to a third of its weight.

Singapore caoutchouc, the product of surrounding countries—Java, Sumatra, China, Manila, the Malay peninsula, and Penang—is chiefly from the *ficus elastica*. Some bearing the same name comes from Borneo, Sumatra, and Malacca, and is the produce of the vine *urceola elastica*, a climbing plant of rapid growth and great size, often attaining a length of two hundred paces and the thickness of a man's body. The vine is usually cut into small pieces for the convenient extraction of the milk, the flow being hastened at times by applying heat to one end of the sticks or billets. The caoutchouc is separated by the action of salt, which causes the particles to coalesce. When fresh, the Borneo caoutchouc is white, soft and spongy, the pores are generally filled with salt water and whey. When dry and old, the color changes to a dull pink or red. The quality is inferior.

The caoutchouc of Madagascar, also obtained from a vine, is of excellent quality. It is prepared by treatment of salt water, and also by artificial heat. It is largely used in France, and ranks next to the Pará in price.

Equatorial Africa is rich in caoutchouc-yielding vines and trees, but its resources are but slightly developed. The collection and preparation is conducted in the most slovenly manner, the caoutchouc being largely mixed with gum from the wood, which spoils the product.

African caoutchouc is received in the form of flakes, round balls and tongues. It is sticky, has a bad odor and but little elasticity. The chief districts whence it is exported are the Gaboon, Congo, Angola, Benguela and Zambesi.

Notwithstanding the wide range of caoutchouc-producing plants, the future supply of this indispensable product is becoming a matter of deep concern. Owing to the reckless habits of the native collectors, all the accessible trees are being destroyed with frightful rapidity, large districts being already stripped of them, and no pains taken to secure their renewal. Millions of trees remain, it is true, buried in almost impassable forests, away from means of transportation; but the cost of reaching them must ever prevent their being the source of much profit.

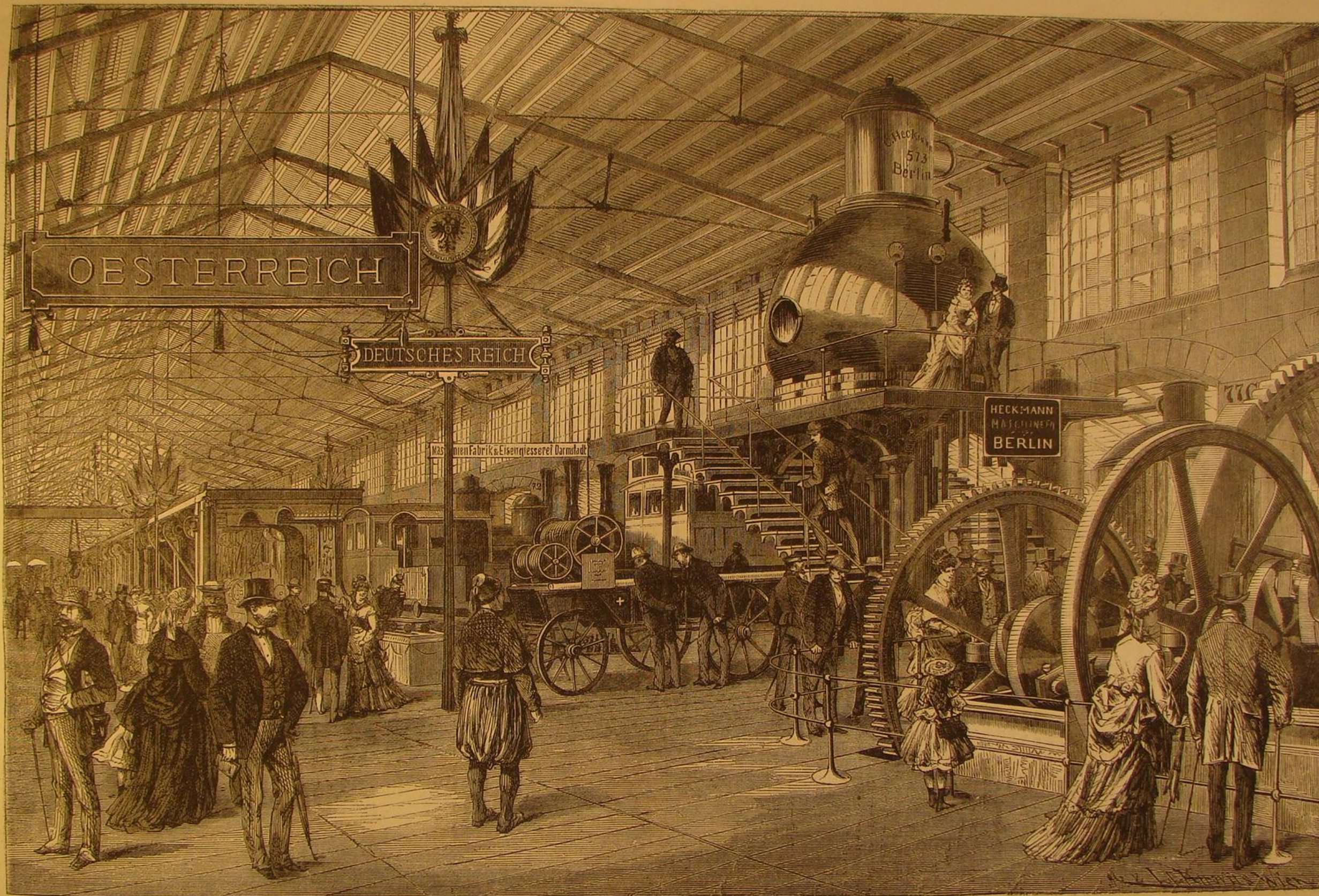
AMERICAN SEWING MACHINE AWARDS AT VIENNA.

The official announcement of the prizes awarded for American sewing machines at the Vienna show, sent by telegraph, is so vague in detail and the statements of exhibitors are so conflicting that, at the time of going to press, we are unable to determine which machine has gained the highest honor. Nearly every one of the manufacturers competing advertises the fact of his having received "a grand medal," and undoubtedly with truth; but it should be remembered that the medals are not the greatest distinctions, and that the diploma of honor is the award which, as we understand the premium system, only one, and that the best, machine can receive.

There is probably no question but that the medals for merit and progress have been bestowed upon all our inventions of this class, either on the ground of utility, superior workmanship, or adaptability to special employments. Every report relating to the show indicates that our sewing machines have excited universal admiration, and have won the highest praises both from crowned heads and people. They have stood preëminent over the similar display of any other nation, and have gained for our general exhibit a degree of credit which otherwise it must have failed to receive.

The honor belongs to the energy, genius, and enterprise of our sewing machine manufacturers, whatever may have been their motive for exhibiting, and to them are justly due the thanks of the mechanics of the country whose skill has been so well represented by their handiwork.

The French Association for the Advancement of Science opened its session at Lyons, on the 21st of August. The city voted \$4,000 to meet the expenses of the society, and placed the Town Hall and Saint Pierre Palace at its disposal. This is the second meeting of the Association, which now numbers 1,000 members.



THE WORLD'S FAIR AT VIENNA—VIEW IN THE GREAT MACHINE HALL.

THE ARCHITECT AND THE BUILDER OF THE VIENNA EXPOSITION PALACE.

The two portraits given herewith represent, respectively, John Scott Russell, the celebrated English engineer, and John Kaspar Harkort, one of the largest Vienna iron masters, two men to whom Austria is indebted for the design and construction of the magnificent edifice which forms, at her capital, the receptacle for the exhibited products of the world.

Mr. Scott Russell is perhaps best known among engineers as the author of the "wave line theory of naval architecture," by which the bows of vessels are made hollow and wedge-shaped, conformably to the wave of motion in water, while, in length, they are proportioned to the ship's run as 3 to 2. He was not the inventor of hollow bows, as asserted by some, but he discovered and applied to shipbuilding the principles of Nature.

In 1855, at his works at Millwall, London, Mr. Scott Russell began the construction of the celebrated Great Eastern, a work confided to him by her engineer, Mr. Brunel. The ship was necessarily experimental, and hence no small difficulties were encountered even before she was launched. The hull was completed in 1857, but, through some defects, required a year's additional labor and the expenditure of some \$400,000 before she could be got into the water. Of the eight engines supplying the motive power, Mr. Russell built the four designed to operate the paddle wheels, and also supplied other machinery, the failure of some portions of which afterwards formed the ground of controversy with the owners, and elicited adverse comment from the press. The model of the Great Eastern, however, is exceedingly beautiful, and she is built on the wave line principle above described. To her fine lines and harmonious proportions her subsequent success, as a seagoing vessel, is doubtless due.

The subject of our sketch was called upon, through the agency of Baron Schwartz-Senborn, to undertake the important task of designing the building for the Vienna exposition. Mr. Russell's first idea was to construct a dome 800 feet in diameter, but it was impossible to find either room or money for so gigantic a structure; it was eventually arranged that he should prepare designs for a building which should not exceed the width of 400 feet. Only a fortnight's time was given him to complete drawings and estimates; and in this short interval, an outline plan and section of iron work, together with the principal details and specifications, were finished under his direction. With these hastily prepared designs, Mr. Russell started for Vienna, but was met with opposition, both secret and public; while many endeavored to show the impossibility of carrying out such a gigantic cupola-shaped edifice. Aided by the energy of Baron Senborn, Mr. Russell was triumphant, and returned to England with the opinion of the mechanical committee "that Mr. Scott Russell's idea was ingenious, excessively simple, and, moreover, well suited to show how iron could be employed in a new and hitherto untried manner." The successful completion of the work has proved the exactitude of the purely theoretical calculations upon which the plan was based. As in the case with his former colossal labor, the Great Eastern, Mr. Russell relied upon the accuracy of his designs and the soundness of his principles to overcome unforeseen and innumerable difficulties, which might arise in the course of a construction hitherto unparalleled and unattempted. The raising of the immense iron ring, of enormous weight and over 100 feet in diameter, to a height of 80 feet, and the placing of the girders, joining in a second elevated ring, was an astonishing feat, and, in a technical point of view, a new and important event in the history of mechanical science.

The first plans for the construction of the great edifice involved the use of large quantities of timber, for the supply of which proposals were invited by the exposition committee. The Austrians, however, even at that early date, began the system of extortion which they have carried through the entire enterprise, and arranged a "corner" in wood, endeavoring by such means to force the Government to pay a most exorbitant price for the large amount required. The "ring" operating the transaction were brought to sudden grief by the prompt alteration of the plans, and substitution of iron for the lighter material. Tenders were then

asked, not only from Austrian firms, but from many of the prominent iron makers in other countries. The Fairbairn Engineering Company, the Cockerill Company, of Belgium, and several other extensive French and English forges competed, but all were underbid by Harkort, who agreed to furnish the 4,000 tons of iron work required from his foundry at Duisbourg, on the Rhine, in Westphalia. Being educated from youth up, by his father, for an ironware manufac-

Danube canal bridge, etc. The whole establishment is capable of sending out every year ten thousand tons of building iron. The rotunda of the Exposition is the greatest work heretofore undertaken by Herr Harkort, and has added celebrity to his name and his establishment.

Regarding the completion of the great structure and its details, we have already given full particulars. We add the two portraits as a part of its written history, for, by the genius and enterprise of the men represented, Vienna has been enriched with a building which, since it is destined to remain, will ever be regarded as a grand and wonderful achievement of modern engineering.



JOHN SCOTT RUSSELL.

turer, he devoted himself, when a young man, to the business, after finishing branch studies at Dortmund and Leipzig. The manufactory, which produced tools and scythes, became, under his guidance, so enlarged as to supply iron for railroads, and finally the work turned towards the building of bridges. The first bridge was at Coblenz, then followed the bridges over the Yssel, near Zutphen, in Holland, the Rhine bridge at Düsseldorf, the Elbe bridge at Hamburg, Stendal, Meissen, the Danube bridge in Vienna, the

sugar refining apparatus, we have German fire engines, turbines, hydraulic apparatus, paper machinery. Then comes a great array of locomotives, cars, and railroad appliances. The sign *Oesterreich* at the left, signifies Austria; that under the banners, *Deutsches Reich*, signifies German Empire.

The Octopus or Devil Fish.

For further elucidation of the habits and character of this marine monster, described by us on page 131 of our current volume, we extract the following from the pages of *Land and Water*, to which it was furnished by Mr. Henry Lee, of the Brighton aquarium, England:

"A crab was so fastened that the string could be withdrawn, and was lowered near to the great male octopus. He was sleepy, and required a great deal of tempting, but the sight of his favorite food overcame his laziness, and he lunged out an arm to seize the precious morsel. It was withdrawn from his reach; and so, at last, he turned out of bed, rushed at it, and got it under him against the plate glass, just as I desired. In a second the crab was completely pinioned. Not a struggle was visible or possible: each leg, each claw, was grasped all over by suckers—enfolded in them—stretched out to its full extent by them. The back of the carapace was covered all over with the tenacious vacuum disks, while the black tip of the hard, horny beak was seen for a single instant protruding from the circular orifice in the center of the radiation of the arms, and next had crunched through the shell, and was buried deep in the flesh of the miserable victim.

The action of an octopus when seizing its prey for its necessary food is very like that of a cat pouncing on a mouse, and holding it down beneath its paws. The movement is as sudden, the scuffle as brief, and the escape of the prisoner even less probable. The fate of the crab is not really more terrible than that of the mouse, or of a minnow swallowed by a perch; but there is a repulsiveness about the form, color, and attitudes of the octopus which invests it with a kind of tragic horror.



JOHN KASPAR HARKORT.



THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 8.

VIENNA, July, 1873.

Beside the steam engines exhibited in the Machinery and Agricultural Halls of the exhibition, there are a few other "prime movers."

GAS ENGINES.

The Lenoir gas engine is exhibited in the French section, where it drives one of Gramme's magneto-electric machines, the recent invention of which has awakened so much interest among electricians. The Lenoir engine has now been in use many years, and evidently finds many purchasers. It is an engine in which the gas is first introduced into the cylinder, where it meets, and mingles with, the required amount of air, and, when the proper quantity has entered, the mixture is fired, impelling the piston by its expansion, which follows the explosion. As the piston must move a considerable distance before the full charge has entered the cylinder, that portion of the stroke is made without doing work. The explosion of the gas also gives rise, momentarily, to an extremely high pressure, which rapidly diminishes as the piston moves forward, and as the products of explosion, steam, carbonic acid, and nitrogen, condense and cool down. It follows, therefore, that the mean pressure obtained in the working cylinder is comparatively low, while the working parts of the machine must be built to withstand safely an extremely high pressure. The losses of pressure from condensation of steam and from the cooling of the gaseous products of combustion probably become much smaller at high than at low piston speeds, but are undoubtedly serious at all ordinary velocities.

There are many places, however, in which the gas engine is to be preferred to its more economical but less suitable competitor, the steam engine; and with the general introduction of illuminating gas in all cities, it has found quite a large market.

The consumption of gas given by these exhibitors for the best performance of their engines, I have been unable to learn, but early experiments made by that well known authority M. Tresca, of the *Conservatoire des Arts et Métiers*,—who is here, by the way, as a member of the International Jury, Group XIII—indicated the consumption, in small machines, of over ninety cubic feet per horse power per hour. Later experiments upon the Hugon gas engine, and with larger sizes, have given something over seventy cubic feet per hour and per horse power. No Hugon engines are exhibited here. The principal difference between the two lies in the manner of igniting the charge, the one using the electric spark obtained from a small battery and the inductorium or Ruhmkorff induction coil, while the other uses a gas jet, ingeniously fitted to a little slide, which carries it into the cylinder to ignite the charge at the proper moment, and brings it out again to be relighted at a fixed jet after it has been extinguished by the explosion.

The only competitor of the Lenoir engine here is found in the German section. This is the gas engine of Otto and Langen. In this engine, the gas is fired explosively, as in the Lenoir, and the contrivance for igniting it is substantially that of Hugon; but the piston is not secured to a crank through the intervention of a connecting rod, as in ordinary engines, but rises freely under the impulsion of the exploding gases, and, when at its greatest height, is caught and, falling slowly, its weight turns the shaft. It has the movement, in fact, of the Cornish engine,—the same rapid rise and the same slow descent of its piston, and is, of course, single acting. An engineer would hardly be likely to propose the application of the Cornish engine to driving mills and ordinary machinery. Its inequality of movement, and its large bulk for comparatively small power, would be serious objections, even if the first were not fatal in all cases. Nevertheless, the builders of this gas engine exhibit an engine numbered one thousand, and claim to have manufactured considerably more than that number. Their success in introducing what seems so extremely impracticable, a method of obtaining, satisfactorily, a motive power from the combustion of gas, is probably due to the exceptional economy of gas consumption which they have attained. They claim to have obtained the dynamometrical horse power upon a consumption of but one cubic meter of gas—less than forty cubic feet, or about one half that reported for the older gas engines—per hour. On one occasion, the

trial of one of the larger sizes of this engine is reported to have given even a better result, bringing the figure down to about thirty-six cubic feet.

The source of this economy must be found, principally, and possibly wholly, in the rapidity with which it makes its upward stroke. The gases have too little time to condense or to fall in temperature seriously. This economy is probably so marked an advantage as to secure the success of this engine, where competing with those previously invented, in spite of the objections noticed. The first impression produced upon the mind of an experienced engineer by its noisy and irregular movement, and by the odor of gas which surrounds it, is, probably, almost invariably quite unfavorable; but it is here doing its work well, apparently, and its economy seems well proven, not only by the certified tests, but by its success in the market.

It cannot be doubted, however, that there is still room for important improvements in this class of prime movers, and we may anticipate that they will be effected before the lapse of a great length of time.

The Brayton gas engine is entered upon the catalogue of the United States section, but it has not made its appearance yet. As the juries have now finished their work, this engine will probably not be examined by a body which has among its members several of the most distinguished engineers and mechanicians of Europe, or of the world. It is a great opportunity lost.

THE TILGHMAN SAND BLAST

is another American invention which has attracted the attention of all members of the International Jury, and which might, possibly, have secured even higher honor than that accorded it by the American Institute of New York in the presentation of the Grand Medal of Honor. It is not ready, however, two months after the opening of the *Welt-Ausstellung*, and those jurors who, of all men, are best capable of appreciating the device, and of giving substantial aid to the inventor, have been unable to witness its operation. It will be considered a remarkably fortunate circumstance if it should be found that the jury have felt themselves justified in making any award at all, when able only to inspect the exhibited samples of work done by the sand blast.

THE JURY OF GROUP XIII (MACHINERY)

has, among its members, some famous men. The President, Ritter von Egerth, is an Austrian engineer whose knight-hood was conferred for distinguished services in connection with railroad work among the neighboring mountains. The elder of the two Vice Presidents is the venerable and distinguished Professor Karmorsh of Hanover, a pioneer in the great work of introducing, and of rendering truly practical, technical schools of high character, and of systematizing the whole scheme of German technological instruction. His work and his writings have made his name known to every educated engineer throughout the world. Although seventy-two years of age, the noble old man works with the jury every day, examining every machine with an intelligent interest, and inspecting the more valuable improvements with an enthusiasm which is quite in contrast with the indifference which less well informed or less experienced members occasionally exhibit. The Professor often returns to his rooms, in the afternoon, with pockets filled with specimens of work done by the machines which have been examined during the day, or even with the shavings which have been thrown out by some tool distinguished by its good work. The regard and the respect which is evidently felt toward him by all his colleagues, without exception, proves that the good work of his lifetime is known and appreciated by all. The second Vice President is Mr. Anderson, well known as the engineer who has under his charge all the British Arsenal and other machinery, and one of the most experienced mechanical engineers living. His little work on "Strength of Materials" has made him known to many of our own mechanics, who have found in it—as did those student mechanics to whom it was given, in England (as a course of lectures)—something which was precisely adapted to their desires and to their mathematical capacity.

Mr. C. W. Siemens, the engineer, metallurgist, and electrician, who has accomplished so much in each of these departments, is another member of the group. His regenerative gas furnace, which is rapidly coming into use in the United States, is pronounced one of the great inventions of the age, ranking with that of the Bessemer steel process. He has a large and interesting collection of machines and models in the exhibition, which are placed "*ausser Concours*" that he may serve on the jury. In the list of his exhibits is an odd kind of steam engine, which should have been mentioned before. The drawing and the machine are equally difficult of interpretation without the assistance of some one familiar with them, although the device is by no means intricate. The water seems to be driven upward in successive compartments fixed upon the face of a wheel, and by its simple weight to produce revolution. Mr. Siemens has been "decorated" by the sovereigns of Europe, and he has acquired a more substantial reward for his labors in such an income as seldom rewards an inventor. His highest reward, however, is the enviable reputation which he sustains as a practical engineer, and as a man of science.

Professor Reuleaux, the Director of the *Gewerbe-Academie*, or engineering school, of Berlin, a distinguished educator and author, as well as engineer, Professor Hermann, of Aix-La-Chapelle, a gentleman of similar position and standing, M. Henri Schneider, of the great iron works of Creusot in France, who has placed *hors concours* one of the most beautiful exhibits in the *Ausstellung*, M. Tresca, the learned and distinguished Director of the *Conservatoire des Arts et Métiers* of Paris, and whose papers and experimental work are so

often found useful to the engineer, and numbers of other hardly less distinguished men, are assigned to this group. It is by such juries that the awards are made. They will probably make some mistakes, but, on the whole, their decisions will probably have much more weight with the world than those of juries in general at public industrial exhibitions.

Listening to the deliberations of a jury so constituted would undoubtedly be exceedingly interesting to the public, were they permitted to be present. A proposition, made by a member or by the President, in the German language is often met by a rejoinder in French, the discussion is continued by a third member in English, and others join in with a *patois* of one or another of the three languages, in which interest or excitement infuses strange accents of the native language of the speakers, who may be Russians, Swedes, Turks, Greeks, or Spaniards, or even Chinese or Japanese. The discussion also frequently brings out some of the great men present, in most interesting histories of invention or of inventors, or, frequently, in very abstruse discussions of general principles.

We spent an hour, yesterday, in examining the

MAGNETO-ELECTRIC MACHINE

of M. Gramme, already mentioned. Many machines of this class have been devised, all of which produce an electric current by the motion of one or of many magnets before a coiled wire conductor, or by the reverse arrangement of moving coils and stationary magnets. The older machines were unsatisfactory in consequence of the cost and the inefficiency of the large or numerous permanent magnets required, or the expense and trouble involved in their operation. Later, it was discovered that the electricity thus obtained might be employed to excite larger electro-magnets, from which a powerful current could be obtained by the use of a peculiar form of revolving armature invented by Mr. Siemens. Still later, it was found that no permanent magnets were necessary, but that, the electro-magnets retaining a small quantity of magnetism at all times, the machine could be set in operation and brought up to full power by diverting a portion of its own current for the excitation of the magnet, while the remainder of the induced electricity was given a useful application. It is to this latter class of machines that this apparatus of M. Gramme belongs. Its distinguishing peculiarity seems to be that there are several Siemens armatures, instead of but one, all arranged on a single revolving shaft, and set like the revolving knives of an old fashioned hay cutter, or, as a better illustration, like the teeth of a very broad faced watchmaker's pinion, or a gear wheel of small diameter. They are quite closely set, but are thoroughly insulated from each other. The electro-magnets are arranged in a usual form and possess no noticeable peculiarity.

In this large machine, one horse power is said to develop a current equal to that of sixty Bunsen standard elements, and to be capable of heating thirteen meters (over forty feet) of iron wire one millimeter in diameter (.004 inch) to a bright red heat. It weighs six hundred kilogrammes (1320 lbs.) and costs about the same, for similar power of current, as the Ladd machine which was, some time ago, described in the *SCIENTIFIC AMERICAN*. Its great and exceedingly important advantage is that its armature revolves but two hundred and sixty times per minute, but a fraction of the speed of the Ladd or the Wilde, and can thus be worked indefinitely without trouble from heated bearings, and with less consumption of power.

R. H. T.

STEAM BOILERS AT THE GREAT EXPOSITION.— LETTER FROM THE ENGINEER OF THE UNITED STATES DEPARTMENT.

The following letter from Mr. Pickering, engineer of the United States Department at the Vienna Exposition, gives interesting information concerning the steam generators and of the American exhibit in particular. The Pitkin boiler, here alluded to, is horizontal, 54 inches in diameter, 16 feet long, with 59 tubes 3 inches in diameter and 15 feet long:

VIENNA, July 23, 1873.

Messrs. Pitkin Bros. & Co.,

GENTLEMEN:—I don't know what you think of me for not writing you long before this time, but if you knew how busy I have been, and the extra work that has devolved on me on account of our commission troubles and changes, you would see how impossible it has been for me to pay proper attention even to those who, like yourself, have so kindly furnished some of the principal apparatus for our department, and without which we should indeed be in a sad plight.

On arrival here, I found only the foundation for the boiler house, and so was in time to see personally to all the boiler setting. The work of boiler setting progressed very slowly, indeed, as did all the work connected with the Austrian General Commission. But with all our drawbacks and delays, we finally got the boiler set and fired up, not the last, as we expected to be, but some two or three days before the French Department; and when all ready for firing, came the boiler testing. Your boiler was subjected to the customary hydrostatic test, and it was declared by the officer in charge to be the only one of the entire collection at this exposition which stood the cold water test without leaking. And now the boiler has been in constant use nearly two and a half months, and has, to the surprise of every one (including myself), supplied our department with all the steam we need, and that with very easy firing and very poor coal. We are running daily four steam engines: one 30, two 8 and one 3 horse power: one 650 pounds steam hammer, one steam puddling machine engine of 5 horse power, three steam pumps, and live steam when wanted for the sand blast exhibit of Tilghman, of Philadelphia. The main steam pipe, furnished by the

Austrian General Commission, is of very thin iron, 6 inches in diameter and 150 feet long. From this pipe all the steam is supplied, except to one 8 horse power engine, which receives its steam through 48 feet of 1½ inches pipe continued from the end of the 6 inch pipe, making total distance of this last engine from boiler 238 feet, as there are 40 feet of 3 inches pipe connecting boiler to the 6 inches main pipe. This steam piping is not covered, and consequently condenses much steam; so much, in fact, that it was necessary to place a steam trap about the middle of the length of this pipe, to relieve it of the water of condensation. The exhaust pipes of these engines and pumps are so far from the boiler that it was found impracticable to use the exhaust steam for heating the feed water; consequently we feed cold water. I am now, more than ever, impressed with the economy and safety of this style of boiler, and our present and previous commissions, as well as myself, desire to express our thanks for your liberality and promptness in furnishing, for use of the American Department of this Exposition, so good a boiler, and one which is so true a sample of a style of boiler now so much in use in the United States.

Very truly yours,
T. R. PICKERING,
Engineer U. S. Department, Vienna Exposition.

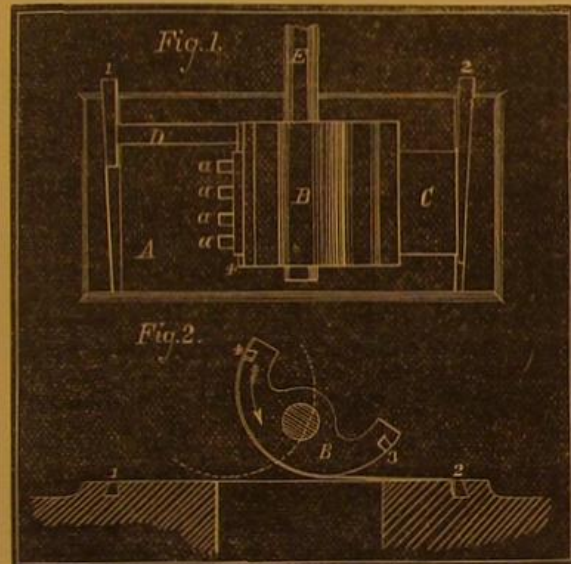
Correspondence.

Caloric Engine Valves.

To the Editor of the Scientific American:

Those engaged in improving the caloric engine may find the following design worthy of trial. If so, they will confer a favor by giving the results in the SCIENTIFIC AMERICAN.

The device consists of a plain rectangular valve seat, A, having several narrow ports, *a*, opening into one passage way, and key ways, 1 and 2, cut one across each end; a segment, B, operated by a shaft, E, extending outside the machine through a stuffing box (not shown); a sheet metal flap valve, C, fastened at one end to segment by a key, 4, the other to the valve seat by a key, 2, and a draw strap, D, put on just the reverse of C, fastened by keys, 1 and 3.



When the shaft rotates with the arrow, Fig. 2, the segment moves to the left, shutting the valve. When it rotates in a direction opposite to the arrow, it moves to the right, opening the valve. In both figures it is shown open. The dotted line, Fig. 2, indicates its position when shut. The shaft is placed near the outside of the segment to reduce its lateral motion to a minimum. The construction being understood, its operation will be apparent without further explanation. Probably the best material for C and D will be soft, thin, sheet steel, and the best results will probably be obtained at a comparatively high temperature, perhaps a dull red heat, steel then being very tough. In adapting this valve to an engine, accessibility should be studied; for, if accessible, a frequent renewal of C and D, when necessary, is inexpensive.

F. H. R.
New Britain, Conn.

The Hot Air Engine.

To the Editor of the Scientific American:

The criticisms of your correspondent H. S. W. (on page 101 of your current volume), of my modifications of the air engine, are quite proper in view of the partial illustration upon which they were based.

If H. S. W. is a thorough practical machinist, I think that a little patient thought will reveal to him a happy expedient for each of the defects he has named. For instance, he fears that the machine will be too heavy. A machine with an eight inch crank need be but about six feet high to the shaft; then there certainly can be no form so simple and appropriate for a firm base for such an engine as that of a short cylinder with a massive flange at its base; the cylinder may be of any desired diameter and weight, the supply pump being placed centrally within this in the form of a lining; then four heavy standards or brackets, firmly fixed to the top of this base casting, will form an ample support for the hot air cylinder, in connection with the support afforded by the central supply pipe. As to the matter of getting at the pistons for repacking, the removal of the lower end of the connecting rods from the ends of cross arm (J) will let the pistons out at the bottom of the cylinders; and what can be more handy? The oilers would be so suspended as to be instantly movable to one side.

As to the ash difficulty, whatever ash arises sufficiently to reach the top of the fire box must be extremely fine and light; and, if the exhaust passage and smoke pipe are fully open, will be taken off through those appropriate channels. By means of a conduit from the bottom of the ash pan outward and downward to the outside of the hot air chamber, the ashes, etc., may be removed very handily.

As to firing up, a stooping posture is the most tiresome and awkward one for a workman to be placed in; it is far preferable to step up two or three easy steps and then stand upright while putting in the coal.

As to the arrangement of the exhaust valve, this may be placed above and out of any danger from heat, as well as at the side of the engine.

As to supplying coal while the engine is working, this is easily done by means of a receptacle, or hopper, with an inner and an outer door, each airtight. I have two methods of working these doors; there is probably no better mode of working the outer lid or door than the one now in use on the Roper engine; and my plans for working the inner door are nearly as simple, and quite as perfect.

I have great confidence in what is termed the "base burning" plan, as exemplified in the Littlefield and some other stoves, especially for the small engines; could this plan be applied to hot air engines, sufficient coal could be put in at once for a day's work, and, of course, only an outer door to the hopper would be needed.

F. G. WOODWARD.

The Nebular Theory and Kepler's Laws.

To the Editor of the Scientific American:

On page 196 of your last volume I attempted to draw attention to, and to promote inquiry as to whether there exists any relation between, the nebular theory and Kepler's laws. I will continue the subject by remarking that a close examination of the inclinations and eccentricities of the orbits of all the planets (including the so-called asteroids, which are really planets), together with the consideration of the active and powerful eruptive forces now known to exist in the sun, strengthens our belief that these laws, as set forth by Kepler, are the result of the development of our present solar system from a single and greatly attenuated mass, as has been supposed by La Place and other eminent astronomers.

Let us examine some of the data on which such belief is based. Beginning at the outer bounds of our system and approaching toward the center, we recognize Neptune, Uranus, Saturn and Jupiter, all large planets, and all having orbits of small inclination and small eccentricity. Just as might be expected, when we consider their great mass and admit the radial force to be small.

Proceeding further toward the center, we find a large group of small planets, more than 130 in number, revolving between the orbits of Jupiter and Mars, in a space where it would appear to be about the place for the throwing off of another planet. But just at this point a change, perhaps small, seems to have taken place in the eruptive force, seeming to indicate an increase of energy in that force. There here seems to be a throwing-off of smaller masses, at much more frequent intervals and generally with increased radial velocity. And it would also seem as if the equatorial motion of the mass did not so much affect the plane of the projection, as in the case of the larger planets.

From the consideration of the above facts, it would appear as if the eccentricities of the planetary orbits were due to the action of the radial or central force; while the inclinations are due to the exertion of that force in a direction forming an angle with the equatorial plane of the revolving solar mass. We may notice also, in passing, that these radial eruptions would not affect the harmony of the orbital motion of these small planets, as the planet-exploding theory would indicate.

Still proceeding towards the center, we may now assume that the eruptive force again became comparatively quiet, and the detachment of the masses took place more regularly; so that the births of Mars, the Earth, Venus and Mercury took place under conditions similar to those of the earlier and larger planets.

Evidence in favor of the nebular hypothesis is continually accumulating. That afforded by the spectroscopic demonstrates that the planets are composed of the same elements as the sun; while the elements in some of the stars are different. This evidence is among the latest, and is probably the most conclusive. Admitting the nebular theory to be true, there is no difficulty in accounting for Kepler's laws. They are what we might reasonably expect to result from a process of evolution as set forth in that theory.

It is extremely interesting to contemplate the possibility of such changes in the solar system and the evolution of so many beautiful worlds from apparent chaos.

Tamarac, Ill.

E. H. PRICE, M. D.

Ignition from Steam Pipes.

To the Editor of the Scientific American:

The Fire Marshal reports 31 fires for the month ending August 16. Among the causes is "heat from steam pipes setting fire to scraps in drying box 1." How do you account for this ignition? It is not probable that any oil was present in a drying box.

New York city.

NORMAN WIARD.

REMARKS BY THE EDITOR.—Our correspondent has omitted to mention the nature of the establishment, the scraps or the drying box, in which the alleged ignition took place. These particulars are necessary in order to reach a satisfactory conclusion. We have published examples of ignition in cotton drying and picking rooms, where steam pipes were used and no oil assisted the combustion.

The Proposed Great Telescope.

To the Editor of the Scientific American:

I have read with interest many articles in your journal in regard to the big telescope; but it strikes me there has not been proposed as yet a really efficient and practical instrument, that is, as to form and dimensions.

Why not construct, on a large scale, one of those fine, silvered glass reflecting telescopes, now becoming so popular in England, which, in the hands of both amateurs and experts, are so successfully aiding the science of astronomy? It is possible to construct such a glass of ten or twelve feet diameter, at but little, if any, more than half the price of such a glass as described and illustrated in your issue of August 16, by F. H. R.; while the light-gathering capacity and penetration of the former would be far superior to the latter. Besides, the length of this enormous instrument need not be greater than the five foot glass of the correspondent just mentioned; and its mounting would be as easily accomplished and at as little expense.

The glass, as proposed by your correspondent F. H. R., would be impracticable, though not at all liable to the objection he anticipates in regard to the division marks of the field of view by dark bands. But it would fail because a sufficient number of pieces of glass, of absolutely the same density and homogeneity, would be difficult to obtain, and on account of the extreme liability to unequal expansion of the glass, cement, and iron, which are parts of the lens. The latter would render it almost, if not quite, impossible to secure for it good definition, without which such an instrument would be almost worthless. Opticians and glass manufacturers know that the present state of the art of glass-making does not enable them to obtain single disks out of which good refracting lenses can be constructed larger than of 28 or 30 inches diameter; so an excellent instrument of that kind, known as the achromatic, cannot go beyond that limit. But for a silvered glass or reflecting telescope, plates of glass of good quality can be manufactured of 10, 12, and even 15 feet diameter. And it is but reasonable to presume that an application of some of the extremely fine and delicate methods of producing surfaces on similar smaller instruments, as practised by some of the English and American opticians, would not fail to secure an exquisite figure and surface on even as large a glass as here contemplated. So large an instrument would, of course, be better adapted to the discovery of the physical constitution of the celestial bodies, by means of its wonderful power to penetrate the unfathomable space, rather than to serve the more exact purposes of mathematical astronomy, this latter being within the province of, and almost altogether performed at present with, small instruments especially constructed and arranged for that purpose. I shall heartily approve the big telescope enterprise if it be put on some sound and practical basis.

Springfield, O.

F. M. B.

A Suggestion for Balloonists.

To the Editor of the Scientific American:

The existence of an upper southwest current in the atmosphere of the northern hemisphere has been maintained by meteorologists for many years. Espy, Redfield, Maury, Butler, and hosts of other scientists, have expressed their conviction that there is a current of heated air at the equator, which rises there and blows off in the upper regions of the atmosphere towards either pole. These currents proceed from a part of the earth where they are moving rapidly, with the earth's motion, to a point where the motion is slower. Their momentum being retained, they assume an easterly course; and in the temperate zone, they would range, more and more, to the east and north, the farther they go northward. For the same reason, the wind blowing from the north pole towards the equator acquires an easterly direction, and seems to come from the northeast. Our surface northeast wind is cold, dry, and heavy. It makes the barometer rise because it is heavier. It chills us with cold from the snow. Its moisture has been frozen out of it. The southwest upper current is warm, moist, and light, and all its effects are the reverse of those of the northeast wind.

The evidence and reasoning satisfy me that there is a southwest upper current. The movements of the clouds show at all times three or four currents; they move in strata, often directly opposed to each other, one above going westward and one below going eastward.

It is manifest that a balloonist can move in a given direction by keeping his balloon in the current, and in that way only. To keep in the current, the balloonist must be able to rise or descend at will. This power Professor Wise has not. He can go up as high as he wants, and he can come down. But having gone up and come down, he cannot go up again. This is the trouble in balloon traveling. It is singular that no effort has been made to remedy this difficulty, except by means of ballast and valve ropes. There are several ways in which it might be done.

Instead of ballast, sand bags, etc., let the aeronaut take strong vessels, like soda fountain chargers, filled with condensed hydrogen, and an air pump for condensing. If the gas of the balloon has leaked, supply the loss from the reservoir. If it needs less buoyancy, withdraw the gas through the air pump, and store it for future use. He can thus be enabled to go up and down several times, and be able to select a particular current on which to sail. With this power at command, there may be some chance for success. He may move up and down till he strikes the right current, and may be able to keep in it till he can reach his destination.

J. W. SKINNER.

Yonkers, N. Y.

THE IRONCLAD HULLING STONE.

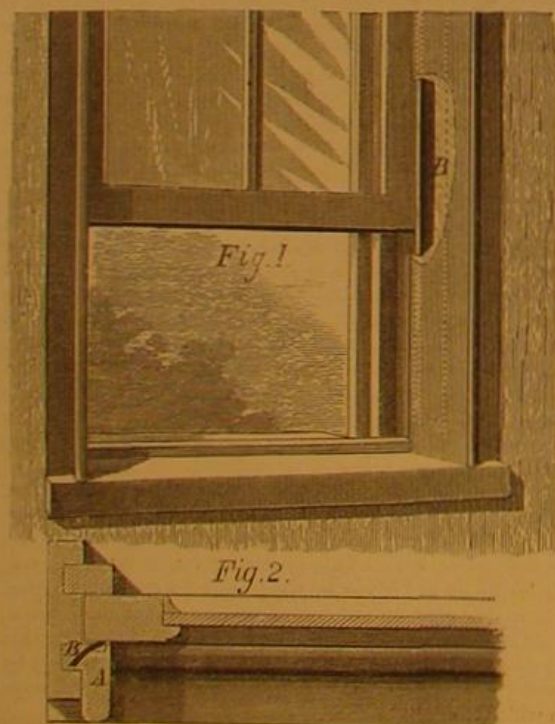
The hulling machine, to which the improved stone here-with illustrated is designed to be applied, is composed of a revolving stone contained in a fixed perforated case. The former is dressed on its edges and has grooves in its bottom in order to excite a blast, so as to spread the grain between stone and case and retard its descent to the bed plate. The improvement in the present invention consists in lining the vertical edges of the grooves with metallic plates, in order to prevent the stone, which is generally of soft nature, from being worn away at such edges through kernels of grain getting between the same and the bottom plate. In Fig. 1, showing the stone reversed, A is the flange, made of the best cast iron, fitted and secured into a recess in the center, as shown. The spaces between the edge of this flange and the stone are filled with lead or brimstone. Through the center opening passes the spindle, on a shoulder upon which the flange rests and is secured by keys. Air is drawn in under the stone through a large aperture cut through the bed plate and platform in the center. The grooves taper in depth from the edge inward, and their vertical sides operate as a fan blower, forcing a strong blast of air toward the circumference, driving the grain the full height of the periphery of the stone. Slides are arranged under the air orifice to regulate the draft. It is claimed that a four foot stone, fed by charges and revolving at two hundred and fifty revolutions per minute, will drive every kernel out through the discharge slide within three seconds.

The principal advantage claimed for the metal bars or facings, B, consists in the fact that the distance between stone and case need not be over one quarter of an inch. The blast has always to break at a very short angle after entering, so that, no matter how strong it may be, it cannot prevent scattered grain from getting under and wearing away the groove edges. To avoid this difficulty, similar machines are ordinarily made with a clearance of three quarters of an inch or an inch. This, according to the inventor of the present device, renders them incompetent to hull dried oats or tender grain without great waste, because the material is not spread evenly, and is caused to lie between stone and case in bulk. The edges, being guarded as above described, are, in the invention under consideration, not liable to such wear; and hence all grain, it is stated, is evenly distributed and hulled.

The bars B, are secured by eyebolts C, Figs. 2 and 3, hooked over a recessed portion of the former and then passed through suitable holes and secured by a nut and washer on top of the stone. The bars can thus be readily detached and shortened as the diameter of the stone diminishes by dressing. Patented June 10, 1873. For further particulars address the inventor, Mr. A. Bertelson, West Salem, La Crosse county, Wis.

IMPROVED WINDOW WEATHER STRIP.

This invention is a combination of both sash holder and weather strip. It serves, therefore, not only to caulk the

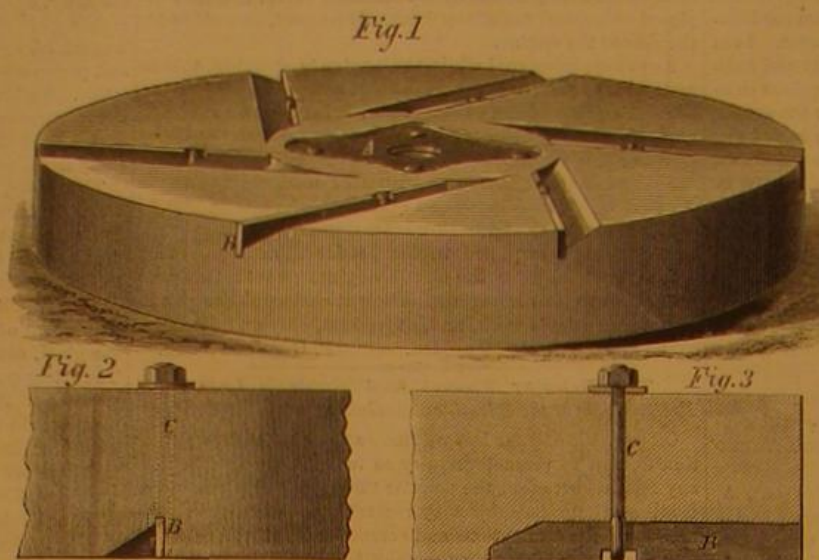


edges of windows, preventing the entrance of cold air or dust, but also as a convenient attachment for sashes unprovided with cords and pulleys.

Fig. 1 depicts the device in position, part of the window casing being broken away to show the india rubber packing. Fig. 2 is a horizontal section of the sash and surroundings, in which A represents one of the vertical battens or guide strips. These are right angled in section, one part fitting in a vertical groove, and the other portion against the inner side of the casing. In each, and on the side facing the sash, is formed a recess corresponding in depth to the thickness of the rubber strip, B. The latter is fastened in an oblique ex-

tension of this recess, by glue, nails, or other suitable means. The front end of the strip projects at an angle above the batten, and is pressed back into the straight portion of the recess, when the sash moves over it. It therefore acts as a spring, holding the sash in any position, allowing the same to be easily and noiselessly opened or closed, while it effectually packs the interstices between sash and frame.

The advantages of the invention are its simplicity and the fact that it is a substitute for both detachable weather strips and the button or other arrangement usually employed to sustain the sash.

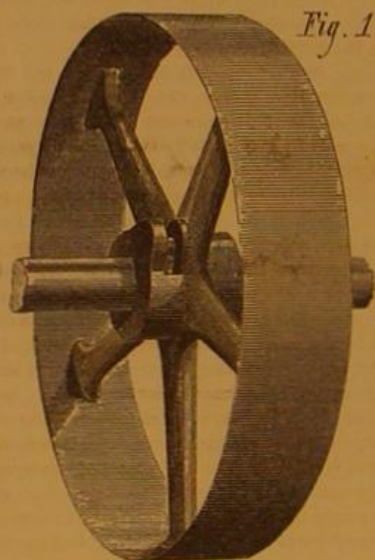


BERTELSON'S IRONCLAD HULLING STONE.

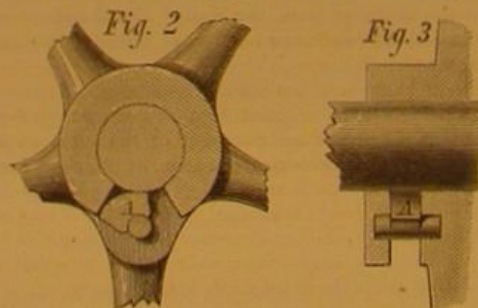
The patent, obtained through the Scientific American Patent Agency, July 8, 1873, is, we understand, for sale, and the model will be exhibited at the coming Fair of the American Institute in this city. From the inventor, Mr. Giles P. Potter, Coventry, Kent county, R. I., further particulars may be obtained.

IMPROVED FRICTION ATTACHMENT.

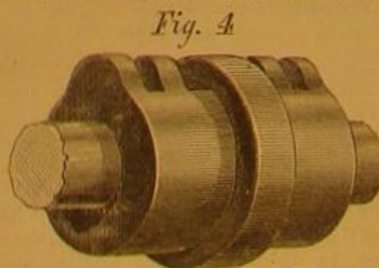
The accompanying illustrations represent a new mode of securing pulleys, couplings, etc., to shafts.



Apart from the practical utility of this invention, it is claimed to possess the merits of economy and simplicity of construction, which render it much cheaper than any other



fastening now in use for the same purpose. If the castings are turned out properly (which requires no particular skill in molding, and but very little additional labor), no further



work is necessary, as the device merely consists in a pin, cast in the lug, upon which is placed a small cam, which works in a space provided for the same.

Fig. 1 represents a pulley with a fastening of this kind. Figs. 2 and 3 represent sectional views of the hub of the same, through the cam, A, showing the action of the latter upon the shaft. The cam or cams on the pulley or coupling, being turned, create the friction or grip, by which the pulley or coupling is held, and which increases in proportion to the amount of force exerted; consequently the pulleys, etc., are held firmly upon the shafts. When pulleys are required to work in opposite directions (which is not often the case), reverse cams will be used.

This device, applied to shaft couplings, it is claimed, will effect even a greater saving than when applied to pulleys, as the couplings will be in one piece, doing away with the labor of facing, the expense of bolts, etc.; and as the flanges will be dispensed with, less weight of metal will be used. Still further, if properly cored, the boring also may be saved.

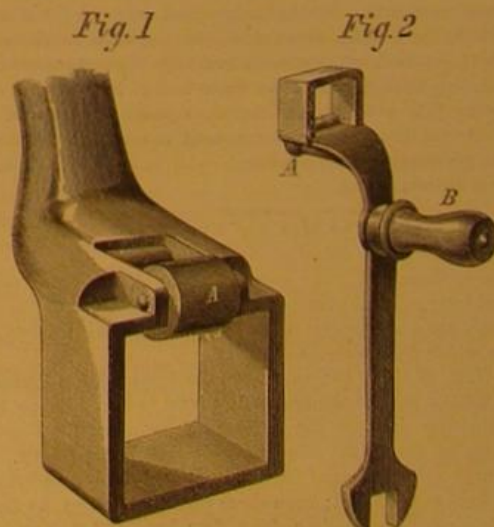
This invention, we are informed, possesses not only the quality of self-tightening (which, in itself, is an important consideration, especially where access to the means of fastening is difficult), but it can also be easily loosened when it is desired to remove a pulley to another part of the shaft; it is claimed, therefore, that a great deal of labor, which usually attends such operations, is dispensed with. It is further claimed that it does not prove injurious to shafts, as is the case with set screws, especially on their giving out, an annoyance which is too often experienced by those who use them in cases where much power is required to be transmitted. This quality particularly adapts its application to pulleys on cold rolled shafts; as in such cases, key seats, etc., are objectionable, as breaking the surface causes them to warp. Fig. 4 shows the invention as applied to a shaft coupling, two mortices being made, on either side of the center.

We are informed that actual trials, by a brake on the surface of a pulley provided with the device, failed to loosen the latter, and caused a scarcely perceptible indentation on the shaft. The invention is in successful operation in various localities in Canada.

For information regarding sale of shop rights, etc., address the patentee, Mr. Henry W. Cox, Peterborough, Peterborough county, Ontario. Patented through the Scientific American Patent Agency, June 10, 1873.

IMPROVED WRENCH.

Any one who has ever removed the wheels of a carriage to oil it, will at once appreciate the improvement which the annexed engraving illustrates. An ordinary wagon or carriage wrench is cast with a slot in one side of the square, in which a small elastic rubber roller, A, is hung, extending into the open space far enough to pinch the nut so that it will remain firmly fixed in the wrench when it is removed from the axle. There is also a handle, B, Fig. 2, projecting from the shank a short distance from the box and at right angles with it, by which the nut, when loosened, is rapidly turned off with a crank movement. The handle also serves to steady the wrench, keeping it from slipping from the nut while being loosened, when, as is frequently the case, it has become very tightly screwed on. This improvement supplies a cheap and, doubtless, efficient wrench which, it is claimed, renders the usually tedious and dirty operation of oiling or greasing rapid and cleanly. With it there need be no rapping of the knuckles, no dropping of the nut and final replacing with the fingers, which so exhaust the patience and ruffle the temper.



For further information address the manufacturer, N. L. Post, P. O. Box 52, East Cleveland, Ohio, by whom it was patented February 11, 1873.

At the Patent Office, Washington, every examiner is now favored with the help of a lady clerk, who takes charge of the official correspondence and looks after the odds and ends of the examiner's business. There is one exception, however. The examiner of medical inventions is debarred from feminine assistance, and is compelled to keep a clerk of the masculine gender.

KANSAS CITY, MO., AND ITS COMING EXPOSITION.

There are probably few localities which more substantially typify the rapid growth, both in population and material prosperity, of our Western towns than Kansas City, Mo. In the year 1855, its inhabitants numbered but 600, and this figure, up to the taking of the census in 1860, had increased to 4,318. In the ensuing ten years, the latter total augmented over six hundred percent; while at the present time it is estimated that the population aggregates over 40,000 souls.

Situated in Jackson county, on the right bank of the Missouri river, Kansas City forms the terminus of nine distinct railways; in addition to which, there are three lines entering on the tracks of others, and four new roads in progress of construction. The completed routes are the Missouri Pacific, the St. Louis, Kansas City, and Northern, the Hannibal and St. Joseph, the Kansas City and Council Bluffs, the Missouri Valley, the Kansas Pacific, the Leavenworth, Lawrence, and Galveston, the Kansas City and Santa Fé, and the Kansas City, Fort Scott, and Gulf. Those upon the tracks of others are the Toledo, Wabash, and Western, the St. Louis, Alton, and Chicago, and the Kansas City and Louisiana. The new lines are the Kansas City, Memphis, and Mobile, the Kansas City and Keokuk, the Kansas City, Wyandotte, and Northwestern, and the Kansas City branch of the Atchison, Topeka, and Santa Fé. A fine railroad and wagon bridge, built at a cost of \$1,000,000, and the first ever constructed across the Missouri, spans the river and supplies another means of access to the city.

It may readily be imagined that so many concentrating lines of railway—a noticeable fact in connection with which is that not one was in operation at Kansas City before the spring of 1865,—attracted as they were to this locality as a point of reshipment and a market for the rich mineral and agricultural resources of the surrounding country, have been largely contributive to its prosperity. This result has been rendered still more beneficial from the fact that a competition has been engendered between the railways and the river boats, a circumstance which has led to the cheapening of freights to a degree below those to any other point West, and hence has given to the trades and manufactures of the city a vigor and strength rarely found in new established towns.

As regards the industries of the place, among the most important is that of packing cattle and hogs, twice as much live stock, it is said, being there slaughtered as in any other city of the Union. In 1872, 187,221 hogs were packed; and we understand that the business, owing to increased facilities, has been carried on during the present year on a largely increased scale.

Although foundries, mills, furniture factories, and simi-

lar establishments are well represented, it seems that there is abundant room for many others. Starch works and distilleries are needed to manufacture the surplus corn. Tanneries, glue, and comb factories are also and even more urgently required; for although Kansas City exports hides, horns, hoofs, and bones, the finished staples of sole leather,

particularly as they incur little or no expense in forwarding their goods to a locality which will doubtless prove an excellent market.

The Projected Indo-Russian Railway.

The new railroad projected by M. Ferdinand de Lesseps is to extend from Orenbourg, Russia, on the line of separation between Europe and Asia, and Peshawur on the confines of Afghanistan, thus forming a direct route, connecting the center of Asia with the northeast of Europe. Orenbourg is now the terminus of the system of Russian railways, while Peshawur is the starting point of the Anglo-Indian lines. The distance between the river Ural, on which the first of these towns is situated, and the Pass of Khyber, near the second, measures about two thousand three hundred miles. The junction of the Anglo-Indian and Russian lines will be at Samarcand, in Bokhara. When this great road is completed, there will be seven thousand five hundred miles of continuous rail between Calais, France, and Calcutta, making the time required to reach the latter city, from New York, about twenty days.

COUNTERBALANCED LIFTING BRIDGE.

This invention, patented by Mr. Walter Brown, C. E., and described in the *Engineer*, relates to the class of bridges which are opened by being lifted into an erect position, after the manner of the ancient drawbridges. In order to facilitate the operation of lifting, it is usual to make the jib end and heel end of the bridge balance each other round the shaft or axle. It is in the arrangement of this counterbalancing that the present invention consists. The counterweight in this case is not attached to the bridge so as to form part of it, but is contained in a separate pit or chamber placed some distance behind the heel of the bridge. This counterweight may consist of a cast iron box filled with sand, water, or other convenient material. To each end of this box a chain is attached which passes over a pulley at the top of the pit or chamber, and is thence led to the point of attachment to the bridge. This point of attachment should be over the axle of the bridge and at a considerable height above it, so as to give a suitable leverage to the pull of the chain. This height may be obtained by placing the axle below the bottom of the bridge girders, and by using a bracket or standard bolted to the top of the outside girder, to which the chain may be attached. It will then be seen that, supposing the moment round the axle of the weight of the bridge to be equal to that of the pull of the chain when the bridge is down, then, as soon as the bridge is raised, the moment of the pull, acting at a longer arm, will be greater than that of the weight, and will therefore continue the motion of itself. The point of attachment should be so arranged that, when the center of gravity of the bridge is ver-



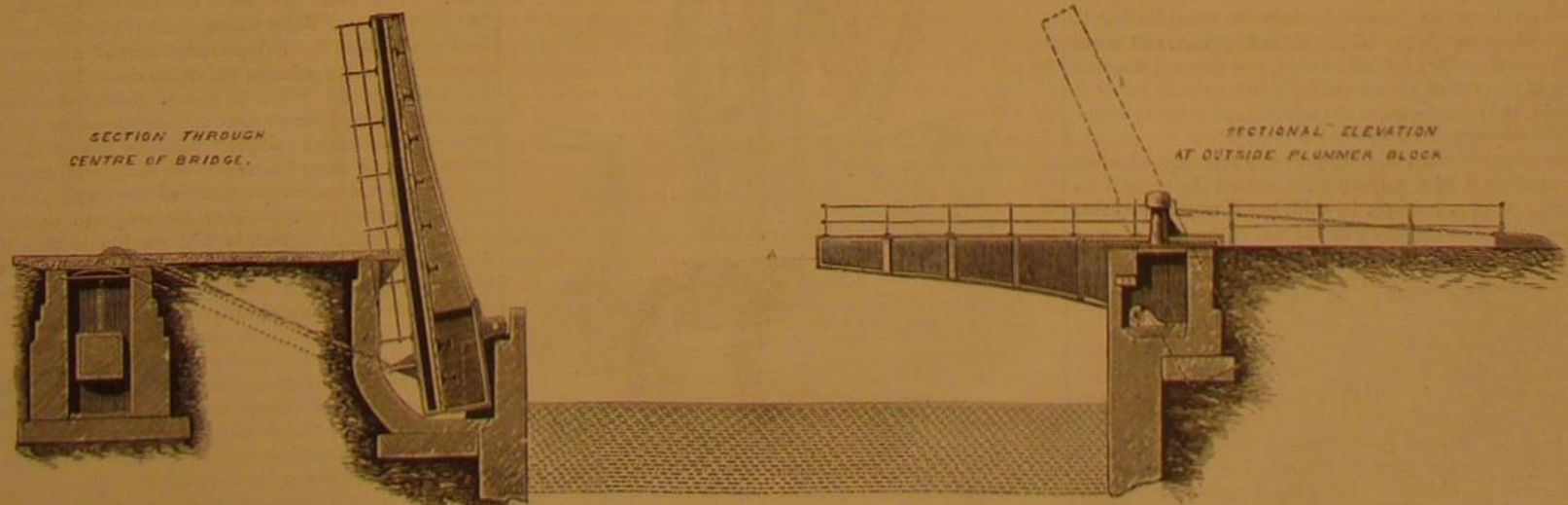
MAIN BUILDING OF THE KANSAS CITY, MO., EXPOSITION.

glue, bone buttons, etc., are imported in great profusion. Smelting works and white lead mills will also find an abundant field for operation. There is a plentiful supply of coal; and from the proximity of the town to the mines of Colorado and Utah, and the minerals of the Ozark range, there seems no reason why a large share of the business of smelting, which now, at enormous expense, finds its way across the continent, and even to Swansea, in Wales, should not be done here. In fact, there is every pre-requisite at hand for a great manufacturing city and a market of almost unlimited extent.

In order to stimulate local energy and, at the same time, to draw the attention of the rest of the country to the rich resources in the neighborhood, the citizens of Kansas City have, for three years past, held an Annual Exposition and Agricultural Fair, which has been the means of attracting large numbers, both of spectators and exhibitors of stock, agricultural machinery, products, etc., from all parts of the United States. A fourth exhibition will take place during the coming fall, and the managers, we understand, have secured liberal arrangements for transportation of freight to and from the Fair. They offer to handle and display, free of charge, all articles consigned to them, and will repack and return the same to such owners as may be unable to attend in person.

We give herewith an engraving of one of the ample buildings, in the number of which are included power, fine art, and agricultural halls. The grounds comprise 974 acres, laid out with groves, race tracks, and every attraction and convenience. By addressing Mr. D. L. Hall, the secretary of the exposition, at Kansas City, premium lists and more detailed particulars may be obtained.

It seems to us that this Fair is well worthy of the attention of manufacturers and others, who propose to contribute this year to the various expositions throughout the country,



BROWN'S COUNTERBALANCED LIFTING BRIDGE

tically over the axle, the line of the chain produced may also pass through the axle or nearly so, so that the two moments may be zero about the same time. From this point the moment of the chain, still acting in a contrary direction to that of the weight of the bridge, will tend to stop the bridge, or to destroy the motion previously given; and as it will again have a preponderance over the moment of the weight, the bridge may be brought to rest in its proper position when fully open. In closing the bridge the same effects will be produced, the counterweight accelerating the motion of the bridge in the first half of its travel and retarding it in the second, so that it may be brought to rest in its original position.

In order to obtain some data for comparison, the bridge has been taken for which the invention was originally designed, namely, a two leaf bridge, 23 feet wide out to out, spanning a 40 feet opening. An estimate has been made of the cost of this bridge on the counterbalanced system, as compared with that of the other types of bridge which might be employed, with the following results: The counterbalanced bridge costs 15 per cent less than an ordinary lifting bridge or a rolling bridge, and 34 per cent less than a swivel bridge; there would also be considerable economy in working, and the new device would, by its construction, be less affected by the wind, when elevated, than the lifting bridge.

Injuries of the Ear.

"Among the causes of injury to the ear must unfortunately be reckoned bathing. Not that this most important and healthful pleasure need, therefore, be in the least discouraged; but it should be wisely regulated. Staying too long in the water certainly tends to produce deafness as well as other evils; and it is a practice against which young persons of both sexes should be carefully on their guard. But independently of this, swimming and floating are attended with a certain danger from the difficulty of preventing the entrance of water into the ear in those positions. Now, no cold fluid should ever enter the ear; cold water is always more or less irritating, and, if used for syringing, rapidly produces extreme giddiness. In the case of warm water, its entrance into the ear is less objectionable, but even this is not free from disadvantage. Often the water lodges in the ears and produces an uncomfortable sensation till it is removed; this should always be taken as a sign of danger. That the risk to hearing from unwise bathing is not a fancy is proved by the fact, well known to lovers of dogs, that those animals, if in the habit of jumping or being thrown into the water, so that their heads are covered, frequently become deaf. A knowledge of the danger is a sufficient guard. To be safe it is only necessary to keep the water from entering the ear. If this cannot be accomplished otherwise, the head may be covered. It should be added, however, that wet hair, whether from bathing or washing, may be a cause of deafness, if it be suffered to dry of itself. Whenever wetted, the hair should be wiped till it is fairly dry. Nor ought the practice of moistening the hair with water, to make it curl, to pass without remonstrance. To leave wet hair about the ears is to run great risk of injuring them. In the washing of children, too, care should be taken that all the little folds of the outer ear are carefully and gently dried with a soft towel."

A correspondent sends us the foregoing, clipped from a newspaper, and asks our opinion thereon. He adds: "I am partially deaf (doctors say from cold), and I was told that bathing my ears in cold water was good, being a sort of a stimulant. I can hear very well in a machine shop, or traveling on the cars, the jarring noise causing the drum of the ear to vibrate and allowing sound to enter."

REMARKS BY THE EDITOR:—The statements contained in the above paragraph are quite correct; and, it might be added, of practical value. The ear is quite as liable to injury from drafts of air as from cold water. The modern style of cutting the hair in men, and of arranging the hair of women, is much to be deprecated; because it was intended by Nature that the hair should fall over the ear, and form thus a protection to it. But as we cannot throw down so great a goddess as fashion, we must use care and artificial means for the preservation of this delicate organ.

If sitting in a draft is unavoidable, the handkerchief should be applied to the ear exposed, or a pledget of cotton inserted within it. The ordinary manner of washing the face does no harm to the ear, because the canal leading to the drum of the ear is partially occluded by wax, and water does not penetrate far; but all swabbing of the ear, whether with dry cloth or lint moistened with hot or cold water or other fluid, is by no means to be advised, as it removes the wax, the necessary safeguard to the internal ear.

Our correspondent is suffering probably from a thickening of the epidermis of the tympanum, caused by chronic inflammation, set up, perhaps, by cold, but it may be by other irritation. He should place himself under the care of some competent aurist, and not attempt to doctor himself.

The Nature of Infection.

Investigations, says Dr. J. J. Brown, result in establishing these facts: There are low forms of life, some of which can and some of which cannot be seen with the microscope. More than thirty varieties of these infest the human system. They permeate the fluids and solids of the body. They are known to be the cause of some diseases, which makes it possible that they are the cause of others. The cause of infectious diseases is obscure. Probably they are caused by species of parasites. This supposition matures into an established fact when supported by the following truths: Under the microscope of Chaveau, the active principle of

infection is a solid granule. Such remedies as are most destructive of parasites are most efficacious in communicable diseases. The cause dies; only living things are subject to death. Löffler shows them or their germs actually to exist in the circulating blood.

New Optical Instrument to Exhibit the Mechanical Combination of Colors.

Frederick J. Smith has designed the following instrument, which he describes in a recent number of *Nature*:

To the center of a disk, A, which can be caused to revolve by the wheel, G, is fixed a plain mirror, B, is fixed at angle of 45° to the surface of the disk. In front of the mirror is placed a prism, D. At the edge of the disk there are placed different slides, E, for cutting off any particular rays; also, above the mirror, is a small slit cut in a piece of brass, C, to admit the ray under examination.

xx is a ray of light which, passing through the slit, C, is deflected at right angles by the mirror, B, through the prism, D, and is then received in the form of a spectrum upon the screen, S. As soon as the wheel, G, is set in motion, the spectrum also moves round the conical screen, S S; and when a certain velocity is arrived at, the colors combine and form the original colored light which is entering at the slit, C. In the same way, by using the slides, any two or more colors may be combined to form the resultant color.

A Good Journal Box.

A correspondent, Mr. C. W. Crawford, of Brazil, Ind., makes the following suggestion for a journal box, and hopes the mechanical profession will avail themselves of it.

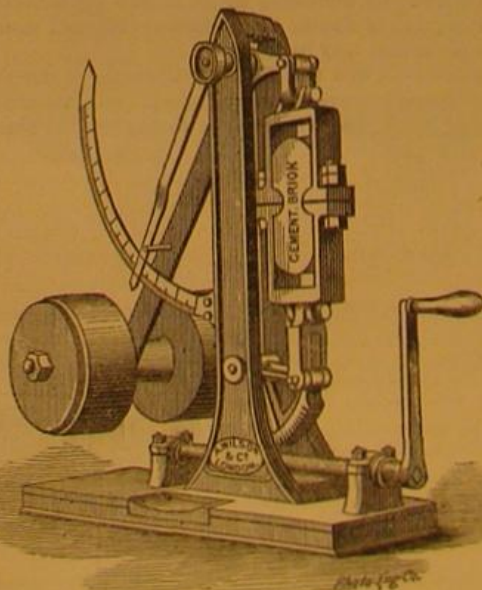


He claims the advantages of simplicity of construction and, consequently, cheapness. The side braces are of such shape as to always take up the wear both hori-

zontally and vertically, by simply screwing down the cap, without the use of liners, wedges, set screws, etc. The journal, being held at three points nearly equidistant, entirely reduces the liability to thump or pound. The box may be fitted with bottom brass or lined with Babbitt metal, according to circumstances. Mr. Crawford states that this is the best main journal box now in use for steam engines.

IMPROVED TESTING MACHINE.

Among modern refinements in the art of construction must be placed in the foremost rank the experimental determination of the cohesive strength of materials under strain. The nice adjustment of dimensions and constructive parts is a corollary of such a knowledge of the ultimate strength of bodies, involving economy of material and



cost. The bearing thereof upon the stability of structures is of essential import; and as a fortress is no stronger than its weakest point, so, whatever be the powers of resistance of the constituent elementary parts of any structure, such as the stones and bricks, it is essential that the medium of

union, or vehicle, as painters might call it, should be at least of equivalent strength.

Usually, however, the absolute and relative strengths of the cement or mortar, that converts the separate elements into the combined whole, are very much matter of chance and guesswork; hence results a waste of power or an increase of risk. As a factor in construction, however, the strength of cements and mortars has come to be regarded as a fit subject for actual determination, and the machine illustrated in the accompanying engravings aims at placing the means of test in every one's reach. It is the patent of Messrs. Michele and Carrington.

Sample blocks, grooved as shown, are formed from the cementitious material required to be tested, and allowed to set and become dry. After a sufficient interval they are placed in the corresponding and suitably formed jaws of the testing machine, the lower jaw being pivoted to one angle of a toothed quadrant, movable by worm and hand wheel, and pivoted on bearings in a pair of parallel standards. The upper jaw is similarly affixed to the short bent arm of a lever, with fulcrum pin carried in the same standards, and of which the long straight arm carries a heavy counterbalance weight; the weighted arm works against a fixed graduated arc carried by the standards, which rest on a bed plate. The jaws are also connected and united by bolts and nuts, which are not screwed home, so that a little play is allowed for the fracture of the cement block, to the extent of one sixteenth of an inch or so. Attached to the weighted arm is also an index pointer, capable of being raised, but not depressed, with it.

The action of the whole apparatus, for the illustration of which we are indebted to *Iron*, is very simple and effective. The cement block or other material to be tested being placed within the jaws, the hand wheel is turned, which, operating by the toothed quadrant, draws down the block, jaws, and short lever arm, causing the weight to move outwards and upwards, thereby exerting an ever increasing strain upon the block of material undergoing test, and of which the resistance must eventually be overcome, resulting in fracture; whereon the weight, being released, drops back until caught and retained by the bolts and nuts uniting the jaws; but leaving the pointer to indicate the breaking strain upon the graduated arc. The peculiar feature of this apparatus is the gradual application of, and increment in, the strain applied, avoiding all jerk or uneven strain, which might exaggerate the breaking effort and yield untrustworthy results.

The Average Migratory Mechanic.

"Forfex" sends us the following portrait, evidently taken from life:

The average migratory mechanic, with great self-abasement, applies to the master mechanic of the shop for work. This gentleman, though regarding him distrustfully on general grounds, from press of work in the shop violates his better judgment, employs him conditionally, and submits him to the foreman, who conducts him to his station. New man scrapes acquaintance with nearest workman by remarking casually: "Work must be looking up in this establishment," and adds ostentatiously: "The old man sent for me to New York, and would not take no for an answer; so to quiet him, concluded to stay till he can get another man in my place. Vessel's on dry dock any way for two months. 'What vessel?' Why, Blue Warrior, chief engineer. Run Uncle Sam's blockade in her during the war," and, winking confidentially to listener, who begins to feel an interest in him, signifying thereby his desire for secrecy on that point, continues: "Two thousand dollars prize money home. Ain't got a spare pair of overalls till trunk comes from city? Thank you. Do's much for you some time. Ever been in Halifax? I built nine locomotives for railroad there. Had ninety men. Ever go there I'll give you a line to boss of whole concern. It'll get you a job on sight. Pretty good lathe this. Always did like to run a double ender. Man ain't liable to get dozy. Lost eight hundred dollars once on contract for building tools for navy yard. Woman, you know! Went to sea. Think I'll recover it, though. Applied to old man there. Says show's good. Know in four weeks. Write to him to-night. Tell him to send letters to this place for next two months. Ain't got four dollars in your clothes? Expect package of tools by express, and mate of the vessel's going to send lot of the best tobacco. Smuggled. Thank you. Bet you'll lose nothing by this. You're like Sam Cunard. Bully fellow. Father's rich. Seconded me once at a little mill. Police always around when they're not wanted. Got any tobacco till mine comes? Solace or Century? Both good. When I was in Cuba," etc., etc. New man ingratiates himself into the confidence of all he can, borrowing as much as possible from his too credulous shop mates, talking away his employer's time, and sequestering his carelessly done work: until at the expiration of two weeks an envelope, containing his wages to date and dispensing with his services, is laid on his lathe. Morning discovers to the widow lady with whom he boarded that he has flown in the night; and upon this being understood at the shop, there is, straightway, mental resignation of sums of money, light tools, clothes, and tobacco."

BORAX IN CALIFORNIA.—Discoveries of borax in California and Nevada have been made to such an extent as to warrant the belief that from these sources the markets in the east of the American continent will, at no distant time, be able to draw their chief supplies.

A WRITER in the *Onelda Circular* recommends saw dust as a substitute for stockings. A tablespoonful of the dust in each boot will do, keeping the feet dry and warm.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The annual meeting took place at Portland, Me., August 30, under the presidency of Professor Joseph Lovering.

Ex-President Hill, of Harvard, read a paper on a mathematical subject, and Professors Young and Hough described their different devices for controlling, by an electric current, the movement of the chronograph. Hon. E. B. Elliott, of the Treasury Department, read a paper on the relation of the frequency of auroras to changes in the length of the earth's radius-vector. "The association of the aurora with electrical or magnetic changes or disturbances in the earth's crust is well understood as invariable. The difficulty of working the telegraph during intense auroras demonstrates this truth. We cannot say that the atmospheric disturbance—the aurora—causes the earth's disturbance; we cannot say that the terrestrial disturbance causes the aurora. Possibly they may both be effects of some cause yet undiscovered. The surface of the sun is subject to vast disturbances, as is manifest by the spots which appear and disappear so suddenly. Hence the amount of radiated heat, no doubt, varies greatly. In these varying thermal conditions, we have the efficient causes of magnetic disturbances. An investigation of the recorded observations of auroras, published some years ago by Professor Lovering, shows that the maximum number were seen in the month of October, and the minimum number in March, the number declining from the former date and increasing from the latter. These months mark the extreme points of the earth's orbit; hence, in these varying thermal conditions we have, if not a cause for the aurora, at least a most remarkable coincidence."

Professor Wm. A. Rogers, of the Harvard Observatory, detailed the results of many ingenious devices designed to render more delicate and exact the various instruments of astronomical investigation. His special purpose was to obtain a substitute for the "spider lines" of the telescope. This he finds in a set of lines etched upon glass by hydrofluoric acid, and rendered opaque by "filling" with plum-bago. The process is too intricate for description without the beautiful specimens of etching on glass, which were exhibited. Quite a lively and somewhat dashing discussion followed among the star gazers on the value of certain refinements of modern instruments, Professors Hough, Hilgard and Young taking part.

Professor Putnam, of Salem, presented a statement of his investigations upon a curious fish, the *liparis*, which has for a long time been a subject of special interest among zoologists.

Professor T. Sterry Hunt very ably discussed the geology and economic mineralogy of the southern Appalachians. After sketching, in a clear and comprehensive manner, the geological origin of the great Appalachian chain, he pointed out the curious decay to which the micaceous and schistose rocks, which compose the great mass of these mountains, is subject, producing what is popularly known as rotten rock, which it really is. While the drift somewhat uniformly covers the surface of the Northern States, it does not extend south of the southern line of Pennsylvania; and hence in the Southern States the soil is the direct result of the decomposition of the rocks underlying that locality. A great variety of valuable economic suggestions were deduced from these observations.

A debate arose between Colonel Whittlesey and Lewis H. Morgan, Esq., on a paper read by the former on the ratio of increase in the human race, with its bearing on the date of its origin. The special point was as to the probable number of the Indian population at remote periods, the reader claiming a high number, from which Mr. Morgan most ably dissented, his extensive erudition on that subject rendering him, perhaps, the best authority in the country.

FOREIGN APPRECIATION OF AMERICAN INVENTIONS.

Mr. Moses G. Wilder, of 121 Chambers street in this city, has, we learn, contracted with the Farrel Foundry and Machine Company, of Waterbury and Ansonia, Conn., to manufacture his machines, he having purchased the patterns and drawings from the New York Steam Engine Company.

Since the illustration of these valuable inventions in the SCIENTIFIC AMERICAN, Mr. Wilder states that he has received repeated requests from foreign periodicals for the privilege of presenting the devices in their pages for the instruction and benefit of their readers. The fact of *Engineering*, of London, publishing a full page engraving and description, and other journals which rarely allude to tools designed abroad making similar offers, free of any expense, indicates the estimation in which improved American inventions are held in other countries, and is a substantial recognition of the merits of these particular machines.

The Mennonites.

What with the proposed advent of several thousand English laborers and the contemplated immigration hither of 150,000 of the better class of Russian peasantry, there is an encouraging prospect for the settlement of our western territory, and its rapid development by a very superior class of colonists. The Russians, otherwise known as Mennonites, leave their country on account of religious scruples, the tenets of their sect preventing them from doing military duty. In brief, they are an order somewhat similar to the Quakers. They come from the valley of the Vistula river, which they have thickly settled and cultivated, showing, by their progress both in industries and education, a marked difference from the ordinary type of continental peasants.

A delegation has recently visited Colorado, Texas, Minnesota and parts of Illinois, searching for suitable lands upon which to locate the colony. The railroads have of course

held out every inducement; and it is understood that there will be several settlements along some of the principal lines. A second deputation of about 100 lately arrived in this city, and is composed mostly of young men with their families. It is hoped that a body numbering over five thousand will emigrate by May next.

Remarkable Railway Disasters.

A collision recently took place on the Chicago and Alton railway between a passenger express train running at the rate of 35 miles an hour, and a coal train, of thirty-five cars, running at a speed of 20 miles an hour. Neither of the engineers saw the other's engine until it was too late to reverse, a fact accounted for by the curve in the road, and partly by the dense fog. The two trains came together with fearful force. Being on the curve, however, both engines left the track and passed each other, that attached to the coal train striking the baggage car a few feet from the end, breaking the coupling between it and the smoking car, which the engine struck square in the end, and with such force as to throw the forward end in the air; so that the engine ran under it, tearing the floor completely out and hurling the fifty or sixty unfortunates who were in the car in a struggling mass to the lower end, where there was no chance for escape, and then ensued a scene of horrors which cannot adequately be described. The smoke stack and dome of the engine were knocked off by the collision, and broken timbers of the smoking car penetrated the boiler, letting loose a dense volume of hot steam, which poured into the car, blinding and scalding the helpless inmates, who with shrieks struggled vainly to extricate themselves. Eleven persons were killed and thirty-five dreadfully injured.

ANOTHER STRANGE DISASTER.

On August 19 at 3 40 A. M., on the Great Western Railway, Canada, when the New York express train approached the Welland canal at Thorold, the draw happened to be open. The regulations of the road and the law require the full stoppage of all trains at all draws, but in this instance, to the astonishment of everybody, the train kept on at full speed and plunged into the canal. The train was drawn by two locomotives, and consisted of several baggage and express cars and an unusual number of passenger coaches. Both engines and all the baggage and express cars plunged into the canal, filling the chasm so that there was not room enough for the passenger coaches, and thus all the passengers and employees escaped injury. The disaster was due to the following singular occurrence: Just as the locomotive reached the bridge, the water gage glass in front of the fire box of the engine burst, instantly filling the cab with steam and boiling water, so alarming the engineer that he jumped before bringing his engine quite to a stand.

A Lightning Freak.

The Pittsburgh Dispatch says: "During a recent thunderstorm near Oil City, a large tank owned by Mr. J. S. McCray was struck by the lightning. It is a 10,000 barrel iron tank, and contained 3,000 barrels of oil. The bolt struck the top of the tank at the edge, and ran completely around the periphery of the top, cutting off the head of every bolt that fastened the top to the side. The top was raised about two feet by the concussion, and the oil took fire, sending an immense body of flame high in the air. In an instant the top fell back to its position, instantly smothering the fire inside. The oil burned off the tank and then went out, and no further damage was done. The cover was not two inches out of its original position after its fall."

REMARKS BY THE EDITOR.—In this case, the lightning simply ignited the explosive mixture of air and vapor contained in the tank, producing an explosion, the sudden force of which was just sufficient to cut the fastening bolts and slightly lift the cover, without projecting the latter into the air. The lightning, we think, did not run around and cut the bolts as above described.

The Sierra Madre Tunnel.

The commencement of this enterprise has created less noise than one would expect from such a huge undertaking. Yet if it should be only partially successful, not reaching the other side of the range for years to come, the tunnel promises to become of the greatest value in the development of the Gilpin county gold veins.

The mouth of the "great bore" has been located about two miles below Black Hawk, on the north branch of Clear Creek, some 7,000 feet above the sea, 1,800 feet above the plains, and nearly 1,200 feet below the level of Central City. Its course is a few degrees north of west, or in a direction that would intersect the Gregory, Fisk, Hunter and other lodes 15° to 20° from a perpendicular. The Bobtail, Mammoth, Winnebago, and other lodes of that system would be cut at a very acute angle.

From the mouth of the tunnel to the Bobtail lode, in a direct line, is 11,000 feet; and from that point on to the Gregory, about 800 more. The course being about 30° north of west, it will run under Central City, almost directly beneath Eureka street, and pass a short distance up that gulch, cut into Gunnell Hill, and pass through it into the main range.

The Bobtail is the first known lode of any prominence that will be intersected. This, as has been said, is 11,000 feet from the mouth, and will be struck about 1,300 feet from the surface. From this point on, the great bore will strike the Gregory, Bates or Hunter, Gunnell, Prize and Winnebago, in the order named. The three latter lodes are about 16,000 feet from the mouth, and will be opened nearly 2,000 feet from their surface outcroppings. Beyond these, if the tunnel ever reaches so far, it is not improbable that other valuable and large veins will be met with. The main divide between Cen-

tral City and Middle Park is from 11,000 to 12,000 feet high in places rising to nearly 14,000 feet. In passing through this, the tunnel will reach its greatest depth, namely, from 5,000 to 7,000 feet.—*Mining Review*.

The Porpoise.

At the Brighton (Eng.) aquarium the keeper in charge of these interesting animals is now in the habit of summoning them to their meals by the call of a whistle; approaching footsteps, even, cause great excitement in their movements, and recent experiments have proved them to be acutely sensitive to the vibrations of sound. By the physiologist a more pleasing spectacle can scarcely be witnessed than the graceful action of these cetacea as they swiftly pursue their course up and down their spacious tank, ascending to the surface of the water at intervals of fifteen or twenty seconds to breathe, each inspiration being accompanied by a spasmodic sob-like sound, produced by the rush of air as a breath is rapidly liberated and inspired through the single central blowhole.

Onward progress is effected in these animals, as in all other cetacea, exclusively by the action of the horizontal caudal fin; the development of muscle at the "wrist" of the tail on which this action depends being enormous and plainly visible externally; the pectorals are devoted principally to the purpose of steering the creature to the right or left, aiding it also in rising to the surface of the water.

The fact alone of the porpoise suckling and evincing much maternal solicitude for the welfare of its young indicates the superiority of its position, in the zoological scale, above that of the other representatives of the finny tribe. A few dog fish, *acanthias* and *mustelus*, three or four feet long, placed in the same tank, soon fell victims to their tyranny, the porpoises seizing them by their tails and swimming off with and shaking them in a manner scarcely conducive to their comfort or dignified appearance, reminding the spectator of a large dog worrying a rat. The fine sturgeon, six feet long, now sharing an adjoining tank with the cod, was first placed with these animals, but in a short time was so persecuted that for safety it had to be removed; while to this day the lacerated condition of its tail bears witness to the pertinacious attention of its former comrades. Some large skate (*raja clavata* and *maculata*), while they maintained their usual habit of lying sluggishly on the floor of the tank, escaped molestation; but no sooner did these fish display any unwonted activity than the porpoises were upon them, and, making a convenient handle of their characteristic attenuated tails, worried them incessantly. It need scarcely be remarked that the skate were removed before further mischief could be done, leaving the porpoises, with the exception of a few conger (which during the daytime mostly lie hidden in the crevices of the rock work), turtles, and a huge monk fish (*rhina squatina*) sole occupants of the colossal tank.

While far behind the porpoises in display of intellect, the representatives of the *gadida*, or cod family, are by no means the least intelligent of fish.—*Nature*.

Balloonaria.

The preparations for the transatlantic balloon voyage are now far advanced, and our enterprising contemporary, the *Daily Graphic*, tells us that an extra force of hands, working day and night, will hasten them to completion. It is believed that the great fabric will be ready for filling by the 30th of August, when it will start on the journey as soon as fully inflated. Besides the large boat suspended under the car, a smaller canoe will be carried, to serve as a life boat. This latter craft is fourteen feet long by twenty-eight inches broad, and is made of paper three eighths of an inch thick. It is a fine piece of workmanship, and is constructed with air chambers so as to be practically unsinkable. In event of the leakage from the balloon causing a descent and rendering it necessary to take to the water, Mr. Donaldson will attempt to reach land in the smaller vessel, while the rest of the party will navigate the larger boat. The above mentioned gentleman recently sailed the canoe on a trial trip between this city and Long Branch, making good time and arriving in perfect safety, although the sea was quite turbulent. The capabilities of the

CARRIER PIGEONS

are being thoroughly tested, and some of the birds have shown a wonderful speed. The Ariel, a pigeon that won the \$2,000 prize in the international contest in Belgium in 1871, accomplished the distance between New York and Stratford, Conn., sixty-four miles, in thirty minutes. Another bird, known as No. 6, made the journey in almost as quick time. The pigeons are of the finest Belgian stock, and some two and a half years ago were imported by Mr. O. S. Hubbell. It is related that the flock, some two dozen birds in all, were imported in two detachments, and on their arrival were carefully confined for a long time in their cages. After they had been thus mewed up, sufficiently long, as it was supposed, for them to forget all about their transatlantic home, the doors of the cages were opened; but to the dismay of their owner, who had invested upwards of a thousand dollars in them, every pigeon promptly flew away. In about four days, however, all returned, apparently very much exhausted and ravenously hungry, since which time none have ever attempted to leave their present abode. It is conjectured that the birds, on being released, made for the Atlantic coast and flew along its whole length, seeking to recognize some features of their Belgian birthplace. They have since multiplied very rapidly, and at the present time number about one thousand.

A number of these pigeons will be carried in the car of the balloon, and released at intervals with dispatches which they will carry, it is believed, directly to their cote at River-

cliff. As it is thrown from the balloon, each bird will probably fly wild until it sights land, to which it will immediately direct its course. The carrier pigeon has no peculiar instinct which directs him homeward, but seems to possess a memory for places, coupled with a very strong attachment for its abode. In its various excursions near the latter, it becomes acquainted with objects, say for a radius of seventy miles, so that, if once it sights any part of the circle, it can easily find its way home. On being let go, it first flies upward and perhaps looks over a circumference sufficiently large to include a portion of the circle above referred to, toward which it immediately travels. But in case it sights no known object, then it will fly in a chance direction for some distance, and then try again, and so on for about three times, when, if disappointed, it returns to its starting point and begins a new flight. A good bird will keep up this repetition until it discovers its home locality, or else it tries so often as to be discouraged; then it seeks a new home. The

HUMOROUS SIDE OF THE VOYAGE

seems to form staple exercise for the wits of the daily journals. Puns of various degrees of atrocity have been perpetrated on the name of Professor Wise, and the word "balloonatic" is so frequently used that it bids fair to become a part of the language. One journal suggests sending up an experimental balloon, with a car load of a selected party from the dozen or so emotionally insane murderers now in the Tombs in this city, and then, when at a sufficient elevation, spilling them out. Another exuberates to the effect that Wise's expedition cannot but be fruitful, because he is sure to find so many currents in the air. A third observes that, if flaming torpedoes are to be dropped along the course of the balloon, it might be well to provide the passengers of ocean steamers with cast iron umbrellas. Some of the alleged answers of correspondents to invitations, from the managers, to a seat in the car are quite amusing. One remarks that the voyagers are pretty sure to reach some locality, but whether in this or the other world is questionable; while another, poetically inclined, replies that:

"If I could read my title clear
To mansions in the skies,
I'd bid farewell to every fear
And with your gas arise."

Skillful Navigation in a Fog.

A correspondent to the Boston Advertiser, who writes from London, after completing his voyage across the Atlantic says: The Siberia, of the Cunard line, sailed from Boston, July 1, on the new southerly course for Liverpool, and striking into the fog on the first day out, did not meet with fifteen minutes' clear weather, when an observation could be taken, for almost eight days. But no pains were spared by the officers to make the dead reckoning accurate. The log was thrown every two hours day and night. On the evening of the eighth day, our latitude was estimated to be north 49° 38', but the fog was still dense enough for the fog whistle to be blown. A little later it lifted very suddenly, then the clouds broke, disclosing the pointers of the Dipper, and a moment later the North Star itself was visible. The chief officer hastened for his sextant, carefully took the altitude of the star, and found it to be 49° 36' to a second. And on the tenth day we came in sight of the Skillings, and bore up the coast of Ireland to the Fastnet Light without changing the course a fraction of a point. And this was the first time the Siberia had sailed upon the new course, and during three fourths of the time she had been enveloped in fog.

DECISIONS OF THE COURTS.

United States Circuit Court.—District of Massachusetts.

PATENT HAND STAMP.—THOMAS J. W. ROBERTSON vs. BENJAMIN B. HILL.

This was a motion for a preliminary injunction in a suit founded on the patent of Thomas J. W. Robertson for an improvement in hand stamps, dated September 22, 1857, extended and reissued December 11, 1871. The patent had been previously sustained in several suits. (Robertson vs. Seaboard Manufacturing Co., 3 Off. Gaz., and others.) The motion was resisted on the ground that the invention was anticipated by a large number of English and French patents, and because the invention, as patented, was lacking in utility from the absence of any suitable device for coloring the face and type of the stamp.

SHEPLEY, J.:

This is a motion for a preliminary injunction. In this case the patent has frequently been made the subject of legal investigation. The validity of the patent has been established and confirmed in at least three cases, and under such circumstances, on a motion for a preliminary injunction, the Court very seldom hears any evidence except on the question of infringement. Under such circumstances the party, by the established rules of equity, is entitled, as a matter of course, to the preliminary injunction without a trial at law and without further trial of the cause, especially in a case like this, where the party defendant in the cause was interested in the defense of the suit and had full opportunity to test the question.

Ordinarily, therefore, in such a case, the Court, on a motion for a preliminary injunction, considers only the question of infringement, and that is the established rule of the Court. In this case, however, the Court has considered, with as much care as the time would allow, one question which has been raised by the counsel for the defendant, and which may properly be considered under the question of infringement. It is contended by the defendant that, when a party has patented a combination, and that combination turns out to be useless, of no practical utility, and another party adds to that combination another element, and thereby makes the whole practically useful where there was no utility before, the party who thus adds another element to the combination, which was necessary to make the prior combination of any practical utility, is not an infringer, and that he is not entitled merely to use his improvement, requiring first a license to use the former combination, but that he may use the whole of it; and that view of the law is undoubtedly correct.

In that view of the law it is contended that there is no infringement in this case, and it is with a view to question of infringement only that the Court has considered it, not deeming it necessary to go into any consideration of the question of novelty, or of the extent to which the defendant's invention is a new and useful improvement upon the plaintiff's.

But considering that the right of the party depends upon the validity of the patent and the fact that that question has been adjudicated so many times, it is not the intention of the Court, in any case, upon a motion for a preliminary injunction, to express any further opinion upon the question involved in the case, except such as are absolutely necessary to the decision of the question of infringement on the motion for a preliminary injunction. But on an examination of the patent, the Court, while it believes that view of the law to be correct, cannot conceive it to be applicable to the present case.

It is contended by the defendant in this case that the combination of the plain ink, which was the combination of a handle and a series of printing wheels, or their equivalents, for printing dates with a fixed type form or printing die for printing purposes, substantially as described, had no practical utility, because without the taking ribbon or device which the defendant has added, it was of no practical use; that the wheels would clog by the ink; and it was of no practical use, and did not come into use, until the ribbon as an inking device was added to it by the defendant.

But it does not appear that Robertson, the plaintiff, here, has stated in his patent any combination with any inking device, but has stated that his combination could be used with any suitable inking device.

An inking device formed no part of his combination, but it could be used, he says, with any suitable inking device. Now, the testimony in the case shows very clearly that the ribbon was an inking device which was known

prior to the date of this patent—was known and in use and described in patents prior to the date of this patent. It was, therefore, one of the inking devices which the complainant had a right to use, and which he is to be considered, in the eye of the law, as having referred to as a suitable inking device in his patent.

Therefore, although it should be proved to be true, that if the plaintiff's combination were used with a common inking pad, or by applying printers' ink with rollers in the usual way, it would so clog and interfere with the turning of the wheels that it would not be a practically useful device, still he was open to use the ribbon as a roller, which had been known and used as an inking device prior to the date of the patent.

The conclusion of the Court, therefore, is that, under the present state of the proof, in view of the prior decisions in the case, the injunction must go, as prayed for.

(Frederic H. Bell, for complainant.)

(James B. Webb, for defendant.)

NEW BOOKS AND PUBLICATIONS.

STEAM AND THE STEAM ENGINE, LAND, MARINE, AND LOCOMOTIVE. By Henry Evers, LL.D. Author of "Navigation," "Nautical Astronomy," etc., and Professor of Mathematics and Applied Science at the Charles Science School, Plymouth, England. Price \$1.50. New York: G. P. Putnam's Sons, Fourth Avenue and 23d street.

An excellent practical treatise, by an undoubted authority. The work is made available for purposes of instruction by the addition of some varied and exhaustive questions, to be answered by the student. The book is No. 22 in Messrs. Putnam's "Advanced Science Series."

PRACTICAL CHEMISTRY: for use in Science Classes and Higher and Middle Class Schools. By J. Howard, Head Master of the School of Science and Art, Islington, England. Price 75 cents. New York: G. P. Putnam's Sons, Fourth Avenue and 23d street.

An elementary book of the highest class; lucid in its descriptions and steadily progressive. The writer is evidently a teacher of ability.

STEAM BOILER EXPLOSIONS. By Zerah Colburn. No. 2 of Van Nostrand's "Science Series." Price 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren street.

Voluminous as the literature on this subject has become, there is still room for practical information; and such sound wisdom, drawn from actual experience, as the late Mr. Colburn possessed can never be out of date. We commend this little book to all our correspondents who write to ask questions on, or to report, explosions of steam boilers.

A GRAND VICTORY OVER EVERY COMPETITOR IN THE WORLD.

The following Cable Dispatch from Vienna will convey the glad intelligence to the world that the "World Renowned Wilson Sewing Machine" has not only taken all of the highest Awards at Fairs and Expositions in the United States, but that it has overwhelmingly defeated every Sewing Machine manufactured in the World, and carried off the first Grand Prize at the Vienna Exposition:

VIENNA, Austria, Aug. 15, 1873.

To W. G. WILSON, President Wilson Sewing Machine Company, Cleveland, Ohio:

"The Wilson Shuttle Sewing Machine was awarded the Grand Prize at the Vienna Exposition for being the best Sewing Machine." RAYMON. Advt.

Recent American and Foreign Patents.

Improved Hopper for Grinding Mills.

Martin Eplegie, Moulton, Iowa.—For automatically closing one spout, and opening the other, of a double or two part stock hopper of grist mills, it is proposed to have a right angled valve arranged between two disks, and pivoted at the angle under the middle partition between the two spouts, so that by a quarter of a revolution on the axis one spout will be closed and the other opened. The side which is open will be subject to considerably more pressure by the grain passing through than the one which is closed by the grain in the hopper above, so that it cannot shift until the hopper from which the grain is running is empty, when the weight of the grain in the other hopper will instantly open it by the weight on the side closing the spout. A bell is attached to the axle of the valve, so as to sound each time the valve shifts and changes the grists to notify the miller of the change.

Improved Reel.

Robert Simon, Paterson, N. J.—This invention consists in a reel, the arms of which are provided with dividing disks for separating the two parts of the skein, so that the silk or thread wound on such reel may be crossed in opposite directions in the spaces between alternate pairs of arms, in order that at such crossing each separate strand will be above its predecessor.

Improved Apple Parer.

William A. C. Oaks, Reading, Pa.—This invention has for its object to so improve the apple parer patented to the same inventor on December 10, 1872, that the knife will make a positive stroke until the apple has made one revolution. The invention consists in providing the gear wheel of the knife arm, at that point at which the knife takes its position for paring the apple, with two or more recessed cogs and a projecting tooth and lug extension, in connection with the pinion wheel of the crank shaft, having also part of the teeth cut off and provided with a circular flange, so that thereby a full stop of the paring knife is obtained while the fork is revolving once with the apple.

Improved Shoemaker's Pinchers.

William H. Hanna, Chico, Cal.—This invention consists of a pair of shoemaker's pinchers, having the jaws in the same longitudinal plane and the teeth abutting against the turning face of the jaws, so as to bring the bite near to the pivot, and thereby not only to secure more leverage in the grips, but thus to enable the upper to be drawn close to the last.

Improved Clothes Pounder.

Edward S. Saxton, Greenfield, Ill.—This invention is an improvement upon the clothes pounder for which letters patent were issued to Ezra Pollard, December 25, 1858, and consists in a wooden block provided with a central vertical hole and with two circular concentric rows of holes, between which a circular communicating groove is formed to allow the air to enter and escape from the inner row of holes through openings in the outer row or in the side of the block.

Improved Parallel Ruler.

Gustav Blumck, New York city.—This invention consists in a main slide piece, with suitable set screws, moving in a guide frame carrying the adjustable ruler, and acted upon by a band spring applied to a wedge-like thumb-piece, which produces alternately, by the pressing and releasing of the controlling finger the required parallel motion of the ruler.

Improved Stop Valve.

George W. Eddy, Waterford, N. Y.—This invention relates to that class of stop valves for water, steam, gas, etc., in which one or two disks or gates are arranged in a chamber traversing the water way, and work transversely across the water way on the seat or seats, and are pressed thereon to close the water passage by means of the valve stem; and it consists of levers combined with the disks or gates and an enlargement on the valve stem in such manner that, when, in closing, the gates have returned to their seats, the levers and the enlargement come into play in such manner that they force the gates upon their seats with a powerful lever pressure, which is produced with the stem by the operator without much effort.

Improved Truss Bridge.

Henry J. Hunter and Jesse Rice, Scioto, Ohio.—It is proposed to have bottom, middle, and top chords composed of three parallel timbers, with double posts framed or boxed between the timbers of the bottom and top chords, and passing between the timbers of the middle chord without boxing, and with braces firmly secured to the posts and the bottom chord, all in a manner calculated to produce very strong frames, capable of sustaining great weight in long spans.

Improved Pile Driver.

Charles H. Smith, Bloomer, Wis.—This improvement in pile drivers consists of an endless chain for raising the drop, working over a driving wheel at the bottom and a drum at the top of the frame, and through contrivances on the drop, with which a lock and a trip are arranged, so that a weight causes the lock to engage the chain when the drop strikes, so that the chain immediately lifts the drop again, and thus saves the time lost in the ordinary pile drivers in running the hooks down to connect with it. The lock is tripped at the top of the frame, or at any desired intermediate point, by an arm coming against any suitable stop in the ascent of the drop. The invention also consists of a crane and hoisting rope combined with the driver and the driving mechanism in a simple manner, for raising a pile while another is being driven by the same driving gear by which the drop is worked. It also consists of a guide for controlling the head of the pile while being driven, contrived so as to be engaged with the rib guides, on which the drop works, after being attached to the head of the pile before it is raised up to be fixed in the machine.

Improved Cradles.

Franklin Chichester, Milwaukee, Wis.—The first invention consists in two-part cradle ends, set apart and connected by intermediate springs. These springs, one at each end, raise the extension and body from the base, which allows the cradle or crib to rock back and forth on the springs, the rocking motion being limited to the width of the openings between the extension and the base. The same inventor has also patented another cradle in which there is a central pivot at each end. A flat spring at each extremity is attached at its ends to the iron rail of the body.

Improved Treadle for Sewing Machines.

William D. Wood, Mount Sterling, Ohio, assignor to himself and John Claridge, of same place.—This invention consists of a pawl and lever and a bell crank combined with the treadle mechanism of a sewing machine, in such manner that the operator can start the machine by a lateral movement of one of the knees, and thus save the labor of starting the wheel by hand. The invention also consists of a holding pawl combined with the balance wheel and a double crank, the object being to prevent the machine from being turned backward, to which a double crank is liable without a holding pawl.

Improved Washing Machine.

Josiah Gilnes, Postville, Iowa.—A board set on edge is designed to keep the clothes upon the opposite sides of the machine separate from each other. An upper roller is fluted longitudinally, and revolves in uprights. To it is attached the crank by means of which the machine is operated. The lower roller is also fluted and slides up and down in slots in the lower part of the uprights. To the lower ends of the sliding bearings and to the upper edge of the ends of the division board are attached pins to which are secured the ends of the U shaped springs, by which the lower roller is held up against the upper one so as to apply pressure to the clothes while passing through the machine. Four rollers at the inner corners of the uprights diminish the friction as the clothes are passing into and out of the machine.

Improved Saw.

Sylvester Cook, Alpena, Mich.—It is proposed to divide the teeth of a cross cut saw into groups of four teeth by a wide blank space of about one inch between, and in each group to have two teeth fronting one way and two the other, with their cutting edges formed at right angles to the longitudinal axis of the saw. The ends of the teeth are beveled enough for clearance, and the cutting edges and ends shaped like a chisel edge by beveling them on one side only. The beveled sides are alternately reversed. At the heel of each rear tooth of a pair is a cleaner, for scraping out the chips cut off by the teeth, said cleaner being an extension of the heel of the tooth as low as the point.

Improved Roller Clearer for Spinning Machines.

Charles B. Brown, Lewiston, Maine, assignor to himself and Alvin Woodman, of same place.—This invention pertains to an improvement in the construction of clearer rolls of spinning frames; and it consists in providing a covered roll with an enlargement, or, in other words, in reducing its diameter uniformly at every point except the center. Thus constructed, only the enlarged portion will come in actual contact with the rolls of the spinning frames.

Improved Metal Planing Machine.

Robert Harper, Glenn Mills, Pa.—This invention has for its object to furnish an improved machine for cutting key seats in shafts without removing said shafts from their bearings. Two screws are screwed in bearings attached to the four corners of the bed. To one end of the screws are attached bevel gear wheels which engage with similar devices on a cross shaft to which power is suitably applied. The screws also pass through screw holes in a cross head that slides upon ways which are so formed as to cause the said head to move back and forth squarely, and to sustain the upward pressure of the tool, thus relieving the screws from any strain. To the crosshead is attached a block, the upper and lower sides of which are beveled to form a way for another block. The side edges of the second block are beveled to serve as a way for a third block, on the forward side of which is a T groove formed to receive the tool holder, through a slot in the forward end of which the shank of the tool is passed. By this construction, the tool can be adjusted vertically and horizontally, and inclined to one or the other side, as may be required. Four set screws pass in horizontally through the side bars of the bed to receive and hold the work to be planed or dressed.

Improved Propelling Vessel.

George W. Dow, Brooklyn, N. Y.—This invention consists in the improvement of that class of boats which use suction wheels in the side of boat, drawing the water in from the side and discharging it at stern or bow, according to whether it is desired to go forward or backward. It consists in the peculiar means for enabling the boat to be backed, by means of a gate closing the channel through which the water is drawn to the rear, and opening a reverse channel through which the current is forced.

Improved Sash Holder.

George W. Richardson, Columbus, Ky.—The object of this invention is to furnish means for holding the sashes of windows in any desired position in the frame or casing; and it consists in the arrangement of a spiral or coil spring, acting upon the sector or wedge-shaped rack. By a slight upward pressure on the operating lever, the sector is turned and the wedge is moved downward and the sash released.

Improved Kerosene Heater.

Ziba B. Grandy and Cyrus H. Grandy, Stafford Springs, Conn., assignors to themselves and William D. Heald, of same place.—The object of this invention is to furnish improved facilities for heating water and other liquids by means of a kerosene lamp; and it consists in two annular liquid reservoirs arranged around the lamp chimney. Two different kinds of liquids—as water and milk, for instance—may be heated at the same time. The heater is made of tin or similar material, and the chimney is riveted or soldered with hard solder so as to resist the effects of the heat.

Improved Ladies' Gaiter Shoe.

Henry C. Letsinger, New York city, assignor to Edwin C. Bart, of same place.—This invention has for its object to improve the construction of ladies' gaiters, so that there will be no seam crossing the instep; and it consists in having the vamp made in one piece with one of the half-quarters, and seamed to the other half quarter, the seam commencing at the junction of the overlapping parts, and terminating in the shank between the heel and sole.

Improved Car Coupling.

Daniel C. Camerer, Martinsburg, Pa.—This invention consists in the improvement of car couplings by combining the buffer spring with a rigid buffer bottom, having an upright plate and a sliding box, having partitions, to support the link in a new and convenient manner.

Improved Life Preserving Attachment for Railroad Cars.

John C. Wan-Is, Nashville, Tenn.—This invention aims to protect brakemen on railroad cars, and consists in a foot piece and rail raised on a bracket applied to the top of cars, so that the brakemen can pass from one car to another without damage to life or limb.

Business and Personal.

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

Parties offering inducements for location of a manufactory of Hardware employing forty hands, also those having a small factory for sale cheap, address with full particulars, Box 3131, New York P. O.

Situation Wanted by a practical Machinist and Mechanical Engineer as Foreman in a Machine Shop or Inventor in a Manufacturing Establishment where inventive genius is required. Address Foreman, Box 957, Dayton, Ohio.

Edison's "Time and Pressure" "Recording" "Gases" are indispensable when testing boilers, etc., as automatic data only are perfectly reliable. See Adv.

For Sale.—A New Stover Dimension Planer 21 ft. x 12 ft. For circular and price address D. S. & B. Co., Box 123, Columbus, O.

Steam and Water Packing Manufactured by The Manhattan Packing Mfg. Co., 13 Frankfort St., N. Y. This Packing is superior to any in the Market.

Buy Boul's Pat. Molding and Dovetailing Machine, for all kinds edge and surface molding. Battle Creek Machinery Company, Battle Creek, Mich.

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Best Steam Fire Engine or Hook & Ladder Signal Lamp. Apply to White Mfg. Co., Bridgeport, Ct.

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Chemicals of all kinds for all trades made to order at our own Laboratory by addressing L. & J. W. Feuchtwaenger, Chemists, 55 Cedar street, N. Y.

Master Car Builder wanted immediately. None need apply unless fully qualified and furnishing best of references. Herrick's Car Works, Oswego, N. Y.

Valuable recipes in every branch of Industry, in the world, furnished by Jas. S. Burch & Co., Franklin, Tenn.

A Machinist and a Moulder with a small capital can form a partnership to a good advantage. Address Letter Box 232, Knoxville, Tenn.

For Sale.—A valuable improvement in Cylinder Planers. Dresses lumber out of wind, one or more sides, while once passing through at rate of ordinary surfacing. Working model in operation. Address Jno. E. Heath, Albany, N. Y.

Wanted.—A machine to take burs out of wool. J. M. Ferguson, 162 Front st., New Orleans, La.

For Inventions or Improvements to facilitate your manufacturing and labor, address S. E. Harthan, Worcester, Mass.

Wanted.—A competent man to take charge of enameling department in Card Factory. Apply to Paper Fabrique Co., Cincinnati, O.

The Olmsted Oiler is the best; it is self-righting, strong and cheap. All Hardware and Tin Houses have it.

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

Inventors who desire to have their inventions and patents introduced and represented in Europe by a gentleman of experience and integrity, should address E. L. Box 275, New York Post Office.

For Sale.—New Patent for Refrigerator and Beer Cooler, etc., combined. Enquire of or address B. Nass, 55 1st Avenue, New York City.

Key Seat Cutting Machine, T. R. Bailey & Vail.

Portable Hoisting and Pumping Engines.—Ames Portable Engines—Saw Mills, Edgers, Burr Mills, Climax Turbine, Vertical and Horizontal Engines and Boilers; all with valuable improvements. Hampson, Whitehall & Co., Newburgh Steam Engine Works, Depot 30 Cortlandt Street, New York.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

Scale in Steam Boilers—How to Remove and Prevent It. Address Geo. W. Lord, Philadelphia, Pa.

Williamson's Road Steamer and Steam Plow, with rubber tires. Address D. D. Williamson, 33 Broadway, New York, or Box 122.

Inventors or parties having specialties for sale, which they would like introduced and represented in cities of Pittsburgh and Allegheny, address O. W. Emery, Box 595, Pittsburgh, Pa.

Belting.—Best Philadelphia Oak Tanned. C. W. Arm, 331 and 333 Cherry Street, Philadelphia, Pa.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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

For best Presses, Dies and Fruit Can Tools Ellis & Williams, cor. of Plymouth & Jay, Brooklyn, N. Y.

Buy Gear's Wonderful Paneling Machine, Boston, Mass.

Fine Machinery Oils.—We take pleasure in calling attention of our Manufacturing readers to E. H. Kellogg's advertisement in another column, and saying that we believe his claims in regard to fine Engine, Spindle, and Signal Oils are fully justified by the facts, and that parties who try his goods will not have cause to regret it.

Drawings, Models, Machines.—All kinds made to order. Towle & Unger Mfg. Co., 30 Cortlandt St., N. Y.

Stave & Shingle Machinery. T. R. Bailey & Vail.

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

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.

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

Bookkeepers should try the Olmsted Patent Roll File and Letter Clip. They are admirable for all papers—save their cost in one day's business. Sold by all Stationers. J. H. White, Newark, N. J., Sole Manufacturer.

To sufferers from batteries that get out of order on Burylar Alarms, etc., the Leclanche Battery Co., 40 West 18th st., New York, guarantee these batteries to last one year without any attention.

Gauge Lathe for Cabinet and all kinds of hand-work. Shaping Machine for Woodworking. T. R. Bailey & Vail, Lockport, N. Y.

For Sale.—3 Pat's at less than half their value, two for Empire in advertising Lanterna, one for Empire in Envelopes, by S. Kish, Jefferson, Iowa.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 39 Grand Street, New York.

Sure cure for Slipping Belts.—Sutton's patent Pulley Cover is warranted to do double the work before the belt will slip. See Sci. Am. June 21st, 1873, Page 289. Circulars free. J. W. Sutton, 30 Liberty St., N. Y.

Catalogue on Transmission of Power by Wire Ropes. T. R. Bailey & Vail.

Bolt Makers, send for descriptive cuts of Abbe's Bolt Machine, to S. C. Forsyth & Co., Manchester, N. H.

Mills for Flour, Feed, Paint, Ink, Drugs, Spices and all other purposes. Bliss Bros., Williamsburg, N. Y.

Nickel and its Uses for Plating, with general description. Price 50c. a copy, mailed free, by L. & J. W. Feuchtwaenger, 55 Cedar St., New York.

Silicate of Soda and Potash.—All grades, in liquid, jelly, and dry state, for sale in quantities to suit, by L. & J. W. Feuchtwaenger, 55 Cedar St., New York.

Parties desiring Steam Machinery for quarrying stone, address Steam Stone Cutter Co., Highland, Vt.

Boring Machine for Pulleys—no limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

Brown's Coal Yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. V. D. Andrews & Bro., 41 Water St., N. Y.

The Best Smutter and Separator Combined in America. Address M. Deal & Co., Bucyrus, Ohio.

Damper Regulators and Gage Cocks.—For the best, address Merrill & Kelzer, Baltimore, Md.

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

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

Gear's Machinery Depot is the largest known. Boston, Mass.

Cabinet Makers' Machinery. T. R. Bailey & Vail.

Notes & Queries

R. B. says: A certain length of railroad track has a siding which is just long enough to allow a train to pass on the main line, when the siding has on it eight cars and a locomotive. Suppose two trains, each containing sixteen cars and a locomotive, and moving in opposite directions, meet at the siding; how can they pass each other?

J. C. L. asks: 1. Will a powerful light of any kind, 8 feet under water, illuminate an object in the water so that it can be seen at a distance of 30 or 40 feet? 2. What kind of light is best for that purpose and how can I make it? 3. Can that light be seen from a small boat or ship 50 or 100 yards away?

C. L. asks: How can I prepare a wheel for grinding the carbon diamonds for turning or working hard metal?

A. E. G. asks: How can I prepare sizing for a plastered wall to be applied before kalsomining?

H. H. says: I have a cast iron house furnace that leaks gas. What is the best recipe for cement to prevent it?

D. J. W. asks: What is the quickest and best way to dress a deer skin, so as to make good buckskin?

C. asks: Is there any cheap metal or alloy that will resist the action of tomato acids? Tin and copper plate are acted upon and destroyed in a very short time.

R. F. H. asks: Is there a process by which I can combine wax with water?



O. G. will find a review of a book on expression on p. 235, vol. 28.—G. B. D. will find directions for a nickel solution on p. 157, vol. 28. Wet your litmus paper with the liquid you wish to test, and watch the change of color, if any.—J. W. McC. is informed that there are no reliable statistics published on the subject.—A. E. G. will find directions for kalsomining on p. 251, vol. 21.—R. F. H. will find a recipe for waterproof leather cement on p. 119, vol. 28.—H. P. will find the rule for calculating horse power on p. 122, vol. 29.

M. M. B. says: I have long known that the compression of air and other gases is attended with an increase of temperature, but how much, I have been unable, from the books and papers that I have had access to, to ascertain. Can you give a table of the increase of temperature by compression? Answer: The following table of heat developed by compression of air and fixed gases is by Professor Thurston, of the Stevens Institute of Technology, Hoboken, N. J. The volumes are expressed in cubic feet.

Pressure in lbs. above atmosphere	Temperature measured from zero Fahr.	Variable temperatures	Constant—60° Fahr.
0	62.1°	98.6	58
5	108.7	80.4	72.5
10	148.3	68.6	89.3
15	179.8	60.2	107
20	209.1	54.0	125
30	259.4	42.2	167
40	299.0	34.5	206
50	329.9	31.4	236
60	354.9	28.8	263
70	375.4	26.6	288
80	392.2	24.6	313
90	406.0	22.8	338
100	418.2	21.2	363

C. M. Mfg. Co. ask what phosphor-bronze is made of, and whether it is capable of being worked readily by the ordinary machinists' tools. Answer: It is made by adding a very small percentage of phosphorus to gun metal (copper and tin) which contains ten per cent of tin. We believe it is capable of being easily worked. It might not be difficult for you to make up a small sample and try it.

H. F. R. says: On page 60, current volume, in answer to B. you state the weight of broken anthracite coal of almost any size to be 53 cubic feet per ton. Have these figures been verified? I find that a coal firm, in whom I have had great confidence, have succeeded in storing ten tons of Lehigh furnace coal into a space of 333 cubic feet, or 31.3 feet per ton. Also seven tons of Lehigh stove coal into a space of 247 cubic feet, or 28.3 per ton. Answer: The figures we gave were average ones, from a variety of results. Should we get a sufficient number of communications, containing the results of actual practice, we may be able to give a closer approximation.

R. H. M. asks what effect turning has in the manufacture of ice cream. Does the centrifugal force, combined with the low temperature, help to freeze it, or is it like the churning of cream to bring butter? Answer: The object of turning or stirring the cream is to freeze it in the freezer is to bring all the particles of cold cream successively in contact with the cold sides of the freezer, in order to make a uniformly frozen mixture. Centrifugal motion has nothing to do with it. If the cream in the freezer were not stirred, it would freeze hard only around the sides of the freezer, and as ice is a very poor conductor of heat, the center of the canful would remain fluid for a long time. That frozen around the sides, too, would be miserable watery stuff compared with that in the center, as it is well known that water, if undisturbed, is apt to freeze more or less free from foreign mixtures. By constant stirring and agitation, however, a uniform frozen cream is produced, and the freezing is effected in a shorter time.

J. H. B. asks: Is there any ingredient known that will prevent sugar syrup from crystallizing? Answer: We cannot recommend any chemical ingredient to prevent syrup from crystallizing. You can attain the object to a certain extent, by heating in open vessels to as high a degree as possible without charring.

T. H. H. asks: What is good to stop a boiler from foaming? I have a 5 horse power one which foams very badly. The boiler is 4 feet high and 2 1/2 feet in diameter; it holds about 75 gallons of water. The water surface takes up about 4 feet 9 inches, and I have only 15 inches steam room. There are 36 one inch tubes in the boiler. The water used is clean. Have I too much water and not steam room enough? I blow the water out about once every two weeks. Answer: Probably in your case the steam room is too small. If you can safely maintain a higher pressure of steam, you will be able to partially close the throttle valve, which may check the foaming.

W. P. H. says: I would like to have your mature judgment as to the correctness of two statements made in your invaluable journal. The first is under the caption "Hot Air Furnaces," dated March 15, 1873. The second is contained in your last issue, August 16, 1873, under the caption, "The Permeability of Cast and Rolled Iron to Gases." If gases do pass through cast iron, as stated in the first, at what temperature? And if not, as stated in the second, will you please give me some light on the matter? Answer: Such action (the passage of hydrogen and carbonic oxide through iron) does not occur at the temperature to which the metal is subjected in ordinary furnaces, but only at temperatures nearly high enough to melt the metal.

F. D. P. says: I have a 7 x 18 engine, running at 100 revolutions per minute, and a boiler 13 feet x 25 inches, with two 1 1/2 inch flues. The feed pump is directly above the piston and is opened by a connection between the piston and pump rods, thus running 100 per minute. Running at this rate, it will not supply the boiler; but, by partially closing the throttle valve and allowing the engine to run slowly, it will fill the boiler very quickly. Now we wish to speed up our engine, but are afraid the pump will work worse. Can you tell us the cause, and how to remedy it? The pump cannot be separated from the engine. Answer: We suppose that the pump runs away from the water, the supply pipe or suction valve being too small. Probably the valve is large enough, and the supply pipe too small, in which case you can easily remedy the trouble. It might be worth your while to consult some good engineer, as, with the data you have sent, it is impossible to give anything but a hypothetical reply.

W. G. asks: 1. Is there any mode by which a common scholar can find the heating surface of a boiler? If so, how is it done? 2. How can I get the size of a smoke stack for a boiler? What is the rule for calculating the area of a number of small flues? Having found the area, do you allow the stack the same, or do you allow it less or more? 3. How big would you make a boiler for a 10, 15 or 20 horse power engine, and how many pounds of steam is one horse power? 4. Which is the easiest way to find out how many barrels a tank holds? 5. Which is the best book for a boiler maker, giving information on one or all of these points? Answers: 1. For flat rectangular surfaces, multiply the length in feet by the breadth in feet. For irregular flat surfaces, we must refer you to rules given in every pocket book for engineers. For cylindrical surfaces, multiply the diameter by the length, and by the number 2.216; add all the areas together. 2. See answer to L. P. C., in SCIENTIFIC AMERICAN for May 24, 1873. 3. Makers allow from 12 to 15 square feet of heating surface per horse power, and half a cubic foot of water evaporated per hour is quite a common allowance for a horse power. 4. Calculate the contents of the tank in gallons or cubic feet, also the contents of the barrel, then divide the first by the second. 5. Haswell's "Measurement," Haswell's "Engineer's Pocket Book," and Bliss's "Sheet Iron Worker," will be useful books for you to have. For a single work, containing a very complete collection of rules and formulas, we can recommend Trautwine's "Engineer's Pocket Book."

P. I. says: I live in the neighborhood of two blast furnaces for manufacturing pig iron, and I would like to fit myself to fill some position of that business. Can you tell me what is the best course to pursue, and what books I should study to learn the same? Answer: We can recommend Overman's "Metallurgy," and Schure's "Researches on the Action of the Blast Furnace."

T. L. B. says: I am building a small oscillating engine, 2 inches bore x 3 inches stroke. Would a boiler 1 foot in diameter and 1 foot in length, with 1 one or one and a half inch flues, be large enough to supply the engine with steam? Would an engine and boiler of these dimensions be large enough to run a boat 16 feet in length? What arrangement could I use to force water into the boiler while under a pressure of steam? Answer: The boiler would be much too small. The boat would be propelled very slowly by such an engine. The boiler could be fed by the direct pressure of the steam, using an arrangement like an equilibrium oil cup.

J. B. D. asks: 1. Can racks be cut in solid wrought iron bars, 3 x 3 x 1 1/2 inches, by a milling cylinder 15 inches long x 1 1/2 inches diameter, so that a plain smooth margin, 1/4 of an inch wide, may be left on each side of the track? 2. Do the patent authorities in foreign countries reject their citizens' applications, if the inventions are known to have been patented or described in a printed publication? 3. Why does lightning sometimes strike green trees, buildings, etc., and at other times strikes dry wood and not lightning? Answers: 1. We think you could cut the racks by the plan proposed, if the machinery were accurately made. The flutes in the milling cylinder should be spiral. 2. In most foreign countries, if the publication of a patent from abroad had reached that country, the application will be rejected. 3. It is probably impossible to explain the reasons for the strange freaks of lightning.

E. asks: What proportion of tungsten would be required to toughen 100 lbs. of German silver? Would it also tend to whiten the German silver? Answer: Tungsten, when combined with iron or steel, not only forms a tough alloy, but one that becomes more and more infusible as the proportion of tungsten increases. Other alloys that contain more than 10 per cent, of tungsten cannot be melted into a homogeneous fluid mass, and where a volatile metal like zinc is used (as in German silver) it would be volatilized before the alloy could be fused. Copper, zinc and nickel, the ingredients of German silver, will only unite with tungsten when all the metals are reduced from their oxides to ether. Metallic tungsten is infusible in the strongest large fire, requiring 200 pairs of Bunsen cells to melt it.

O. C. says: I am told that John Fitch was the inventor of steam, or first applied steam to navigation. If this be so, what had Watt, Fulton and Stevens to do with it? Answer: Watt's improvements were confined to the engine itself, making it available for all purposes. Fitch, Fulton and Stevens experimented in adapting steam engines to the work of revolving paddle wheels.

A. P. asks: 1. What is meant by ebouite? Is it the same as ebony? 2. Must the upper disk of Carré's electrical machine be just one sixteenth of an inch thick? 3. How much would a patent cost for the improvement of the plow? Answers: 1. Ebouite is hard vulcanized rubber. 2. Yes. 3. \$50 in full, if simple.

T. F. H. says, in reply to R. K., who asked how to make tight joints in engine cylinders: Two engines, made by different makers and of different patterns, have been closely observed by the writer. The first was made useless by this eating away of the iron, as described by R. K., so that it could be cut like plumbago after being used about 5 years. In that time it wore out two sets of steam chest covers or bonnets, and the studs were pulled out of the cast iron so that larger ones had to be fitted in their places. The covers were first packed with rubber, as soon as the softening of the iron was observed, the rubber was replaced with canvas and red lead, still the eating away grew worse. Tallow was the lubricator then. After awhile it was found necessary to have the surfaces of the joints refaced, and the joint was made with white and red lead alone, and sweet, fresh and sweet, was used as the lubricator. Still the destruction went on; lard oil, paraffin, and sperm oil have all been tried, but there was no help, and the conclusion was that the iron was poor somehow. That engine was replaced about two years ago by another of a superior make. This one has steam valves on one side of the cylinder, and independent exhaust valves on the other side. There is a cover over each valve, and the joint is made iron to iron, the surfaces being nicely fitted by scraping. This engine will be used up precisely like the former. There is nothing unusual in the boilers or their connections with the engine. The exhaust is conveyed into a cast iron heater with brass tubes, and several engineers and experts say that is where the mischief comes from. But if so, why does not the exhaust side of the cylinder waste away like the steam side? On the contrary, nothing of the kind can be found there, the iron being hard and sound. With the former engine, the boiler used was rather too small for the power required; and being forced, the steam was sometimes rather wet. Boilers of ample capacity supplying the driest steam are now in use. Something in the water was thought of, and the water was analyzed by Dr. Nichols, of Boston; the result shows that no reasonable fault can be found with the water for steam purposes.

W. Y. C. asks: 1. Way should cyanide of potassium when mixed with pure rain water to form a saturated solution, begin to turn brown after remaining clear for three days, deposit a brown sediment and gradually grow darker until perfectly opaque, the temperature being from 50° to 60°? The solution is kept in a glass stoppered bottle. 2. In removing stains from white garments, which is the best form in which to apply chlorine? 3. What is verdigris; why and how does it form, and why does it form most readily where candles are being burnt? 4. What is the best way to make solutions and test papers of litmus and turmeric, and must they be boiled with water or not? 5. Will perchloride of tin turn to the protochloride of tin on introducing pieces of black tin? 6. Is it true of any polygon (regular or irregular) that twice the number of its sides minus 4 is equal to the number of right angles contained in the sum of the interior angles of that polygon, whether there be re-entrant angles or not? Answers: 1. It may be owing to some impurity in the water, or it may, to some decomposition of the cyanide. 2. A solution of bleaching powder (chloride of lime). 3. Verdigris is a basic acetate of copper made in Southern Europe by the action of refuse pressed grapes on sheets of copper. It forms by the action or affinity of acetic acid on or for copper. The only action that burning candles could have would be to heat the materials and hasten the chemical change. 4. Boil your litmus or turmeric in water; and when a strong decoction is made, soak blotting paper in them and dry. 5. No. 6. Yes.

A. D. N. asks, in reference to our reply to Y. E., page 92 of our current volume: Supposing Y. E. were to connect a similar engine to the other end of shaft, set it revolution ahead, how would it increase the strain upon the shaft? Is not the strain upon an engine shaft variable from nothing at the dead centers to the maximum when the cross head is at the center of the guides? Would not, therefore, the addition of another engine merely make this maximum strain continuous and uniform? Answer: Suppose, in the case of one twelve horse power engine, the shaft were just strong enough to transmit this power, and would break if more strain were put upon it. Now, attaching another engine of 12 horse power, the shaft would have to transmit more, and would evidently break. To those who understand algebra and elementary mechanics, the matter can be explained in another way. Let P=pressure on crank pin, and r=radius of crank. Then for one engine, the maximum moment of strain on the shaft=P x r. Adding another engine of the same size, with its crank set at an angle of 90° to the first, we find the maximum moment of strain = P x r x 1/2 = P x r x 1/2 x 2, which is 1/2 x 2 times as great as the maximum moment in the first case.

R. V. E. asks: 1. What causes the attraction of the needle of a surveyor's compass? 2. Where is that attraction situated? 3. How great is the variation of needle of compass, and (4) in what time will it return to true course? 5. What is the title of the best work on these questions? Answers: 1. The earth is a great magnet, causing the needle to be in the magnetic meridian. 2. The magnetic meridian of any place is supposed to depend upon the temperature of the place. 3. It is different at different places; and there is a line of no variation. Needles placed on this line point to the true north. 4. The variation is changing in the United States, at a rate varying from 2 to 7 minutes annually, in different localities. 5. You will find a concise statement in Gillespie's "Land Surveying."

P. G. W. says: On a railway in our neighborhood, much of the line has a grade of 100 feet to a mile; and in order not to exceed this grade, the line makes a long *detour* down the slope leading to a valley; the gage of the track is 3 feet; the rails are about 25 feet long, and weigh some twelve pounds a foot; they are put together in the usual way, with two iron straps and four bolts to each joint. A Baxter-Hemington steam car has been running for a few days upon the finished portion of the line very successfully, making hourly and half hourly trips. With a pressure of steam of 125 pounds to the inch, it passes these heavy grades with forty passengers, without hesitation and with the speed of a brisk trot of a horse. When I first saw an illustrated description of the Baxter steam car in the SCIENTIFIC AMERICAN, I failed to comprehend how the exhaust steam from a small cylinder into a larger one could add power to an engine without condensation, and my logic is still puzzled to make it out. But I suppose it is one of those things whose merits cannot be got at short of practical test. Here is a steam car with two cylinders, the pistons of which are five and eight inches diameter; these pistons are connected to the same crank shaft in the usual locomotive style; the small cylinder exhausts its steam into the large one and drives the eight inch piston with a force of perhaps 15 pounds to the square inch. Does not this 15 pounds react upon the five inch piston and detract from its effect nearly an equal amount? Is it possible that a partial vacuum is created in the larger cylinder or in the exhaust passage beyond by the momentum of the passing steam, after the manner of the Gifford injector? Answer: The pressure upon the large piston reacts upon the small one, as you suppose, creating back pressure; but as the area of the second piston is the greatest, the effective pressure, which equals total pressure minus back pressure, is available for purposes of locomotion.

R. F. asks: How are coiled springs, such as clock springs, tempered? Answer: First hardened in oil, then ground and polished, and afterwards hammered.

A. P. says: I have a small cylinder boiler made of five inch steam pipe 15 inches long, which I use for running a small engine. I have a cast iron plate that sits upon the stove with a hole large enough to permit one end of the boiler to go in the fire about 4 inches. The boiler sits upright upon the stove; there is no flue in the boiler. There is a head screwed in each end. The steam pipe is near the top. The trouble is that, when I raise steam and go to start the engine, the water rushes out ahead of the steam and it is some time before I can start the engine. I use but very little water, in order to get dry steam. Can you tell me of any way to prevent this? Answer: Perhaps by placing a dry pipe within the boiler, you may remedy the trouble.

T. H. N. asks: How shall I remove fleas from a valuable dog without injuring his hair? Answer: Use what is known as dog soap, which contains a large quantity of carbolic acid.

C. K. B. asks: 1. What is the rule for finding the horse power of tubular boilers, also the rule for the common two flue boiler? 2. Who is publisher of Auchincloss's "Link and Valve Motions?" Answers: 1. Only an approximate rule can be given. Divide the heating surface in square feet by 15. 2. The book is published by D. Van Nostrand.

A. R. says: 1. I have a small horizontal engine, 1½ inches bore x 3½ inches stroke: what is its power? It makes 150 revolutions per minute with 50 lbs. pressure. 2. What pressure would a boiler 8 inches diameter x 10 inches high, with flue in center two inches in diameter, made of 14 ounce copper, stand? Answers: 1. About 1½ of a horse power. 2. Between 30 and 40 lbs. per square inch.

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

G. W. E.—This ore contains too much sulphur to be available as an iron ore.

C. P. H.—The stone enclosed is common quartz, of no value.

S. H.—The ore you send is iron pyrites. To determine the presence and amount of silver in it will cost \$10.

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 Small, Fast Steamer. By J. G. X.
- On Tidal Retardation. By E. F.
- On Cumberland Gap Cave. By H. B. N.
- On Solar Motion. By J. E. H.
- On Retardation of the Earth. By J. T. H.
- On Gravitation. By S. J. W.
- On Snake Bites. By J. H. H.
- On Catching Rats, etc. By A. F.
- On Boiler Explosions. By R. S. H.
- On Water as Fuel. By H. O. L.
- On Economical Steam Engines. By J. W. H.
- On Jumping from Railway Trains. By J. E. M.

Also enquiries from the following:

- J. J. B.—D. M. S.—W. E.—T. A.—Z. Z. Z.—W. C. L.—E. K.—C. S.—W. G. D.—G. E. B.—A. T.—F. H. T.—J. B.—E. J. R.—S. Z. M.

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

Correspondents in different parts of the country ask: Where steel bars, used in lieu of church bells, can be obtained? Where can a standard shape for teeth for gears be had? Where can a sewing machine, that makes stitches alike on both sides, be bought? Which is the best apple parer, corer and slicer? Where are head blocks for circular saw mills made? Which is the best machine for boring logs lengthwise, for boring, etc.? Where can I get a carpenter's gage? Who makes machines for turning spindles for wagon backs? Where can I get a waterwheel tested? Who makes rubber balls and pins for ten pin alleys? Where are toy rubber balloons manufactured? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Index of Inventions FOR WHICH Letters Patent of the United States WERE GRANTED FOR THE WEEK ENDING August 5, 1873, AND EACH BEARING THAT DATE. (Those marked (r) are reissued patents.)

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

- 25,025.—GAS.—L. D. Gale. October 22.
- 25,030.—GAS.—L. D. Gale. October 22.
- 26,087.—HALE HOOP FASTENING.—J. T. Butler. Oct. 29.
- 26,135.—PORTABLE PUMP.—W. T. Vase. October 29.
- 26,115.—WATER CLOSET COCK.—D. Wellington. Oct. 29.

EXTENSIONS GRANTED.

- 25,005.—GOVERNOR VALVE.—B. Fitts.
- 25,014.—WOODEN WARE CUTTER.—G. R. Hay.
- 25,096.—POSTMARKING STAMP.—M. P. Norton.
- 25,070.—ROOF FOR RAILWAY CARS.—A. P. Winslow.
- 25,235.—MANUFACTURE OF IRON.—B. Lauth.

DESIGNS PATENTED.

- 6,791.—COLLAR BOX.—R. W. Betts, New York city.
- 6,792.—NURIA.—H. Boot, Philadelphia, Pa.
- 6,793 & 6,794.—BOAR.—B. H. Prindle, Philadelphia, Pa.
- 6,795.—SIGN.—H. B. Titus, Brooklyn, N. Y.
- 6,796 & 6,797.—CARPETS.—A. T. Webster, New Brunswick.

TRADE MARKS REGISTERED.

- 1,393.—WHISKY.—J. E. Cassidy, Boston, Mass.
- 1,394.—MEDICINE.—S. De Grath, Jersey City, N. J.
- 1,395.—GUANO.—B. M. Rhodes & Co., Baltimore, Md.
- 1,396.—FERTILIZERS.—O. Wittichen, Haymarket, Va.
- 1,397 to 1,399.—STEAM PACKING.—Silver Lake Co., New-tonville, Mass.
- 1,400.—BRAIDED CORDS.—Silver Lake Co., New-tonville, Mass.

SCHEDULE OF PATENT FEES:

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

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, 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.

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HOW TO OBTAIN Patents.

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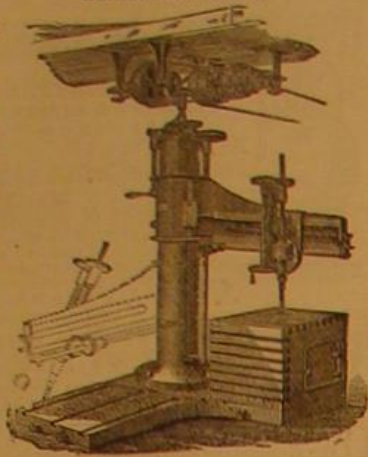
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THE VOYAGE OF THE GRAPHIC BALLOON.

As the 10th of September, the day set apart for the ascent of the *Graphic* balloon, is also the regular day of publication for the present issue of our journal, we are obliged to go to press without waiting to learn the circumstances of the departure. In case the latter take place, however, the facts will be found in our following number. We have obtained, through the courtesy of Mr. Donaldson, a number of original sketches by that gentleman of novel and interesting apparatuses and modes of performing operations pertaining to the voyage. These ingenious conceptions, we illustrate on our initial page, and give herewith various explanations and particulars concerning them.

The representation of the air ship itself, which forms the center piece, is intended to give an idea of the proportionate sizes of the balloon, car, and life boat. The great sack is 108 yards in circumference, and is constructed in nine elliptical sections, each 176 feet long by 54 feet wide. These are joined together by means of two rows of stitching to each seam, in the style known to seamstresses as "felling"; and then each seam is covered with two coats of varnish composed of linseed oil, beeswax and benzine. The sewing together of the fabric is at the time of writing completed, and nothing remains to be done but to add the "re-inforce" or crown piece, consisting of one additional thickness of sheeting extending twenty feet in every direction from the zenith of the globe; and to complete the riveting-in of the safety valve at the extreme top. The marine netting which is to envelope the balloon, will then be put in place and inflation proceeded with. The car is fourteen feet high, and is divided into two compartments, the upper of ten and the lower of four feet. The second floor, on which the aeronauts will live, is nine feet in diameter. The small cabin thus formed is furnished with tables, chairs, instruments, etc., and the space below is devoted to ballast and stores. The exterior of the car, which is now completed, is covered with blue and white striped canvas, and quite prettily decorated with flags. The peculiarity of this part of the apparatus is that it may be readily cut away, piecemeal, when it becomes necessary, through the escape of gas diminishing its sustaining power, to lighten the balloon. After the ballast is all gone, the lower part, and then the upper portion, of the car is dropped, leaving the lifeboat still suspended from the concentrating ring, as a means of support to the voyager. The boat is twenty-two feet long by four feet broad, built of Spanish cedar, copper fastened and clinker built. She is fitted with the necessary spars and sails, and is considered fully able to keep afloat, even in the roughest weather.

The arrangements for suspending boat and car are shown in our engravings. In order to avoid any danger through the breaking of the concentrating ring, and at the same time to have the netting firmly secured thereto, the device shown in the lower left hand corner of the engraving is employed. This consists in fastening the heavy ropes (sixteen in all), which carry the weight of the car and its contents, around the ring by a clove hitch, and splicing a thimble in the upper ends to which the netting is attached. If, as was the case with the unfortunate *La Montagne*, the ring should break, the ropes would merely swing out and still support the load; while on the other hand, they can be cut below the ring without the clove hitch slipping from the latter.

In case gas should escape from the main balloon to such an extent that the aeronauts find themselves rapidly descending, the ballast goes first, then all movables, then the car, piece by piece, then the small balloon, until nothing is left but the life boat and also the canoe hanging from the concentrating ring. Four ropes lead from the boat up outside of the car to the ring, so that it hangs from the latter, independent of any other portion. The party is now in the boat, but the balloon is still descending. As they near the water, a drag composed of a number of canvas buckets attached at intervals along a rope is thrown out, forming a sort of sea

anchor and steadying the balloon. As soon as the life boat touches the surface, the sustaining ropes are cast adrift, leaving her attached to the balloon by a single line which is fastened to the bight of another rope, the ends of which pass through rings near the bow and stern of the vessel, joining amidships. At the same time, a canvas drag is veered astern, keeping the bow of the boat in the direction the balloon is travelling. This arrangement will be understood from the drawing marked "detaching the canoe," an operation afterwards performed in a similar manner. Knots in the rope prevent it being drawn through the rings in the boat in the wrong direction. At the word, one of the party cuts the line between the rings, out of both of which at once the ends are of course pulled by the balloon. The boat is then free, and sail is made. Meanwhile one of the party (Donaldson) has remained behind. We may here remark that four persons are all that will undertake the voyage; the two aeronauts, Wise and Donaldson, an officer lately of the merchant service, and a reporter of the *Daily Graphic*. While the operations of getting the large boat clear have been under way, Donaldson has been letting out his drag of buckets, securing his canoe to the concentrating ring and finally fastening to the latter two blocks, through which he reeves a rope, to one end of which he attaches a bag of sand to act as a counterbalance, and to the other—himself. It is clear that, as soon as the life boat is cut adrift, unless something hold the balloon, it will, on being so greatly relieved, shoot upwards too suddenly and dangerously. Here the canvas buckets come in play; but after the large boat is fairly clear, these must be hauled up to enable the balloon once more to ascend. How this is to be done, another of our drawings represents. Donaldson lets himself down by his cord, the sandbag balancing him, until he can get hold of the rope, then he pulls up the buckets and empties them one by one. It is hoped that, by thus so greatly lightening the balloon, it may with its single passenger be enabled to reach the European shore in safety; but in case even these endeavors prove fruitless, Donaldson will have to take to his canoe and trust to reaching land in her, or else to being picked up by some passing vessel.

The drawing of a man dangling like a spider from a line, on the right of our engraving, represents the mode of taking observations of the sun. The navigator is placed in a sling or chair, and hoisted by a whip from the balloon netting, well out on the sunny side, so that a sight can be got without the shadow of the globe. This apparently unsteady position will really, we think, be susceptible of less motion than on the deck of a rolling ship; the correction for "dip" to be applied to the observations, however, we imagine, will be something rather extraordinary.

The two upper sketches are a plan of an ingenious descent alarm and of an automatic ballast regulator, both ideas of Mr. Donaldson. The former consists of an ordinary barometer tube, A, ending below in a cup, B, filled, of course, with mercury. Passing up through the latter are two insulated wires, which, as shown, connect with a battery and burglar alarm bell. These wires extend up the tube until they reach a point, corresponding to the height of mercury due to an elevation of 2,000 feet above sea level. Here they meet, and at the junction is a non-insulated point of metal. Of course just so long as the balloon remains at an altitude of over 2,000 feet, the surface of the mercury will be located below the point of junction of the wires, but the moment a descent occurs below that elevation, the mercury, rising, comes in contact with the non-insulated metal, establishes the current and sounds the alarm. The 2,000 feet mentioned is merely arbitrary, as the instrument will be regulated to give warning whenever the balloon sinks below the current of air in which it is desired to travel.

The ballast regulator is an ingenious contrivance for keeping the balloon balanced, so to speak, at just a certain height. Mr. Donaldson informed us that the position of the air ship can be thus adjusted with the greatest nicety, and mentioned an instance where he managed to sail for a considerable distance at a height of only six feet above the ground, hardly varying his altitude an inch until on carelessly throwing out a piece of bread, he was surprised to notice that he had ascended some feet. The apparatus referred to consists of a bladder, A, inflated before ascending, with common air, and placed between two boards, one of which is fixed upright and the other hinged thereto. A rubber spring keeps the movable piece up against the bladder, and, by suitable connection, the moving board is attached to the handle of the spigot of a water barrel, so as to turn a stream on or off in accordance with its motion. This connecting device is so adjusted that, when the bladder swells, as the balloon rises into atmosphere of greater tenuity, the handle of the spigot is moved to diminish gradually or check the escape of water. Should, however, the balloon descend slightly, the contraction of the bladder allows the rubber spring to pull open the faucet, and permit a sufficient discharge to enable the resumption of the proper level.

HELL GATE.

Owing to the reduced appropriation made this year for the improvement of the East River channel at Hell Gate, the work on Hallett's Point progresses slowly, very few miners being employed. The headings and galleries are nearly completed according to the original plan; still an immense volume of rock remains to be removed.

Our readers will remember that it was at first intended to remove part of the rock dry and the rest by grappling after the breaking up of the reef by a grand explosion. The experience since gained on Pot Rock has shown the cost of grappling in a current like that of Hell Gate to be much more than that of removing the rock from below, even un-

der the unfavorable conditions that prevail at Hallett's Point. It has, therefore, been decided to sink the entire excavation under the river some twenty feet deeper, making a cavity capacious enough to engulf the shell of the reef and its supports, yet leave a depth of water above sufficient for the passage of the largest vessels. The deepening of the excavation has been begun in the Humphrey and Hoffman headings.

The skill and care with which the work has thus far been carried on give assurance of the successful completion of the undertaking at as early a date as the funds provided will admit of. Already 90,000 blasts have been fired, consuming 33,000 pounds of nitro-glycerin, without a single accident—a remarkable record for an explosive material having such an ominous reputation for going off inopportunely. An elaborate survey of the Gridiron has been made by soundings, during the year, but as no appropriation has been granted for its destruction, its lease of life is indefinitely extended.

Among the valuable scientific observations made during the progress of the work at Hallett's Point is an extensive and very interesting series on the transmission of power by compressed air. The drills are several hundred feet distant from the compressors, yet the variation of pressure between the receiver and the drills is surprisingly small, ranging about two or three pounds in a pressure of fifty. Not unfrequently the gage at the drill records a pressure one or two pounds greater than that simultaneously observed at the receiver, the excess being attributed to a pulsation caused by the periodic stroke of the drill.

THE VIENNA PRIZES.

The complete list of awards to American exhibitors at the Vienna Exposition has at length been received, and 359 prizes have, it appears, been won by our representatives, the total number of whom, according to the latest information, was 922. It seems, therefore, that but a little over a third of all present, including those not competing, received distinctions. Out of 412 grand diplomas of honor, the highest award, America has taken eight; four of these go to the group of Education, and are given respectively to the Smithsonian Institution, the National Bureau of Education, the State of Massachusetts, and the city of Boston. The remainder are won by S. S. White of Philadelphia for artificial teeth, W. A. Wood, Hoosac Falls, N. Y., for mowing and reaping machines, William Sellers & Co., Philadelphia, for puddling furnaces and tools, and Corliss for perfection of steam engines. The latter gentleman was not an exhibitor, although his improvements appeared on large numbers of both American and foreign engines, and consequently there is considerable dissatisfaction expressed by other persons who went to the expense of competing but failed to gain the diploma.

The medal for merit was awarded to 155 exhibitors. It seems that there was no comparison instituted between like articles in the departments of different nations, and that the premium simply means that a meritorious display has been made. One medal is as good as another, so that inventions of real value and excellence, exhibited by originators and manufacturers, gain no higher distinction than articles of much less importance contributed through dealers and commission merchants.

The medals for progress number 57. This distinction is given for valuable designs or inventions made since the Paris Exposition of 1867. It may be fairly considered as a higher prize than the medal of merit. It has been awarded for chromos, photographs, several agricultural machines, the sand blast, and to the Remington, Howe, Wilson, Singer, Wheeler & Wilson, Secor, and Weed sewing machines; besides other articles, of which, for lack of space, we are obliged to omit mention.

The medal for good taste was designed for artists who do not compete for the progress or merit medals. Four have been awarded to Americans, two of them being to artists (Bierstadt and Healy); and, strange to say, two to makers of artificial teeth, which is probably a mistake in the published list.

The coöperative medal, given to assistants for producing meritorious articles of work, has been conferred upon 19 persons. Three are awarded for labor on the Wilson Sewing machine, two for the Wheeler & Wilson, three for the Singer, three for the Howe, and one for the Weed.

Honorable mention (or the diploma of recognition, as it is termed) has been made of 116 individual exhibitors, and also of ten cities for school reports.

In the absence of the particulars regarding the number of awards gained by other countries, it is hardly possible to estimate the relative proportion of prizes taken by Americans. It appears, however, that the comparison cannot be much in our favor, for it is stated that over 30,000 medals and diplomas were granted, and that the mere list filled a quarto volume of 529 pages. The only award of any real value is the diploma of honor, for the medals indicate no particular excellence. Our sewing machines, known to be the best in the world, gained no higher distinction than the awkwardest imitations from English and German factories.

The description of the ceremony of presentation of medals characterizes it as an extremely stupid and tedious affair. The Emperor was not present, and the awards, which it was supposed would be conferred by him in person upon distinguished inventors and others, were read from a list in the hands of Baron Senborn.

A NEW railway tunnel through the rocks of Jersey City Heights, opposite New York, has been begun by the Delaware, Lackawanna & Western Railroad.

THE PATENT ICE MACHINE.

An interesting case pertaining to the artificial production of ice has lately occupied the attention of the Commissioner of Patents. We allude to the application of F. P. E. Carré for an extension of his patent for ice machines, patented in France in 1859, and in this country in 1860.

The Commissioner has refused the petition for extension, and the invention is now public property.

The general method of effecting congelation by artificial means is to make use of a liquid which will energetically assume the gaseous state at a low temperature. In passing from the liquid to the gaseous state, the gas takes up a large amount of heat, and it draws this heat from whatever body it happens to be in contact with. This phenomenon may be readily illustrated by pouring a few drops of water upon a plate, and resting the bottom of a watch crystal on the plate in contact with the water. If now a small quantity of ether is placed in the watch crystal, the ether will evaporate or assume the gaseous form with great rapidity, and will draw so much heat from the water as to freeze it. This is the general principle on which most of the ice machines operate, and various refrigerating liquids are employed. In some of the machines ether is used, in others sulphuret of carbon, in others the light liquids from petroleum. These substances, after having passed from the liquid to the gaseous form, may be again restored to the liquid condition by the application of pressure, to wit, nearly 100 lbs. to the square inch. For this purpose pumps worked by steam engines are usually employed, but the great pressure of the gas results in much leakage and consequent loss of power; and until Carré brought out his improvement, the business of making ice was always attended with difficulty and expense.

In the Carré apparatus, a boiler containing ammonia and water is used, to which heat is applied, and pressure produced whereby the ammoniacal gas is driven over and condensed in a suitable receptacle in liquid form. The pressure is then shut off, when the ammonia immediately begins to boil and expands into the gaseous form with energy. The chamber in which the ammonia is allowed to expand surrounds a vessel of water, from which the expanding gas absorbs caloric, and the water congeals. The ammoniacal gas is then brought into contact with cold water, by which it is absorbed, and the ammonia water is then returned to the boiler and again used in the manner described. The process of ice manufacture is thus made continuous. There is little or no waste of ammonia, for it simply circulates around through the apparatus in pipes and chambers, condensing at one point and expanding at another as required, no pumps being required to effect the condensation.

The wonderful absorption, by water, of ammonia renders the use of this agent especially advantageous over any others at present known, for the purpose of ice making. At the ordinary temperature, water absorbs over seven hundred times its volume of ammonia, while the latter may be readily expelled from the water by the application of heat. It requires a temperature of 103° Fahr. below zero to solidify liquid ammonia. Placed in an iron vessel, it produces, at a temperature of 50° Fahr. a pressure of 97½ lbs. to the square inch. It was used at one time in New Orleans as a motor for a street car, an engraving of which appeared some time ago in our paper.

It appears, from the proceedings before the Commissioner of Patents, that the Carré ice machine is now in extensive and successful use in various parts of the country, especially at the South. The city of New Orleans is chiefly supplied with ice made by this apparatus, which furnishes ice for \$5 a ton less than the price at which it can be imported from the North. The Carré machine is one of the most valuable inventions of the day, and it is not therefore surprising that the makers of all other ice machines, who have heretofore been compelled to use condensing pumps, should appear in full force at the Patent Office, to prevent the extension of the Carré patent. In this they have succeeded; and now they may throw aside their steam engines, discard their expensive pumps, and adopt the simple, effective and brilliant invention of Carré.

What surprises us is that the Commissioner of Patents should have rejected Carré's petition on the slender reasons that he assigns. He states that Faraday bent a glass tube into U form, and put ammoniated chloride of silver in one end, to which heat was applied. The result was that the ammonia was driven over and liquefied in the opposite end of the tube, which he now dipped in water. The heat being removed, the liquefied ammonia then expanded into gas, extracted caloric from the water and congealed it, and the gas went back to the other end of the tube and was again absorbed by the chloride of silver.

The Commissioner states that all that Carré did was to take this principle, first illustrated by Faraday, and substitute it, in ice machines, in lieu of the exhausting and condensing pumps used in Twining's, Perkin's and other ice apparatuses. Carré's labors during a period of thirteen years netted him \$65,000, or \$5,000 a year, which the Commissioner thinks is sufficient compensation.

This decision of the Commissioner, drawn up by a Board of Examiners in Chief at the Patent Office, is only one more illustration of the worthlessness of the Washington examinations, by which inventors are too often deprived, not only of credit for their discoveries but of substantial benefit.

What Carré did was to give to the public a new and splendid refrigerating apparatus, whereby cooling chambers for the preservation of important articles of food, and the production of ice, could be readily and economically effected. This was a great achievement, something never done before and entitled the author to the highest consideration as a public benefactor. The economic advantages conferred up-

on this country, by the introduction of Carré's invention, already amount to millions of dollars per annum; and every year, as the use of the invention is extended, these benefits will be augmented.

In the face of these undeniable facts, which are presented in the Commissioner's report, he dismisses the petition of Carré and attempts to belittle the invention by pronouncing it merely a substitute for pumps, and merely an imitation of Faraday's tube. Faraday's glass tube experiment was made public in 1823, but remained inert and useless, so far as practical ice manufacture was concerned, for more than a generation. It was not until Carré, in 1859, produced the present invention that ice could be economically manufactured, and but for Carré it is probable that we should not now be in possession of this remarkable and invaluable process. The Commissioner's conclusion is narrow-minded and erroneous. A device which is merely a substitute for another, is only capable of the functions of the original. Carré's invention was far more than a mere substitute. It eliminated from ice machines all the difficulties that had attended their operation. It rendered them effective, economical, and commercially practical, when before they were expensive, leaky, and well nigh useless. The tube of Faraday was a brilliant experiment, illustrating a novel principle. But, commercially speaking, it was not an ice machine. It required more than thirty years of time and the inventive genius of a Carré to give the principle practical embodiment, or harness it into duty for creating ice.

The action of the Commissioner of Patents in decrying the merit of Carré's discovery we regard as a disgrace to the country; and we trust that the next Congress will make prompt amends by reversing the Patent Office decision.

PENS AND THEIR FAILINGS.

It is a noteworthy fact that the man who made more steel pens than any other, and better ones,—the late Joseph Gillott—never wrote with a steel pen. With all the men and machinery at his command he was never able to produce a pen that suited him so well as the time-honored plume of the old gray goose. Mr. Gillott was not alone in his preference for the inconvenient yet easy quill. The kindly firmness of its bearing and its easy movement have never been approached by any of its metallic imitations. The iridium pointed gold pen, properly ground, comes nearest to the writing quality of the quill, and greatly excels it in durability; but gold pens are never properly ground by the makers. Steel pens, though excellent for pen drawing, are altogether too hard, scratchy, and tiresome for rough and ready writing, their persistent use resulting in that painful exhaustion of the nerves and muscles of the hand and arm known as writers' cramp—a malady due not so much to the necessary labor involved in tracing the letters as to the unnecessary and exasperating effort constantly called for in forcing the pen to go the way it goes hardest, and in keeping it from swerving right and left into easier paths: a malady, it may be added, which dates its origin from the introduction of steel pens, and which is demonstrably not caused by the chemical action of the ink and the resulting electric currents, or anything else save the vicious action of the pen itself.

To return to the goose feather is impossible. The supply is inadequate to meet the great and increasing demands of modern writing. For much of this literary and commercial labor, the writing machine in some form or other will be required; but there will still remain an immense amount of irregular writing which must be done by hand with metal pens; and it is time the penmakers began to furnish something approaching the good qualities of the quill. Only the blinding effect of tradition and training can account for the failure of penmakers to discover and correct the radical and plainly apparent faults of their productions. Take for illustration, the most common and mischievous of pen defects, faulty pointing.

One of the first principles of mechanical construction is that the bearing surface of any sliding tool or structure should be such that the line of least resistance shall lie in the direction in which you wish it to go. Skate irons, sled runners, and a thousand other illustrations will occur to the reader. The principle is too plain and self-asserting to be overlooked by the dullest, save in the matter of penmaking. In pens, however, the line of least resistance, if there be any, is sure to lie in any direction rather than that of the general stroke. The only effort made to lessen the resistance shows itself in giving a round point to the pen, a device most commonly adapted by gold pen makers. This is better than nothing; still it is faulty, in that it compels the user to constant exertion in keeping the stroke from wavering; and at the same time it reduces the bearing surface of the pen to the minimum, thus increasing friction and making fineness coincident with scratchiness. It is like setting an ice boat on round knobs, instead of on long and narrow runners.

To give a fine stroke easily and smoothly, a pen should rest not on a point but on an edge several times longer than it is thick, its length lying in the direction of the up stroke. By this means, the bearing surface of the pen is increased many times, and the smoothness of the writing in proportion. And as the least resistance is met in the line of the upstroke the writing will have a regular slant without any effort on the part of the writer to steady his hand. The down strokes lying at a slightly greater angle to the line of writing will, of necessity, be a trifle broader, giving distinctness to the letters, likewise without change of pressure or other effort. Sharpen a lead pencil, making one end flat and the other to a round point; then compare the writing of the two, for illustration of the position here taken.

A wrist all but crippled by the use of pens of ordinary make has compelled the writer to make a critical study of

pen points, experimental as well as theoretical, for his own relief. Through the destruction of innumerable pens,—as the surgeon spoiled his "hatful" of eyes—the following process has been developed for converting an ordinary stiff, scratchy, tiresome pen into one that will glide over the paper as kindly as a quill. It is comparatively easy to give a quill point to a steel pen; but it soon wears sharp and requires frequent retouching on a fine stone to keep it in condition. A well tempered gold pen is better. Choosing one with a large point—a Mable, Todd & Co.'s "Broad Point" is the easiest to improve,—carefully grind the back bevel-wise until the "point" presents a long sharp edge, like that of a narrow chisel, slightly oblique to the line of the slit. This done, rub the writing edge lightly on a fine hard stone, holding the pen as in ordinary writing. This will give a bearing surface as above described. The outer and inner corners of the edge and those at the slit will require a few light touches to round them slightly. Any roughness due to the coarseness of the stone may be removed by delicate rubbing on a finer stone or on hard paper. If the pen lacks the soft quick spring of a good quill, grind or scrape away as much gold from close to the point as may be required to bring it to the desired flexibility. A pen so improved will have all the good qualities of a quill, so far as attainable with a metal so slow tempered as gold. It is impossible that, by the use of some more elastic non-corrosive alloy like American Sterling, a perfect quill action could be attained, together with durability. What penmaker will try it, and bless mankind while making a fortune for himself?

DEODORIZING THE OFFAL FROM SLAUGHTER HOUSES.

We publish, on another page, an illustrated description of an invention and process for treating the offal from slaughter and rendering houses, and converting it into a fertilizer. This subject is most important from a sanitary as well as from an economical point of view; and this new system is probably destined to come very largely into use. In Chicago, the health authorities have suppressed the use of all other apparatus for this purpose, on the ground that the hygienic necessities of the case were not complied with, leaving the Storer method master of the field.

SCIENTIFIC AND PRACTICAL INFORMATION.

SILICA LENSES.

In a new work entitled *Telescope and Microscope*, recently published in France, the following method of obtaining a lens for a cheap microscope is ascribed to an experiment of Sir Humphrey Davy. The process consists in igniting one end of a wheat or hay straw and allowing the entire spear to consume gradually. The cinder is then heated in the blue flame of a burner; and from the siliceous contained, a solid globule of glass is formed, said to be well suited for microscopic purposes.

MUSKET STEEL.

Professor Heeren has analyzed this remarkable metal and finds that, excluding carbon and perhaps traces of other substances, it contains 8.3 per cent of tungsten and 1.73 per cent of manganese. Untempered, this steel resists the file; but after tempering, it becomes much softer and readily yields.

AMMONIA IN PNEUMATIC TUBES.

MM. Tommasi and Michel have suggested the substitution of ammoniacal gas for air, in propelling dispatches through the tubes of pneumatic systems. First combined with water, the gas disengaged by heat enters the orifice of the tube and, being under sufficient pressure, drives the dispatch boxes through before it. On reaching the exit opening, it re-condenses, forming a vacuum in the pipe through which the boxes may be returned by atmospheric pressure. The apparatus is said to require very little fuel or gas.

METHYL GREEN.

In preparing substitution products of rosaniline (fuchsin) with the alcohol radicals, instead of causing the iodine compound to act upon a salt of rosaniline, it is now customary to produce them directly by the oxidation of methyl-aniline. In this way a compound is obtained, which is chemically identical with the so-called iodine violet, but which is prepared without the use of iodine. It is known in the trade as methyl-violet, to indicate the method of its preparation. It is distinguished by its losing none of its brilliancy by artificial light. This preparation of methyl-violet could not fail to influence the manufacture of iodine green. A means was sought for causing the methyl violet to take up the radical methyl so as to form the green methylated methyl rosaniline. In this case the use of iodide of methyl was not absolutely necessary; and in many manufactories in South Germany, the chlorine compound is used, which produces a green, crystallizing in beautiful crystals, while the iodine green is an amorphous powder; the chlorine green is also more soluble in water than the iodine. Not being obtained as a by-product in making violet, there is no foreign dye adhering to it, and a fresh dye bath gives as soft a green as one that has been used, which is not the case with iodine green, a fact generally known. Hence the so-called methyl green has two important advantages over that prepared with iodide of methyl.

First, it is more permanent than iodine green, and the solution may be boiled without decomposition. Secondly, wool is dyed with methyl green alone, it not being necessary, as formerly, to neutralize with ammonia and afterwards brighten with acid. In dyeing different shades, this is of great importance. The extensive use of iodine in the manufacture of aniline colors for the last nine years has caused a fourfold increase in its price, and was continually becoming more expensive, so that it is important to be able to dispense with it altogether.

HOW TO CATCH MOLES.

We presume there are few of our agricultural readers who at some period have not heartily anathematized the moles. Although these little animals do a considerable amount of good in killing insects and worms which would destroy grain, they more than counterbalance the benefits they confer upon the farmer by the injuries they inflict upon the work of the gardener. They appear to have a taste for the choicest bulbs and for the roots of the rarest flowers, while their tracks very speedily ruin the appearance of smooth and neatly kept lawns.

The Patent Office records show that plenty of inventive genius has been expended in attempts to devise an efficient mole trap. Of these inventions we have tried quite a number in our efforts to rid our garden of the nuisance, but we have found none so satisfactory as the very simple plan represented in our engraving. As soon as a fresh mole run is



found, indicated of course by a ridge on the surface of the ground, a hole should be dug and a large sized ordinary flower pot set therein. Over the top of this receptacle, a piece of board is placed, leaving a space of about three inches between it and the edge of the pot so that dirt from above will not fall into the latter. The openings of the run lead, as represented, into this space. The earth is replaced and the surface of the ground restored. The mole in following his usual road blindly comes to the crifice leading to the pot, into which he incontinently tumbles. As he is unable to crawl up the sides or burrow through the hard earthenware, he decides to remain and wait for assistance, which generally comes in the shape of a gardener and a rat terrier. The transactions of the mole with the last mentioned of this pair are such as to destroy his taste for bulbs or for future mining investigations.

In using this device, we caught seven moles the first day and three on the second day after setting. Since then we have captured one occasionally. The result is a marked improvement in the aspect of our lawn and flower beds. The trap was contrived by George Becker, a gardener in Llewellyn Park, Orange, N. J., and is not patented.

Water Gas.

The improvements of W. D. Ruck are now in successful operation at the gas works of Chichester, England, and that city is now lighted by the new method, which is described as follows in *Engineering*:

The elements are water, coke, iron, and spirit. The water is converted into steam, which is passed through a superheater, and then through a set of retorts containing coke and iron, the charge for each retort being $1\frac{1}{2}$ cwt. of coke and 1 cwt. of iron. One ton of coke put in and worked off, plus the steam, produces 132,000 cubic feet of gas, and to effect this 2 tons of coke are used in the furnace. The gas thus produced is passed through a condenser and a washer similar to a Coffey's still, and afterwards through a purifier containing oxide of iron. From the purifier it is conducted to the saturator, where it passes through rectified petroleum spirit, which increases the bulk of the gas about 25 per cent, so that 132,000 feet becomes 165,000 feet, the cost of which is stated to be 40 cent per 1,000 feet.

In carrying out the manufacture of water gas at Chichester, the gas works have been only partially altered, so that the manufacture of coal gas is still carried on; the public, in fact, being supplied with a mixture of the two gases. This, it would appear, is the most economical method of applying the water gas, inasmuch as the coke from the coal gas can be utilized, and the latter gas can be made from cheap coal, as the former is found to be a very rich gas. Hence gas companies will probably find the water gas process useful as a supplementary manufacture while and whenever coal is dear, for it is not intended that it shall supersede the ordinary manufacture. At any rate, present experience at Chichester goes to place this beyond a doubt, for there a pure and brilliant combined gas is produced, having an illuminating power of 18.50 candles. The city and environs of Chichester have for some six or seven weeks past been lighted by a mixture of the two gases in proportions varying from one third to two thirds, the present proportions being equal parts. Arrangements have been made for lighting the city for twelve months with this gas. In order to demonstrate to those interested in gas making that the process can be applied to existing works practically and economically, more than a hundred gentlemen, the greater portion being gas engineers and managers, recently visited the works. They were conveyed from London to Chichester by special train, and when there saw the whole process in operation, explanation being given by Mr. Spice and Mr. Quick, the engineers to the new gas company. Mr. Spice was put under cross examination by several gentlemen who were skeptics on various points, but he reasonably and conclusively answered every argument brought to bear against the new gas, both with regard to details of manufacture and commercial points. At the Chichester works coal costing 30s. per ton was formerly used, while an inferior coal at 21s. is now employed in the retorts, the re-

sulting coke being utilized in producing the water gas. The stability of the gas has been proved by keeping it for six months, at the end of which time it is stated no separation or condensation had taken place. Its travelling capacity is shown by the fact that it has been delivered by itself, and is now delivered in combination with coal gas to lights 24 miles from the works, and burns freely. That the lighting of the city is all that can be desired was admitted by the visitors who strolled through the streets after dark, previously to their return to London. The new gas has been subjected to the test of a reduction of temperature to the extent of 27 degrees without its illuminating power being affected. In fact everything appears to have been done to prove in it a commercial manner, the greatest proof of all being its practical adoption at Chichester, by which, up to the present time, it is shown to be a scientific as well as a commercial success.

DEEP SEA DREDGING APPARATUS.

The headquarters of the United States Fish Commission have been established for the present season at Casco Bay, Me., and the work to be accomplished consists in exploring the waters and sea bottom in the vicinity in order to obtain all ascertainable facts relative to the animals inhabiting that region. The Blue Light, a steamer of 85 tons, has been fitted with all the latest appliances and machinery, and placed at the disposal of the Commission.

We extract from the *Tribune* the accompanying illustrations of the instruments employed in deep sea explorations, the most useful of which is the dredge, which, in its present



FIG. 1.

form, is capable of scraping, from the ocean floor, everything lying in its path. It consists of an open iron frame (a in the engraving, Fig. 1), which acts as a scraper, and to which is attached a fine meshed net, b, about four feet in length. Over the net, a canvas bag, c, open at the bottom, is extend-



FIG. 2.

ed, serving to protect the former from injury while it is dragged over rocks. To extricate the implement in case it becomes caught on any obstacle at the bottom, the drag rope, d, is attached to only one of its handles, and is connected to the other by a light line, e. It follows that, when a hard strain comes, the light line breaks, and the heavy rope pulls thereafter at one end of the frame. The obvious result is to

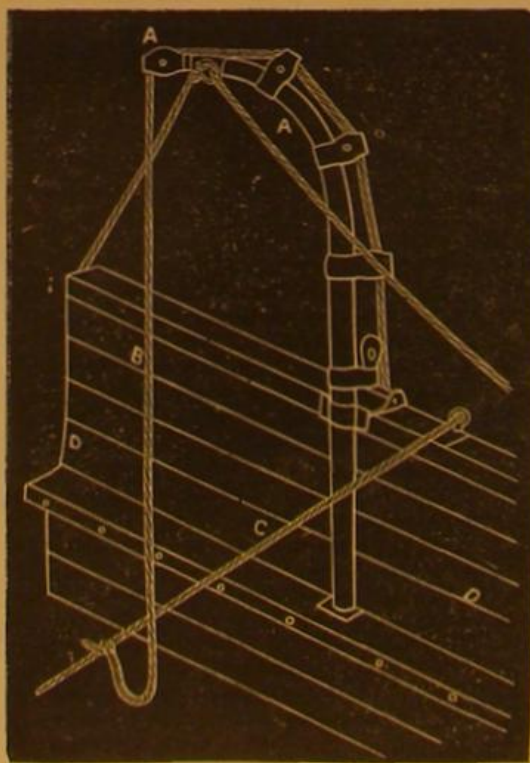


FIG. 3.

pull the scraper sideways out of its predicament. This is a simple modification of an old device, and is quite efficacious. To bring the scrapers down to their work, a weight of about twenty pounds is attached to the drag rope, one or two yards in advance of the dredge.

The specific value of the apparatus is as a scraper, as it brings up an abundance of material from the sea bottom; but where the bed is comparatively smooth, and the chief object in view is to obtain fishes and other active marine animals characteristic of the locality, the trawl (Fig. 2) is a more serviceable instrument. The front of the trawl is a beam, a, in our second figure, ten or twelve feet long, to the ends of which are affixed curved iron shoes or runners, b. From it depends a funnel shaped net, c, of perhaps thirty feet in depth, weighted by a string of leads, d, on the forward lower edge. These weights and that of the runners are sufficient to sink the trawl, and it does not usually need an extra weight in front, on the drag rope, as does the dredge. Projections or webs, e, proceeding from the inside of the net, called pockets, serve to prevent fishes captured in the net from getting out by the route that they go in. Over a smooth bottom and meeting no obstructions, such a trawl may be dragged along for hours at a time, till it grows so heavy with its accumulated treasures that its safety requires that it be hauled up and emptied. But, on the other hand, it may catch suddenly. Having caught, unless the strain is at once relaxed, it will be torn to pieces. On the other hand, if skillfully managed, it may be made to bring up almost anything which it incloses, and there is shown at the landing near the laboratory, on this island, a rock weighing nearly a quarter of a ton, which the Blue Light brought up in the trawl. The problem, therefore, is, when the trawl catches, to relieve the strain at once, and this is accomplished in the following manner: The trawl, suspended by a strong rope, is let down rapidly from a davit on the bow of the steamer, until the slackening of the rope indicates that bottom is reached; the steamer meanwhile moving slowly backward till a suitable angle is secured, so that the trawl will drag properly over the sea bottom. Then, while the rope is still running out, a seaman swings himself out on the davit and ties one end of a light line, called the check-stop rope, with a skillful knot, fast to the drag rope, and the other end to the side of the vessel. The business of trawling is now fairly begun, and the steamer is backed slowly along over the ground selected, at the rate of about a mile and a half per hour.

Fig. 3 shows this check-stop arrangement; a is the davit, b the drag rope, and c the check-stop line.

The trawl is now dragging from the bow and suddenly catches on the bottom. The strain has been all along on the check-stop rope which now parts with a snap. Instantly the order is given to reverse the engine; but long before the motion of the boat can be changed, the slack of the drag rope, which this simple contrivance has provided, relieves the strain, and time is afforded to let it out until the motion changes. The boat is then run rapidly forward until it stands over the sunken trawl, the steam engine winding in the drag rope. Then, with a little dextrous management, the trawl is easily pulled away. This device entirely takes the place of the costly accumulators used in the telegraph cable service, instruments which interpose a sort of drum made of india rubber in place of part of the drag rope, the elasticity of the material serving to release a heavy strain.

The Heart and the Circulation of the Blood.

Dr. Marey, says *Les Mondes*, has recently demonstrated that the heart acts like all mechanical motors in that the frequency of the pulsations varies according to the resistance which it meets in driving the blood through the vessels. When the resistance becomes greater, the throbs diminish; they accelerate, on the contrary, if the opposition becomes less. During life, the action of the nervous centers makes itself felt on the heart, of which it renders the pulsations slower or quicker, whatever may be the resistance experienced. Dr. Marey eliminated this nervous influence by removing the heart of an animal, and causing it to work under purely mechanical conditions. The heart of a turtle was arranged with a system of rubber tubes representing veins and arteries. Calf's blood, defibrinated, was caused to circulate, and a registering instrument noted the amplitude and frequency of the movements of the organ. When the tube containing the blood leaving the heart was compressed, the liquid accumulated in rear of the obstacle and the heart emptied itself with greater difficulty, the pulsations weakening perceptibly. On relaxing the pressure, thus allowing free course to the blood, the throbs accelerated rapidly.

Pure Sub-Iodide of Mercury.

Lefort recommends the following method for preparing the sub-iodide of mercury free from iodine and from metallic mercury: 60 grains of pure crystallized pyrophosphate of soda are dissolved in 300 grains water, and 30 grains acetate of the suboxide of mercury added. The solution requires several hours, during which it is frequently shaken. If the soda salt is chemically pure, the mercury salt dissolves perfectly; but this is seldom the case, and the excess of alkali precipitates some oxide of mercury, so that the solution requires filtering. It is then still further diluted with water, and a solution of 30 grains iodide of potassium in 2 ounces of water gradually added with constant stirring or shaking. This produces a precipitate which is at first a brownish green, but becomes a bright green, closely resembling oxide of chromium, and on settling acquires a yellow green color. If the mercury solution contains any mercuric salt at the start, some biniodide of mercury is formed, giving the liquid a pinkish color; but this is easily avoided by adding a slight excess of iodide of potassium, which is so dilute as not to decompose the sub-iodide, while it is able to dissolve the biniodide. The precipitate is washed with cold water by decantation, collected on a filter and dried with gentle heat in the dark.

A NEW SYSTEM OF CONSTRUCTING BLAST FURNACES.

Mr. Franz Buttgenbach, manager of the Neuss Hütte iron smelting works on the Lower Rhine, has prepared a report on his system of smelting iron, to be read at the meeting of the Iron and Steel Institute, held at Liège last month. In organizing this arrangement, the inventor's object has been to obtain a blast furnace, the hearth of which should be readily accessible on all sides; and following up this idea he built up a blast furnace 50 feet high and 17 feet in diameter at the boshes. In 1867 a model of the above named blast furnace was exhibited in Paris, and was highly approved by a great number of engineers of every nationality.

The inventor states that the fundamental idea of this mode of construction, and the advantages of the system, may be summed up as follows: (1) The masonry work of the stack is quite independent of the blast furnace proper. Each ring or course of brick constituting the hearth, boshes, and inside wall is readily accessible and free from any casing, except as regards a small portion, measuring from 3 feet to 4 feet in height at the widest section of the blast furnace. Consequently, the whole of the above several parts are completely bare and easily reached for any purpose required while the furnace is in active operation. This feature conduces to the duration of the furnace, for in case of need any injured part can be repaired even when the furnace is at work. (2) The inside wall and the upper part of the boshes being cooled by the atmosphere having access thereto, they remain in the normal condition without wear, and do not become unduly heated at any time, being therefore indefinitely kept in a state of preservation, since there never occurs a fusion of materials at this height. (3) The hearth and the lower portions of the boshes may be replaced without any difficulty whatever while the work is going on, so that there is no occasion to apprehend any extinction of the fires so long as the in-wall is not destroyed. The hearth and boshes can be renewed without affecting the in-wall injuriously. (4) Each particular brick being accessible during the working of the furnace, corrosion can be obviated by cooling down with water thrown on the several parts, or by means of water vessels or tweers, whereby the wear and tear can be checked. (5) The utilization of the gas at the furnace mouth can be so managed as to make it yield the best results. The pillars supporting the platform of the furnace top are gas pipes, and drop into sheet iron vessels fixed to the summit of the base of the stack where it slopes away. These vessels are open on one side, so that, when filled with water up to a certain height, they can be shut down by means of a valve measuring a few inches square. The gas issuing forth out of the furnace mouth finds its way into these receptacles, and in its passage through them travels over a

large surface of water. Here it deposits the dust, while a great part of the water, suspended in the gas in a state of vapor, is condensed. Consequently the gas reaches its destination in a highly purified condition, and may yield the very best results in those parts where it is desired to make use of it. The arrangement of the said water receptacles allows of the withdrawal of the dust or grit deposited while in full working, and in the event of an explosion the area, of but a few square inches, of the water column paralyzes, as though it were a gigantic valve, any injurious effects. Explosions from time to time serve the purpose of

general progress of the manufacture. (6) The gas pipes, being supporters also of the platform surrounding the furnace mouth or top, render the said platform independent of the blast furnace proper, and that without involving any special outlay.

The inventor, whose extensive experience entitles him to speak with authority, states that he has been using this method for the last six years with the very best results. Its application is very simple indeed, and free from the objectionable features of other known methods, since the work of the bottom of the furnace can be performed in case of need without depending upon the

mouth of a tweezer for running off the slag.

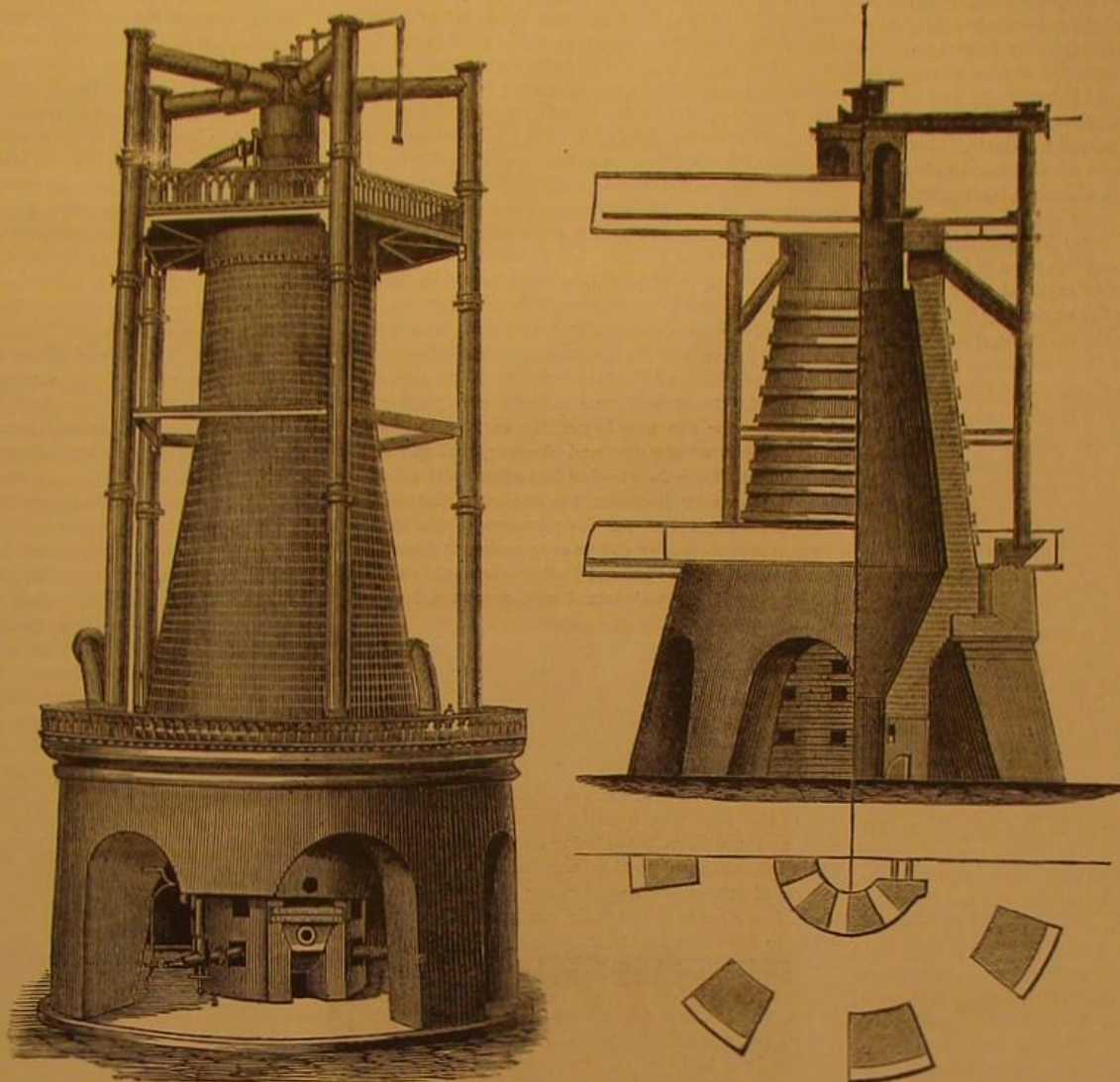
The hearth is closed in by a cast iron tympan placed in the usual position (see Fig. 2). This tympan arch is cooled by a current of water passing through a coiled iron pipe fixed in the cast iron. In the center of this plate, there is an aperture or orifice measuring 0.75 inch, running almost over the entire height, and the cooling pipes are situated as near this kind of slit as may be. This slit is closed up by means of ordinary clay. A, the upper portion of the slit, is placed two or three inches higher than the center of the line of the tweezers.

b is the level center of the tweezers, c the columns of the breast, d the dam, e the tap hole, p the space between the dam stone (tympan closed in with clay), T, cast iron tympan. The slag of the blast furnace, ascending above the dam stone and reaching the level of the tweezers, runs off easily through a hole driven by means of a light steel bar into the said slit; and since the level of this hole may be altered at will, a means is thus afforded for changing the level at which the slag is run off over a range of 24 inches, which is a very great advantage in itself; but, in addition to that, there is this further facility, namely, that nothing hinders one from tapping the melted ore at this same slit.

We are indebted to the *Engineer* for this illustration and for part of the explanation thereof.

HOW TO CONDUCT SLAUGHTERING, PACKING AND RENDERING WITHOUT OFFENSE.

The subject of the disposition of the offal from slaughtering and packing houses, at present agitated in all our great cities, has become a matter of national importance. These establishments are necessary to civilized life, and therefore have legitimate claims to existence; but the people who suffer from the offense caused by them have also a right to insist that they shall be carried on without injury to health or property. In many instances, otherwise most desirable and valuable suburbs have been monopolized by these establishments. The interests of a business so extensive and important should be made to harmonize with sanitary laws



BUTTGENBACH'S IMPROVED BLAST FURNACE. Fig. 1.

clearing off the dust and grit that may still be clinging to the inner walls of the pipes. Moreover, there is the advantage of confining these subsidiary appliances to a spot on the works, which does not in any way interfere with the

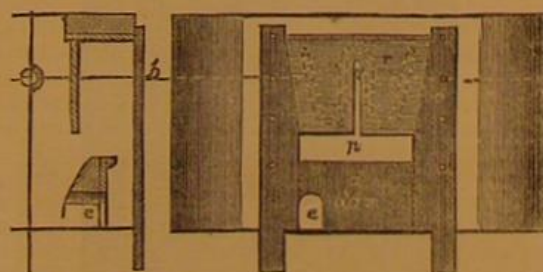
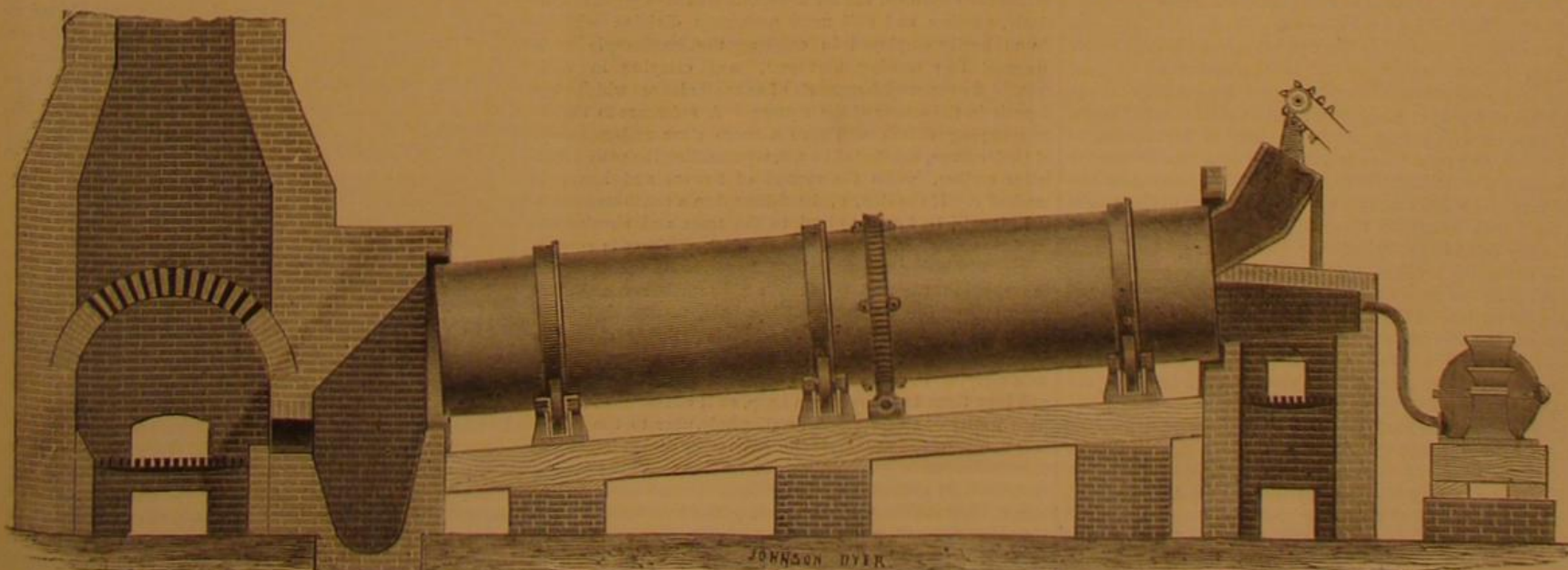


FIG. 2.

vantage of confining these subsidiary appliances to a spot on the works, which does not in any way interfere with the



STORER'S DEODORIZING CYLINDER AND PROCESS FOR CONVERTING OFFAL INTO FERTILIZERS.

and rights of land owners. Suggestions to this effect have been made and many plans devised, and we now present to our readers a plan which is claimed by the inventor to be the quickest and most comprehensive method of accomplishing the end. All the offense from these establishments arises from the manipulation of the blood and offal.

By the apparatus and processes of Jacob J. Storer, of Boston, these are so handled and treated that no cause of complaint can exist. The accompanying engraving illustrates the revolving deodorizing cylinder, designed by Mr. Storer, for converting the blood and offal into fertilizers. The cylinder consists of a boiler shell lined with fire brick. It is set at a slight incline for the more ready delivery of the dried fertilizer, is supported on friction rolls, and made to revolve by gear or belt. At the feed end of the cylinder is a fireplace in which a fire is maintained for the ignition of the pulverized fuel, which, under the Whelpley & Storer patents, is the principal agent of the work. At the delivery end of the cylinder is a receiving chamber or pit, into which the dried material falls, and whence it is removed by a bucket elevator. Just beyond this pit, and in the base of the smoke stack, is the gas mingling and combustion chamber, having a dome-shaped perforated roof.

This machine is operated as follows: The fire is urged in the first fireplace until it has become hot enough to instantly ignite the pulverized coal, which is injected over it by the pulverizer or blower, as shown in the engraving. The jet of burning pulverized coal, entering the cylinder, quickly heats it to the desired temperature. At the same time, the fire on the grate in the gas combustion chamber has brought the walls of the chamber and the perforated dome to almost a white heat. The cylinder is then put in revolution at the rate of four turns a minute, and the blood and offal, separately or together, are fed into it by an elevator. The material, as it passes through the cylinder, is exposed to the direct contact of the flame and products of combustion, and to the direct radiation of the hot brick lining of the cylinder. As it contains from fifty to eighty per cent of moisture, an enormous volume of steam and gases is immediately generated. These move forward into the gas-mingling and combustion chamber, and, by the high temperature therein maintained, are decomposed and burned, the perforated dome retaining them sufficiently long for this purpose. There escapes, then, through the perforations of the dome, an intense white flame, of sufficient volume to generate steam for all the purposes of the work, not the slightest offensive odor escaping.

The fertilizer is preferably allowed to discharge from this machine while it still contains from 8 to 10 per cent of moisture. It is found that, notwithstanding the high temperature in the cylinder, it cannot be charred or burned, because of its envelope of steam, while it contains this percentage of water.

A cylinder 4 feet in diameter and 30 feet long treats from 3 to 5 tons of raw material per hour, converting it into a fertilizer containing not more than 10 per cent of moisture. A cylinder 6 feet in diameter and 50 feet long will treat from 10 to 15 tons per hour, according to the character of the material, or above 250 tons per diem.

The capacity of these machines and their rapidity of work are such that one of them will dispose of all the refuse of any one of our large cities, obviating the necessity of an hour's accumulation of raw material about any establishment. A cylinder of 5 tons capacity per hour, with necessary auxiliary machinery and buildings, can be erected for about \$10,000. Works of twice this capacity could be erected for about \$15,000.

Most of the offense of slaughtering and rendering establishments arises from the escape of tank steam and gases, from the accumulation of "tank stuff" and blood, and the manner of disposing of the "tank water." The steam and tank water are disposed of inoffensively in the following manner: The tank steam and gases are carried through cold iron coils for condensation. The condensed steam is then passed through efficient filters, while the uncondensed steam and gases—already reduced to a minimum—are carried into a combustion chamber like the one attached to the deodorizing cylinder, and there burned.

The tank water is made to flow through a series of "catch basins." Each series, used alternately, is divided into sets of two or more basins. In the first set the heaviest particles of animal matter are deposited. In the second set the particles of animal matter in suspension are deposited by the application of a proper precipitant, while the third set of basins is furnished with proper filters, for further purification of the water, and from these it may flow into the sewers or streams without contaminating them. The precipitated animal matter—which amounts to 8 or 10 per cent of the weight of the "tank water"—is removed from the basins and inoffensively dried in the cylinder.

By spreading a slight covering of fine charcoal upon the "tank stuff" as soon as it is discharged from the tanks, and upon the surface of the blood in the receiving tubs, the escape of offensive odors is entirely prevented. The same application is made to these, as well as to the dead animals, when they have been loaded into carts or boats for transportation.

For further information, address J. J. Storer, 161 Tremont street, Boston, Mass.

PROGRESS OF THE HOOSAC TUNNEL DURING AUGUST, 1873.—Headings advanced from the east end westwardly, 158 feet; from the west end eastwardly, 93 feet. Total advances during month, 251 feet. Entire lengths opened to September 1, 24,163 feet. Rock remaining to be pierced, 865 feet. Whole length of the tunnel, 25,031 feet.

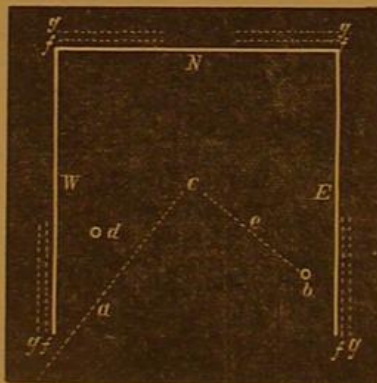
ON THE HONEY-MAKING ANT OF TEXAS AND NEW MEXICO.

BY HENRY EDWARDS, CALIFORNIAN ACADEMY OF SCIENCES.

The natural history of this very curious species (*Myrmecocystus Mexicanus*, Westwood) is so little known that the preservation of every fact connected with its economy becomes a matter of considerable scientific importance, and the following observations, gleaned from Captain W. B. Fleeson of this city, who has recently had an opportunity of studying the ants in their native haunts, may, it is hoped, be not without interest.

The community appears to consist of three distinct kinds of ants, probably of two separated genera, whose offices in the general order of the nest would seem to be entirely apart from each other, and who perform the labor allotted to them without the least encroachment upon the duties of their fellows. The larger number of individuals consists of yellow worker ants of two kinds, one of which, of a pale golden yellow color, about one third of an inch in length, acts as nurses and feeders of the honey-making-kind, who do not quit the interior of the nest, "their sole purpose being, apparently, to elaborate a kind of honey, which they are said to discharge into prepared receptacles, and which constitutes the food of the entire population. In these honey seeking workers the abdomen is distended into a large, globose, bladder-like form, about the size of a pea." The third variety of ant is much larger, black in color, and with very formidable mandibles. For the purpose of better understanding the doings of this strange community, we will designate them as follows: 1. Yellow workers; nurses and feeders. 2. Yellow workers; honey-makers. 3. Black workers; guards and purveyors. The site chosen for the nest is usually some sandy soil in the neighborhood of shrubs and flowers, and the space occupied is about from four to five feet square. Unlike the nests of most other ants, however, the surface of the soil is usually undisturbed, and, but for the presence of the insects themselves, presents a very different appearance from the ordinary communities, the ground having been subjected to no disturbance, and not pulverized and rendered loose as is the case with the majority of species.

The black workers (No. 3) surround the nest as guards or sentinels, and are always in a state of great activity. They form two lines of defence, moving different ways, their march always being along three sides of a square, one column moving from southeast to the southwest corner of the fortification, while the other proceeds in the opposite direction. In most of the nests examined by Captain Fleeson, the direction of the nest was usually towards the north; the east, west, and northern sides being surrounded by the soldiers, while the southern portion was left open and undefended. In case of any enemy approaching the encampment, a number of the guards leave their station in the line and sally forth to face the intruder, raising themselves upon their hind tarsi, and moving their somewhat formidable mandibles to and fro, as if in defiance of their foe. Spiders, wasps, beetles, and other insects are, if they come too near to the hive, attacked by them in the most merciless manner, and the dead body of the vanquished is speedily removed from the neighborhood of the nest, the conquerors marching back to resume their places in the line of defence, their



object in the destruction of other insects being the protection of their encampment and not the obtaining of food. While one section of the black workers is thus engaged as sentinels, another and still more numerous division will be found busily employed in entering the quadrangle by a diagonal line bearing northeast, and carrying in their mouths flowers and fragments of aromatic leaves which they deposit in the center of the square. A reference to the accompanying sketch will give a more clear understanding of their course, the dotted line, *a*, representing the path of this latter section, while the mound of flowers and leaves is marked *c*. If the line, *a*, be followed in a southwest direction, it will be found to lead to the trees and shrubs upon which another division of the black workers is settled, engaged in biting off petals and leaves, to be collected and conveyed to the nest by their assistants below. On the west side of the encampment is a hole, marked *d*, leading down to the interior of the nest, which is probably chiefly intended for the introduction of air, as, in case of any individuals carrying their loads into it, they immediately emerge and bear them to the common heap, as if conscious of having been guilty of an error. A smaller hole, near to the southeast corner of the square, is the only other means by which the interior can be reached, and down this aperture, marked *b*, the flowers gathered by the workers are carried along the line, *e*, from the heap in the center of the square, by a number of smaller yellow workers (No. 1) who, with their weaker frames and less developed mouth organs, seem adapted for the gentler office of nurses for the colony within. It is remarkable that no black ant is ever seen upon the line, *e*,

and no yellow one ever approaches the line, *a*, each keeping his own separate station and following his given line of duty with a steadfastness which is as wonderful as it is admirable. By removing the soil to a depth of about three feet, and tracing the course of the galleries from the entrance *b* and *d*, a small excavation is reached, which is spread in the form of a spider's web, a network of squares spun by the insects, the squares being about one quarter inch across, and the ends of the web, fastened firmly to the earth of the sides of the hollow space which forms the bottom of the excavation. In each one of the squares, supported by the web, sits one of the honey-making workers (No. 2), apparently in the condition of a prisoner, as it does not appear that these creatures ever quit the nest. Indeed it would be difficult for them to do so, as their abdomens are so swollen out, by the honey which they contain, as to render locomotion a task of difficulty, if not to make it utterly impossible.

The workers (No. 1) provide them with a constant supply of flowers and pollen, which, by process analogous to that of the bee, they convert into honey. The fact that the remainder of the inhabitants feed on the supply thus obtained, though it is surmised, has not been established by actual observation; indeed with reference to many of the habits of these creatures, we are at present left in total ignorance, it being a reasonable supposition that, in insects so remarkable in many of their habits, other interesting facts are yet to be brought to light respecting them. It would be of great value to learn the specific rank of the black workers (No. 3), and to know the sexes of the species forming the community, their season and manner of pairing, and whether the honey-makers are themselves used as food, or if they excrete their saccharine fluid for the benefit of the inhabitants in general, and then proceed to distil more. I regret that at this time I am only able to bring before the notice of the Academy specimens of the honey-makers (No. 2), the other members of the community, except from Captain Fleeson's description, being quite unknown to me. It is, however, my hope that, at a future meeting, I may be enabled to exhibit the other varieties, and to give some more extended information upon this interesting subject. The honey is much sought after by the Mexicans, who not only use it as a delicate article of food, but apply it to bruised and swollen limbs, ascribing to it great healing properties. The species is said to be very abundant in the neighborhood of Santa Fé, New Mexico, in which district the observations of Captain Fleeson were made.

Correspondence.

Height of the Earth's Atmosphere.

To the Editor of the Scientific American:

In an article on this subject which appears this week in the SCIENTIFIC AMERICAN, No. 7, page 101, under the signature of J. E. Hendricks, the celebrated method, first suggested by Kepler, of determining at what height the atmosphere ceases sensibly to refract light is explained and illustrated. Nothing can be added to the lucid and compact statement of your correspondent.

I propose, however, to suggest a new method of proving the height of the atmosphere, which is worthy of attention on account of the precision with which such element in the formula can be determined. The average highest temperature under the torrid zone is not to be identified with the mean temperature, which is much lower, being about 83° Fahr., while the highest temperature is 111.5° Fahr.

Let *d*=density of air on the hydrogen scale, *h*=height above base, *p*=pressure at base, *a*=coefficient of expansion per 1° Fahr., and *t*=average highest temperature at equator. We will take one mile of atmosphere, one inch in thickness, on which to make the experiment and test the formula, so as to estimate the height to which this atmosphere will extend when all the elements have been applied.

$115^\circ \text{ Fahr.} \times 0.002036 \times 14.75 \times 14.416 = 48.2478$. Otherwise arranged for our terrestrial atmosphere: $h = \frac{t \cdot p \cdot d}{a}$ = 48.2478 miles; $t = \frac{h}{d \cdot p \cdot a} = 111.5^\circ \text{ Fahr.}$; $a = \frac{h}{d \cdot p \cdot t} = 0.002036$;

$d = \frac{h}{t \cdot p \cdot a} = 14.416$; $p = \frac{h}{d \cdot t \cdot a} = 14.75 \text{ lbs.}$

Hence, it follows that, if we could take a mile of our atmosphere, or any other pure gas of equal density, and subject it to the temperature, expansion, pressure, and density which are now normal to our atmosphere, it would reach an altitude of 48.2478 miles; and the refraction of twilight confirms this result, for it terminates when the depression of the sun below the horizon amounts to 18°, or, more correctly, 17.8°.

It is easy to deduce from this fact that the atmospheric refractive power ceases when the light exceeds 49 miles; for the angle of incidence and also of refraction being each 9°, we have $9 \times 69.5 = 625.5$ miles; hence $625.5^2 \div 7925$ (earth's diameter) = 49.3 miles, height of refractive atmosphere. Our new formula gives the result 48.2478 miles with much greater precision, and the angle 17.8° more correctly agrees with observation than 18°.

PATERSON, N. J.

Pure Air in Cars.

To the Editor of the Scientific American:

The desire of your correspondent F. S. C. for pure air in railroad cars might be gratified by constructing ventilating filters, which should be regulated by the conductor or some other official. The filters should be made of thin layers of raw cotton, kept in place by coarse wire gauze. This, I believe, is the best air filter known. They would require cleaning or removing perhaps once or twice a month. E. M. G. Jr.

Baltimore, Md.



THE GREAT EXPOSITION—LETTER FROM UNITED STATES
COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 10.

VIENNA, August, 1873.

In the Machinery Hall, the United States is most largely represented in that section of the classification which embraces

WOOD AND METAL WORKING TOOLS,

and we find strongest competition also in this section of the exhibits of the principal foreign countries. The largest and at the same time most noticeable exhibitors of metal working machine tools are Messrs. Sellers & Co., the Browne and Sharpe Manufacturing Company, and Pratt & Whitney, from the United States, Messrs. Sharp, Stewart & Co., Ransome & Co., and two or three other firms from Great Britain, and Ducommun & Co., from France. These firms all exhibit machinery which is remarkable for neatness and effectiveness of design, excellence of material, wonderful accuracy in fitting up, and also for the extent to which tool finishing has been made to excel and to supersede the older practice of finishing by hand. Many other firms, and especially those of European countries, exhibit fine looking tools; but there is usually but little originality to be discovered in their designs, and they present, to the eye and hand of the mechanic accustomed to our American practice, evidence that they have been produced under a system which is now rapidly going out of use in the United States and Great Britain. Half effaced file marks show that the more truly mechanical method of obtaining accurate surfaces by the use of the broadnosed tool and the many other refinements of modern practice are unknown to their builders.

The beautiful planer of Messrs. Sellers & Co., with its odd kinematic combination of the worm and the rack for driving the table, and its neat reversing gear, have long been known to mechanics at home. That at least some of the leading foreign builders have also appreciated it is proven by the appearance, in the exhibits of continental firms, of copies of this machine marked "*système Sellers*." All other nations, in fact, seem to copy American and British machinery, and rarely to produce original designs. In many cases, the copy is acknowledged, and sometimes the fact is made prominent in the circulars of the copyists, with the evident knowledge that it will render their productions more readily salable. Where attempts have been made to produce original designs, the departures from our standards have very generally been marked by most awkward proportions and frequently by extremely ungraceful shapes.

There is really very little in the exhibition which approaches, in any respect, the machinery exhibited by the several firms named; and those American mechanics who have come here to learn acquire only the knowledge that those from whom they expected to learn are simply following the leaders whose practice is already familiar to every American and British artisan. Nearly all of the machinery of this class in the United States section has been for a long time placarded "sold;" and it is extremely probable that several of the more novel machines have been purchased to serve as models from which to copy. Looking at these fine pieces of mechanism a few days ago, a distinguished member of the jury, whose opinion is probably as much respected as is that of any one of his colleagues, pronounced their builders "the leading constructors of the world, beyond dispute." And as even the leading French firm of Ducommun & Co., and the leading firms of every other nation (not excepting, in some departments, the British), copy their constructions, it may be readily believed that our American mechanics are occupying a most creditable position. The Sellers planer, the Browne & Sharpe universal milling machine, and the Pratt & Whitney screw cutter seem to have been most copied.

In the manufacture of metal working machine tools, the practice in America and in Great Britain is generally very similar. Strong, heavy frames, the absence of all moldings and other kinds of ornamentation which were so much in vogue a few years ago, great accuracy of workmanship, and the least possible use of hand tools (either in "assembling" or in finishing) seem the prominent characteristics on both sides of the Atlantic.

If a difference is remarked at all, it is usually that British builders put in more metal and build rather more substantial machines, while the Americans excel in the ingenuity and skill which they display in matters of detail. It may certainly be questioned whether the former do not err in

building machinery with a view to such extreme endurance. Improvements take place so rapidly that these very long-lived machines must frequently be superseded long before they are worn out; and when thrown into the scrap heap, they still represent considerable capital; and the machine which is set aside by the progress of improvement, at a time when it has more nearly reached the limit of its endurance, is the better machine of the two. To determine precisely where to find the proper limit is certainly a problem; but it can hardly be doubted that our best machinery is capable, usually, of doing good work for a length of time which will probably exceed that limit. It may be added also that, where capital is as valuable as it is in the United States and in all new countries, a good business policy dictates that a smaller proportion be expended in first cost and a greater in maintenance than in countries like Great Britain, where capital is plentiful and cheap.

The remarks which have been made in regard to metal working machinery at the Vienna exhibition will also apply to wood working machines. Here, also, the United States and Great Britain have been the leaders and the originators, and continental builders have copied from them. In this department, the American mechanic can probably claim more credit for originality than the British; but our transatlantic competitors, while adopting American machines, have sometimes improved upon them, and they have generally built them very much more substantially. This contrast is much more marked here than in the preceding class of machines, and attracts considerable attention. The British machines are also all painted a plain lead color, while those from the United States are often elaborately painted in "loud" colors. While the latter colors offend the eye of our friends on this side of the water, they also render more apparent the difference in strength and simplicity of frames. A comparison of the work done by the two is not at all to the disadvantage of the American; and a comparison of prices, making allowance for the difference in the cost of stock and of labor which is charged against each, is decidedly in our favor.

In the French section, the

BAND SAW

is exhibited by Perin, its earliest successful constructor; but the leading English firm of Ransome & Co. copy the beautiful machine of Richards, London & Kelley of Philadelphia. We consequently find exhibited, in the United States and British sections, a pair of precisely similar machines. The most thoroughly well contrived band saw in the exhibition is, perhaps, that of Mr. B. D. Whitney, the inventor of the pail-making machinery which has so greatly interested visitors, particularly foreigners, who are not generally familiar with machinery of special application. In this band saw, the arrangement of spindle bearings and of springs, and the contrivance for taking the back pressure of the blade, are exceedingly well planned. Perin uses neither springs nor weights, but the British builders use weights very generally for taking up the stretch of the blade as it warms up and expands while running. A well arranged spring, in consequence of its greater compactness and the absence of motion, is considered by our mechanics to be preferable; but the weight is almost invariably used in Britain, and Perin insists that, when a saw is hot enough to slip on its pulleys, it is time to stop it, and thus explains his omission of that detail. The French exhibit some beautiful specimens of band saw blades. Of

WOOD PLANING, MOLDING, MORTISING, AND OTHER MACHINES, the largest and finest collections are found in the British section. Rogers & Co., Fay & Co., and Witherby, Rugg & Richardson, who are the exhibitors of the excellent tools in the United States section, while equaling in quality, do not all taken together equal in magnitude the exhibits of either of several British and continental builders. The patterns used throughout are, however, generally those which, having become standard in the United States, have spread abroad. The continental builders exhibit nothing original; but a few firms make very creditable copies. Some of the Swiss work is excellent, and the German exhibits of Zimmermann and of Schmaltz, with the fine display of Carl Pfaff from Austria, are also well worthy of notice. The latter is "*ausser Concours*," its exhibitor being a member of the jury.

The British builders seem to find a market for what they call a

COMBINATION MACHINE,

and nearly every exhibit contains an example of this *multum in parvo*. A planing and a molding machine, a circular saw, a mortising and a tenoning machine are all placed on one compact but exceedingly complicated frame. Its compactness and the somewhat lower cost, as compared with a similar collection of detached machines, are probably the reason of its success in the market. It seems improbable, however, that it can be well adapted for use in establishments where much work is done. Separate tools, with ample space around them, with more accessible parts, and which may be used independently, are indispensable for such places. These combination tools seem well adapted for pattern shops and for small carpentering establishments.

The French section contains one wood planer which is particularly interesting and novel. The knives are slender strips of steel which are wound spirally in grooves about a metal cylinder revolving on a horizontal axis above the table of the machine. The knives are thus so contrived as to make a "draw" cut, and do their work rapidly and beautifully. The machine would, however, probably prove far less efficient were it not for the neat method adopted of setting and sharpening these spiral blades. Directly above the cylinder carrying the knives, and upon a parallel axis, re-

volves an emery grinding wheel, which can be very readily set properly; and being then put into rapid motion, it is moved from side to side by a slow feed while the knives are slowly revolved beneath it. The blades are thus sharpened in place and are given perfectly keen, straight and properly set cutting edges. The blades themselves are simple in form, very light, and are easily made by cutting them out of thin steel plate. This seems a most excellent tool. It does not require the fixed scraping blade which is now so generally adopted for making the smooth finishing cut on the ordinary tool.

In the manufacturing of

MACHINE TOOLS OF ALL KINDS,

the ideas which have been the secret of the success of our largest builders,—that of making them in large quantities from carefully considered and standard designs, and of doing as much work as possible by means of machines, specially constructed for the accurate production of each important detail; in fact, of manufacturing, rather than simply making (and of which the sewing machine and the gun-making trades are the most perfect illustrations),—are at last becoming appreciated and are being adopted on this side of the Atlantic, manifestly to the great advantage of both producers and consumers.

There is, however, one way in which it tells strongly against them where they compete with our own people. Lacking that wonderful ingenuity and originality which Nature and our

PATENT SYSTEM

have conferred upon the American mechanic, their standard designs are always a little less perfect than our own standards. They are what were standards with our builders at an earlier date, and thus it happened that, while always closely following, they never quite overtake. The modern system of manufacturing renders change of design a far more important matter than before, and the caution which is naturally induced by the expense of changing designs tends to keep them farther behind. A liberalization of patent codes and the gradual training of the workmen of Europe to a knowledge of the importance of good workmanship and of the methods of securing it will, at a time which we may hope is not very far distant, do much toward remedying all this, and toward the improvement of the condition of the people in Europe. We draw some of our best material from among them, and it seems sufficiently evident that not upon Nature but upon man's own imperfect political systems lies the responsibility of the existing unsatisfactory conditions of manufactures in Europe. R. H. T.

Arctic Regions.

The 80th of the series of papers on the progress of geographical research in the polar regions, published by Dr. Petermann in his *Mittheilungen*, contains a *résumé* of what is known from all sources respecting the American north polar expedition under the late Captain Hall, and is accompanied by an elaborate map, in which the results of this expedition, as far as these are known, have been critically compiled, together with data of the former voyagers, Kane and Hayes. The story of the *Polaris* voyage is already well known in England, and no fresh tidings of the ship, which wintered, 1872-73, with the ten remaining members of her company on the coast of Northumberland Island, in lat. 77° 20' N. in Baffin Bay, have reached us since autumn of last year. Two vessels, however, generously sent by the American Government, have for some time been on their way northward to find and succor the *Polaris* crew.

In his remarks on the general results of this voyage, Dr. Petermann draws a remarkable contrast between the advances made by the various expeditions which have been undertaken in steam vessels, and by those in which sledge traveling has been tried; maintaining that, since Hall's expedition had shown that there is no such thing as a permanent covering of ice in this branch of the Polar Sea, sledge traveling is little to be depended on, and steamships should alone be employed. The discovery of drift wood on the shores of Hall Land (the east coast of Robeson Strait, between 81° and 82° N.) makes it not improbable, Dr. Petermann believes, that the land breaks up here into an archipelago of islands, or at least that there is communication by which Asiatic drift wood finds its way hither; and on the other hand the presence of numerous musk oxen in these regions makes it very probable that Hall Land is in uninterrupted connection with the coast of East Greenland in lat. 77° N., explored by the second German expedition of 1870-71.—*Academy*.

PRODUCTION OF VEGETABLE TISSUE.—It has been ascertained by Professor E. N. Horsford that an ethereal extract of green leaves, which has been separated by hydrogen chloride into two layers, a yellow and a blue layer, contains in both portions phosphoric acid, iron, potassium and calcium. He has further observed that a mixture of sodium phosphate and iron protosulphate in presence of water is able both in light and darkness to reduce carbonic acid to carbonic oxide. From these observations it appears probable that the formation of a solution of a phosphate of iron protoxide may be a preliminary stage towards the production of vegetable tissue from the element of carbonic acid, water and ammonia. Formic acid, it is well known, may be formed by the direct combination of carbonic oxide and water.

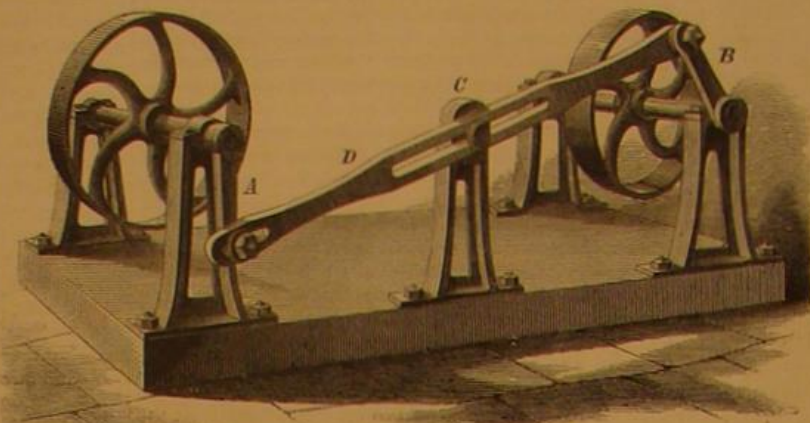
THE cast-iron works of Mr. Krupp at Essen, Prussia, now cover an area of 1,000 acres—larger than the Central Park, New York city. Nearly 18,000 men are employed in connection with the works. The area under roof is 200 acres.

DEVICE FOR TRANSFERRING MOTION.

By means of the invention represented in the annexed engraving, an efficient substitute, it is claimed, for cog wheels is provided, in cases where it is desired to transmit motion from one shaft to another, both working with the same velocity. The device is stated to be cheaper and to operate with less loss of power than the cog wheel gearing; and also, to be able to transmit positive power for any distance, from one to twenty feet, and thus is of especial use in cases where belts would slip.

A and B are crank arms of two shafts, between and in a line with which is a fixed standard, C. The latter at its upper end has a stud or pin. Dis the connecting bar, slotted longitudinally along its middle part for connection with the stud on the standard, as shown. One end of this bar is pivoted to crank arm, B, and the other extremity is provided with a short slot by which it is connected to the pin of the opposite crank.

When one shaft is set in motion, power will be communicated by the lever, U, to the other, which will rotate in an opposite direction. The inventor believes that, by connecting together a number of these devices (attaching a third shaft to the second by another lever, and similarly a fourth to the third and so on), power may be transmitted over considerable distances. Patented July 15, 1873, by Mr. William H. Benson, of Waynesboro, Augusta county, Virginia, who may be addressed for further particulars.



BENSON'S DEVICE FOR TRANSFERRING MOTION.

almost every thing in the line of fruits, flowers, and plants grown in Indiana. James Vick, the Rochester florist, offers prizes to the amount of \$150 on flowers grown from seed purchased of him.

In the mechanical department, every facility will be afforded for a thorough and complete determination of the merits of the articles contributed. All machinery will be in motion. Ample space and power will be furnished, free of charge. The driving engines will be in operation one week or more previous to the opening of the exposition, so that machinery may be adjusted and in proper running order on opening day. The main line of shafting will be speeded at 200 revolutions per minute. Pulleys will be 20 and 24 inches in diameter. Other sizes of pulleys will be put on the shafting, if furnished by exhibitors three weeks previous to the opening of the exposition.

Twenty thousand dollars, payable in cash, gold and silver medals, and diplomas of new and elegant design, are offered in premiums for articles mentioned in the premium list, ob-

vessels, covered with a bladder, paper, or good closing lid. If the linen filter is not thick enough to keep other ingredients from passing through, besides the liquid tallow and water, it is better to repeat the filtration. Tallow thus obtained may be used for ordinary food, for pomades by the addition of pure olive oil, for salves and plasters, by the addition of white wax, and may be kept well preserved for a time, as free from smell as when first prepared.

Asbestos Piston Packing.

From an address, by J. G. Gibbon, before the London Association of Foreman Engineers, it appears that the name of this indestructible compound is derived from the Greek word *asbestos*, which, translated, literally means unburnable—a title which is justly earned by this extraordinary substance. Asbestos is a mineral; it is found in nearly every part of the world, and occurs in distinct veins and seams, usually in the serpentine formation of rocks. In order to procure it, it is necessary to mine in regular form, and to work the seams by blasting and tunneling. The manufacture of asbestos steam packing is at once a simple and beautiful process. The raw material is brought to the manufactory in considerable quantities from different parts of the world. It comes in sacks, and resembles most closely chips and blocks of wood, although of a beautifully white color. The fragments are picked apart and reduced to a fibrous condition like jute, or flax, or cotton.

The material once properly opened up, it is, by means of simple and ingenious machinery, formed into packing of the usual market sizes. The machines themselves are as easily attended to as are weaving looms. As to what has been really accomplished by this packing, I have no direct evidence to offer, but from the sample I have here I think it does not seem to possess a good fiber; and that when the flaxen twine which binds it is cut, it will become very much like cotton waste. I am inclined to think, therefore, that when the glands get heated and the flaxen twine is cut through, it will blow out like charred flax, and have no elasticity. However, I am here to be corrected in my opinion, if I form a wrong one, by those who can offer contradictory evidence. A large screw steamer lying in the West London Docks has just replaced the whole of its packing by asbestos.

Uncomfortable Car Seats.

Why do not the makers of street cars contrive a seat back that will be comfortable? Do their customers (preferring "short fares") order the cars to be made so as to discourage long riding? It would seem so, unless the painful curves of the seats are specially contrived to accommodate the humps of wirework and newspapers, so much affected by the women folk. Certain it is that the human form divine, male or female, has no curves to correspond with those set for the weary traveler to lean against. Only by making a hoop of himself can any normally shaped human being get his spine to touch the seat back where it ought to find support.

A caustic Briton declares it to be a characteristic of the genuine American that he always wants to sit on the small of his back. To judge from the ordinary structure of car seats, one would think his sole desire to be to hang himself up by the shoulder blades, the only certain line of contact between the sitter's back and the seats invariably crossing that portion of the body. Below that line, you can usually stuff a book or a bundle, or even a small satchel, with ease and comfort.

In many cases the original perversity of the seat back is heightened by fasten-



ENELL'S AUTOMATIC BOAT DETACHING APPARATUS.

Patented April 29, 1873. For further particulars address the inventor, Mr. Charles A. Enell, 307 Walnut street, Philadelphia, Pa.

THE INDIANA STATE EXPOSITION.

Indianapolis, during the coming fall, is to be the location of an exposition of the industries and manufactures of the State of Indiana. Whether or not the fair, in comparison with the similar shows to be held in St. Louis, Louisville, Chicago, Kansas City, and other points, will realize the anticipations of its projectors in being the finest exhibition in the Western States, it all events deserves the credit of being organized in a thorough and substantial manner, and after a system which, it seems to us, might be profitably followed in all future local displays. A committee representing the State conferred with another delegation from the capital city, and the joint body decided on the amount necessary to secure the State from any loss. This sum, fixed at \$100,000, was guaranteed by the leading firms and individual citizens of Indianapolis; and, thus founded on a sure pecuniary basis, the preparations for the enterprise were begun; committees were sent to other cities to obtain information regarding cost and construction of buildings, and then plans were submitted and fixed upon. The State fair grounds were ready at hand, so that no land had to be purchased. The buildings are now completed, and they afford a grand aggregate of over four hundred thousand square feet of exhibiting space. There is to be a fine collection of paintings in the art department; and a

tainable on application. Saw mills, reapers, mowers, threshers, separators, and grain drills will receive no award, for the reason that it is not practicable to have such thorough tests and examination of their merits as will be just to the exhibitor. The board will, however, provide every necessary facility for their display, and propose, as an inducement to manufacturers and dealers in these articles, to appoint an examining committee, composed of members of the board, who will give each article of this kind such consideration as will enable them to report their respective merits for publication in the annual reports. We also learn that, by special request, no premiums will be offered for fire and burglar-proof safes, bank and safe locks, sewing machines and musical instruments. The fair opens on September 10, and closes on October 10.

To Purify Tallow.

In order to obtain tallow quite free from smell, and to preserve it for a long time without becoming rancid, the following simple process, says the *Chemical Review*, may be used. The fresh tallow is melted in boiling water, and when completely dissolved, and consequently hot, it is passed through a linen filter—it is then boiled along with the water and carefully skimmed—then rendered solid by cooling and washed with water, and lastly separated from it carefully by pressure. It may be melted at a moderate heat and preserved in earthen although ample provisions will be made for their exhibition.

ing a ridge of wood so as to increase the gap between the hollow of the sitter's back and the opposite curve of the seat. If the same board were placed six inches lower down, it would make some approach toward affording the passengers a back rest where it is most needed.

The Compass in Iron Vessels.

Captain R. B. Forbes, of Boston, Mass., states that the compass in iron ships is specially affected in certain localities on the coast of Nova Scotia, which accounts for the loss of steamers in that region. He further says that, in spite of corrections, applied in England, whereby iron ships may be safely navigated in a given course approximately west-south-west and east-north-east, when they come to head more to the north or south by several points on the American coast, their corrections, good on the coast of England, are valueless in some ships. It is well known that the heeling of the iron ship, the rolling, the pitching, the concussion of the waves, have an important effect upon the compass—hence, nothing but constant observations of the sun at noon and the north star can insure a correct course.

W. P. H. suggests placing a box in the corner of a room for the purpose of destroying a rat or mouse. Let there be room enough for the vermin to get behind the box, and a little pressure will crush the offender against the wall.

Journalism.

There are three papers published in this country, which, taken together, are adapted to furnish a liberal education to any person who will read them conscientiously and intelligently. These are the *New York Tribune*, the *Nation*, and the *Scientific American*. The first is distinguished as the very Bayard of newspapers—without fear and above reproach. Its news is accurate, comprehensive, well arranged; and it is written in excellent English. The *Nation* we admire as a literary journal. Though its political articles are admirable specimens of candid and able writing, its reviews of books are more characteristic and distinctive. The *Scientific American* is least known of the three papers mentioned, for the reason that it is popularly supposed to be designed for specialists. Nothing could be further from the truth. In the same sense that the *Tribune* is only a newspaper and the *Nation* only a literary journal, the *Scientific American* is only scientific. It is worth, to the man of common school education, twice over more than any rival journal in the United States, and it will teach no man to despise the English language, or to regard less the pursuit of knowledge—for its own sake, and for what it will bring. What we have written is wholly unsolicited testimony to the worth of three papers that come to this office; it is given from the purest motives, and without the slightest idea that it will be of service to anybody, except those persons whom it may induce to subscribe for one or all of three excellent journals.—*Interior*.

THE TURKISH TREASURE PAVILION AT VIENNA.

Among the one hundred and forty special buildings, in addition to the main exhibition edifice, pertaining to the Vienna World's Fair is the Treasure Pavilion of the Sultan of Turkey, or King of the Ottomans. The pavilion is in the form of an oriental kiosk. The domed within ceiling is painted in arabesques, and pendant from it are five large golden walls. Here may be read the history of the Sublime Porte from the days of the conqueror of Byzantium, Mahmoud II., to the present Padishah, Abd-ul-Aziz. The golden throne of Nadr-Shah is here, which was renowned in the East before the peacock throne of the Great Mogul at Delhi was dreamed of. It is marvelous in its workmanship, large enough for a coach, and weighs four and a half hundredweight. It is enameled in celadon, green and crimson, and its patterns of arabesque are in rubies, emeralds and pearls. Above it hang the turban and armor of Sultan Murad, heavy with gold and gleaming with jewels. Near it are the horse caparisons of Selim III., with the heavy Mameluke stirrups and Arab bit of solid gold, encrusted with diamonds. Scabbards, where nothing but diamonds can be seen; cinctures of diamonds; bowls of China porcelain, their patterns marked out in gold and reset with rubies; clocks encased in diamonds and glistening with crescent moons and stars; hookahs with golden bowls, and chibouques whose amber mouth pieces are encircled with rings of diamonds, gleam and glisten everywhere.

The value of the Turkish treasures contained in the pavilion is estimated at \$27,500,000.

Finishing Stereoscopic Transparencies.

The method adopted by many, of fitting up transparent slides for the stereoscope by mounting them with a plate of ground glass is very far from being a good one. The coarse granularity present in a picture when in juxtaposition with ground glass is totally subversive of the fine details.

Thin paper has been tried as a backing for stereoscopic transparencies, but no sample that we have seen is free from objection. It is true that when it is used the granular appearance peculiar to ground glass is no longer present; but paper has a kind of texture and unevenness peculiar to itself, which is very far from being pleasant; and when such a quality of paper is used as shall be homogeneous, it possesses so much "body" as to seriously interfere with the transmission of light.

The requirements of a body that shall act in the most perfect manner as a backing for stereoscopic slides are homogeneity, a requisite degree of translucency, and facility of application. The great manufacturers of transparencies in France thought they had provided a successful rival to ground glass by the introduction of "ground glass varnish," that is, a varnish which, instead of drying bright and transparent, dries dead and, therefore, more or less granular. A varnish composed of wax dissolved in chloroform is a type of this class of varnish. But none of these ground glass varnishes answer well for the purpose in question; while, however, they are quite as good as, in most instances better than, ground glass, they are still inferior to what they should be. A backing of a far superior kind to any of those now in general use may be made by means of white pigment, emulsified with one or other of several substances that we shall name presently.

Carbonate of lead forms a good pigment for the purpose. It is known as white lead, and flake white. The carbonate of commerce usually contains a large proportion of sulphate of barytes, which, however, does not affect it for this purpose. Some samples of carbonate are more opaque than others. It may be made of a fine translucent character by precipitating a solution of either acetate or nitrate of lead by a solution of carbonate of soda, by which carbonate of lead is precipitated and acetate or nitrate of soda left in the solution. When this is washed—at first with water, and then with methylated spirit—and is added to plain collodion, an emulsion is obtained which, when poured upon a plate of glass, forms a layer of great smoothness and uniformity, and as free from apparent grain or texture as a plate of opal glass.

Another fine white, known as "miniature painters' white," is obtained by adding dilute sulphuric acid to an acetic or nitric solution of litharge, and washing the white precipitate. There is a fine and permanent white known as "alum white," which makes a beautiful emulsion with collodion. It is known by some as "Baumé's white," and no difficulty ought to be experienced in obtaining it under one or other of these designations. Ordinary Spanish white we have not found to answer well; but pearl white, sometimes called "Fard's Spanish white," makes a useful pigment

for our purpose. It is the trisnitate of bismuth, and in he favourite pigment used by ladies who do not feel satisfied with the degree of whiteness imparted by Nature to their complexions.

When one of these pigments is mixed with collodion and is applied either to the picture itself (although, without an intermediate layer of gum or india rubber, this cannot be done) or the face of the protecting glass, next to the picture, the transparency will then have a charm it never previously possessed. The most delicate tints will be seen with even greater distinctness than if a backing of opal glass were employed; and the operation can be conducted with great celerity and at a trivial cost, for the quality of the collodion need not be taken into consideration.—*British Journal of Photography*.

Boiler Explosions.

R. S. H. writes to deny the possibility of the formation of an explosive gas in a steam boiler, and states his belief that the small quantity of water injected at a time, by a feed pump, could never cause an explosion, even if some of the plates were red hot. Further, a red heat would, he says, assuredly start the seams and cause leaks so as to extinguish the fire before water could come in contact with the plates. He asserts that high pressures are much more dangerous than people generally believe, even if the boilers are unusually strong; and he cites, as an instance of the manner in which safety valves are overloaded, a case on the Union Pacific Railway, in which the engineer tied down the valve lever of a new Baldwin ten wheeled engine; in a few seconds the boiler burst, and six inch axles were torn in two by the explosion.

Ship Canal through Syria.

T. L. F. writes to point out the possibility of constructing a ship canal along the valley of the Jordan, the advantage in the route being the low level, which is beneath that of the Mediterranean. There is no doubt of the possibility of such a work, but its magnitude, and the fact that the Suez canal is already in operation between the two seas, will probably deter capitalists from aiding the scheme.

CORK JACKETS FOR STEAM BOILERS.—M. Chevallier, a French engineer, has adopted cork for the jacketing of boilers and other parts of machinery. Cork is known to be an excellent non-conductor of heat, and these cork jackets are said to diminish the outward radiation by 15° C. The cork is cut in the form of staves, and these are united together by tongues, as in the case of flooring boards, so that the lines of junction are protected, while the cork staves are easily removed when the necessity occurs. Portions of one of these jackets, which had been on a boiler at work for fifteen months, were exhibited the other day at a meeting of the Paris Society for the Encouragement of the Arts, etc., and were not found to have been in any way affected by the heat of the boiler.



THE TURKISH TREASURE PAVILION AT THE VIENNA EXPOSITION.

THE MAGIC LANTERN AS A MEANS OF DEMONSTRATION.

BY HENRY MORTON, PH.D.

PART 2.

We have thus far considered the condensers chiefly in reference to the first portion of their office, namely, that of collectors of light from the radiating source. We will now, however, pass to some of those general considerations which may claim our attention when we look at the condensers in their relation to the objects and object glasses or objectives.

RELATIONS OF CONDENSERS AND OBJECTIVES.

To make the subject entirely clear, we should revert for a moment to the general properties of lenses as producers of images from luminous objects. Let CD (Fig. 6) be such an object, as a candle flame, placed a little beyond the principal focus of the lens, AB . Then all rays emanating from any point (as, for example, C) will be collected at a corresponding point, E , and will there form a point of the image, EF . This will be true for each point of the flame, CD , and consequently a perfect image of this flame will be formed at EF . The perfection of this image would evidently be unaffected by any possible irregularity in the rays from CD . Thus, if very few rays went in the direction, CA , and nearly all followed the line, CB , the point of the image, at E , would be the same as if all the rays reaching it came through CA .



FIG. 6.

If, now, in place of the candle flame, we suppose a luminous surface to exist, at CD , an image of this surface will be produced at EF , and will be clear and uniform, provided only that the surface, CD , is uniform in emitting equal amounts of light from its different points, no matter how irregular may be the directions of the rays leaving these points, always providing that they enter the lens, AB .

Thus, suppose that, in the luminous surface, ACB (Fig. 7), rays from A were so emitted that above they were closely packed, while below they were thinly scattered; rays from B were emitted in an opposite order, and from C were close packed in the center and scattered on the outside; yet, if an equal number of rays or quantity of light came from each element, the image of each would be equally bright:

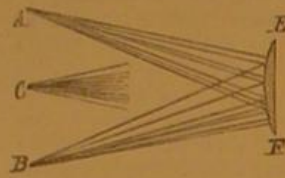


FIG. 7.

and if this were true of each point or element of the surface, the image would show a uniform field of light, no matter how irregular the emission of the various points might be as regards the direction of the rays. If, however, one point emitted or furnished more rays than another, or gave light of a different color, any such irregularity or difference would be represented faithfully in the image.

We will now apply these general principles to the case of the magic lantern. Let AB (Fig. 8) be the front element of the condenser, through which rays are passing into the object glass, CD , which is at such a distance that it makes on the screen, EF , an image of any point in AB . Then, if an equal amount of light is coming through each point of AB , an uniform white disk will appear on the screen, EF , no mat-

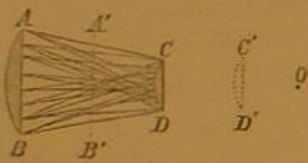


FIG. 8.

ter how irregular (in the sense above described) are the directions of the rays. The irregularities will, in fact, be very great, for besides such as are due to the aberrations of the condensers, these lenses will themselves be tending to form somewhere an image of the source of light. In fact, such an image would be formed, at O , about the principal focus of the lens, AB , if the objective, CD , were removed. This formation of an image at O involves a great irregularity of the distribution of light between O and AB , indeed, the existences of imperfect images of the source of light. But of all this, the objective, CD , takes no account, and simply forms, at EF , an image of the distribution of light which actually exists at AB . Suppose now, however, that CD were removed to $C'D'$. Its focus remaining as before, it would clearly form an image, not of the surface, AB , which is now beyond its reach, but of a surface, $A'B'$, at its proper distance. But it evidently would by no means follow that, because the light was evenly distributed at AB , it must also be so at $A'B'$. On the contrary we have already seen that, as we advance from AB , the distribution of the light will become more and more irregular; and it will be an image of this irregularly luminous surface which will be thrown on the screen at EF .

This shows us that, to secure a clear and even field of light on the screen, we must, in the first place, have such a combination of lenses in the condenser as will secure an even distribution of light at the outer surface of the last lens;

*Note.—We are here, of course, neglecting all effects of aberration, or, in other words, are assuming an ideally perfect lens, as the point in question does not depend upon any of the conditions so excluded.

and, secondly, that the objective must be so placed that it will, as we say, "focus" on this surface, that is, have this outer surface of the condenser and the screen as conjugate foci. To fulfil this last conclusion it is evidently necessary that the object (such as the picture to be shown, or the like) should be placed close to the front of the condenser, since it, as well as this surface, must be in the focus of the lens, that is, the conjugate focus with the screen. It is for this reason that the plan, sometimes proposed, of using a small picture with large condensers, by bringing the picture forward on the cone of rays to some point where they will just embrace it, fails of a satisfactory effect. The field of light is more or less discolored and unequal; and though, by cutting off its margin, we can improve this, it is at best but unsatisfactory as compared with the effect obtained with the same light and smaller condensers. The same explanation also shows us the advantage of that divisibility of the condenser, which we have before mentioned, into the collecting lens or lenses, by which diverging rays are brought into a parallel bundle, and of the condenser proper by which they are concentrated into the objective. Thus, for example, suppose that we desire to polarize the light, by reflection, from a bundle of glass plates. If the condensers are inseparable, the object must be placed beyond the reflecting surface, and therefore very far from the surface of the condenser, and thus involve an uneven field of light, not to mention imperfect polarization, in consequence of the difference in angle of various parts of the cone of light.

If, however, we can separate the condensers from the collectors, and introduce the reflecting surface between, we then have the rays all parallel, when reflected hence at the same angle and equally polarized, and the object in contact with the front surface of the condenser (see Fig. 9). Again, if we desire to exhibit objects that must be kept in a horizontal position, such as waves in a tank of water and the like, this separation of the condensers affords a ready means of accomplishing it in a most satisfactory manner. This modification of the instrument is, however, so important an appliance to the magic lantern, when used as a means of demonstration, that it deserves some more extended notice.

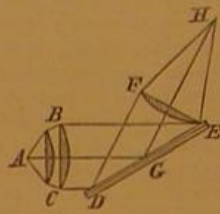


FIG. 9.

THE VERTICAL LANTERN.

This instrument involves such natural and simple applications of appliances, familiar to every one using such apparatus, that, as we might naturally expect, in some form or other it has been independently devised by several persons. Thus such an attachment to his ordinary lantern was made by Duboscq, at least as early as 1868, as the present writer is informed by Dr. H. Schellen, the renowned author of "Spectrum Analysis," though this manufacturer does not seem to have thought it worth while to describe it until very recently. From the imperfect arrangement of the condensers, it also does not yield very satisfactory results.

Professor J. P. Cooke, of Cambridge, Mass., used a vertical lantern at a very early date, of which he published a description in the *Journal of the Franklin Institute* for December, 1871, Vol. LXII, page 411. In the *Chemical News* for July 8, 1869, is described a very imperfect arrangement in which the lantern is turned over on its back, and a square prism is used to throw the rays upon the screen. Beside the inconvenience and danger to the lenses, of having them thus directly over the light, the square prism fails to reflect a large part of the rays unless the screen is very much above the level of the lantern.

In the *Chemical News* for February 25, 1870, there is described, by Edwin Smith, M. A., an arrangement for showing the motions of a galvanometer on a screen, identical in all respects with that of Duboscq and Professor Cooke. In none of these were the conditions required by theory, as above explained, fully provided for, and the action was consequently so far unsatisfactory that the instrument was never brought into any general use.

The form devised by the present writer, in 1871, which seems first to have made its way into general use and to have conferred the name "vertical lantern" on the instrument, is shown in the accompanying engraving, Fig. 10. The collecting lenses of the condensers are attached to the ordinary lantern box, and are omitted in the figure; and from them a bundle of parallel rays falls on the

FIG. 10.

mirror of silvered glass, AB , and is reflected upward to the condenser proper, placed horizontally at C . Passing through

this it meets the object, a tank of water or the like, resting or supported immediately above, and then traversing the objective, EF , is, by the mirror of silvered glass, FG , thrown upon the screen.

Mr. George Wale, of Hoboken, N. J., by whom this instrument was first made for the present writer, has devised a very pretty arrangement by which all the advantages of the vertical lantern can be combined with those of the ordinary instrument, and has manufactured a large number of such instruments, which are now in use in the principal colleges of the country.

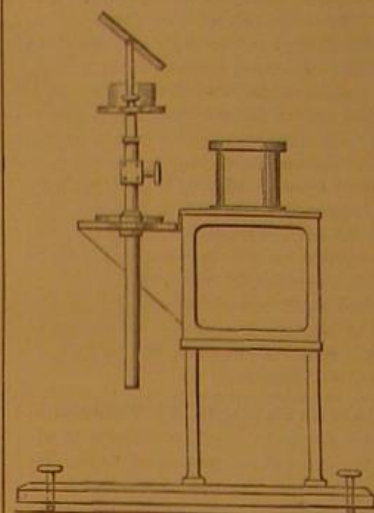


FIG. 11.

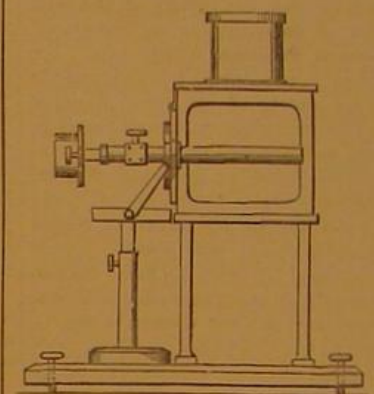


FIG. 12.

been heretofore constructed. But while it is desirable to have the most perfect appliances where we can, yet much may be accomplished with very simple means. Thus Dr. R. M. Ferguson, in the *Quarterly Journal of Science*, 1872, No. XXXIV., page 267, suggests the following arrangement, in which only such apparatus as is found in any laboratory is needed, in addition to an ordinary magic lantern. The condensers of ordinary lanterns are generally of rather long focus, so that if the light is brought to within about three inches, a bundle of approximately parallel rays will be obtained. An ordinary retort stand is then so arranged in front of the lantern that its lowest ring shall carry a mirror, and the next one a large watch glass filled with water. This makes the condenser; and, if we want to show the motions of waves or cohesion figures, this water-lens itself furnishes the necessary tank. The object glass and second mirror are carried by another ring of the same retort stand. The present writer has further simplified this construction by using a small watch glass, also filled with water, for the objective. This last, indeed, gives us a curious means of illustrating certain relations of lenses. Thus, with the ordinary vertical lantern, we remove the objective and substitute a watch glass. Then, placing a conspicuous picture as an object upon the condenser, we see only a blur of light on the screen; but as soon as a little water is poured into the watch glass, the image starts out with perfect distinctness. If, now, the size of the image on the screen is noted, and alcohol, bichloride of tin, or other highly refracting liquid, is substituted for the water in the watch-glass-objective, we shall find it necessary to bring the lens nearer to the object to secure a good definition; while, at the same time, the image on the screen will be proportionately enlarged. Watch glasses of various curvature may be likewise employed to illustrate the effect of this condition. The only serious objection to the use of water lenses, as above described, both for condenser and objective, is their liability to disturbance by motion, which obliges us to avoid the least jar to the apparatus, since this entirely confuses the image on the screen.

Loose Pulleys.

G. P. says: "I have had great trouble in procuring a small loose pulley that would stand running at a high rate of speed with a very tight belt. After trying a large number of different kinds, of wood and iron, with long and short bearings, bushings of Babbitt, copper, etc., none of which would stand more than two months, I at last procured some sole leather; I put the flat surfaces together and bolted through with four bolts; after boring and turning, I soaked it well in oil and put in place. It has now been running about one year and is, apparently, as good as new. It requires very little oil."

REMARKS BY THE EDITOR.—If a loose pulley is properly arranged, it will run as well as a shaft bearing. It must be long enough, and have efficient provisions for lubrication.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Introduction of the Metric System into Medicine

was the subject of two papers read by Dr. H. W. Wiley, of Indianapolis, and Professor E. B. Elliott. The former gentleman said the other sciences have adopted a uniform system of weights and measures, and that it is now proper time for medicine to accept the doctrine of science. Proximately, we may take the gramme as 15.5 grains. It is evident that all medicines now given in from one to two grain doses could as readily be presented in gramme doses, since all grain weights could easily be reduced to corresponding terms of the gramme. In regard to fluid remedies, we can make similar reductions.

Thus 1 cubic centimeter equals 16 minims; .25 centimeter equals 4 minims; 2 centimeters equal 32 minims; 4 centimeters equal 64 minims, equal 1 fluid dram, equal 1 teaspoonful, equal 60 drops.

The paper was principally devoted to the subject of unification of doses, in order to avoid those serious accidents which result so often from the carelessness of physicians, druggists, and nurses. In order to this, both solid and liquid remedies should have a standard dose, say for solids 2 grammes, and for liquids 4 centimeters, or a teaspoonful. This could be accomplished by rubbing up the solids with some inert substance like sugar of milk or chalk, and mixing liquids with mint water.

Professor Elliott harmonizes the metric and apothecaries systems on the basis of the troy grain. If we augment the weight of the troy grain by about three (more exactly 2.88) per cent, the new grain so formed will be contained in the gramme exactly fifteen times—a very simple ratio; and the accidental substitution of this new grain for the old grain and vice versa, by the apothecary, would not appreciably change the quantity of medicine in a dose. The following is the scale of relation to the new grain with the metric series proposed by Mr. Elliott:

Proposed Apothecaries Weight.

Equivalent wt.
Troy grains.

5 grains* equal to 1 tergram ($\frac{1}{2}$ grain).....	5.144+
30 tergrams equal to 1 decagram.....	154.32+
100 tergrams equal to 1 ounce (new).....	514.4+
30 ounces equal to 1 kilogram.....	154.32+

* 1 new grain equal to 1.0238 troy grains.

The corresponding table of measures of capacity is as follows:

	Old Minims.
5 minims* equal to 1 fluid tergram.....	5.41830
30 fluid tergrams equal to one centiliter (in fluid decagram).....	162.54990
100 fluid tergrams equal to 1 fluid oz.....	541.83000
30 fluid ounces equal to 1 liter.....	1625.490000

* 1 new minim equal to 1.08380 old minims.

Professor G. W. Holley discussed

The Proximate Future of Niagara.

Professor Tyndall said that, if the rate of recession named by Sir C. Lyell, a foot a year, was correct, in 5,000 years the Horseshoe Fall would be far above Goat Island, and the American channel would be dry. Professor Holley showed that Sir Charles's rate was the result of a conjecture founded on a guess. He also, by means of the most trustworthy data we have since the commencement of the historic period, showed that it would be more than twice that length of time before the Falls would recede a mile. He also described the formation of the bottom of the river, the course and depth of the different currents and the location of the bars, all of which indicated that the American channel would never be without water.

Professor Tyndall thinks that the depth of the water will determine the course of the chasm channel as the gorge recedes, and the rate of excavation. Professor Holley cited the physical facts which tend to prove that it is the character of the bed of the river, the harder or softer nature of the material to be broken down, that will decide these points. He particularly noticed the fact that the Falls were constantly diminishing in height as they receded, until they reached their present site, where the river makes an acute angle with its former direction. This was necessarily the case, because they were receding in the line of the dip of the underlying rock. They are now rising on the dip, and will be 50 feet higher than now when they are two miles up stream. To this bend in the river we owe one of the most beautiful features of the great cataract—the rapids above the Falls.

Do Snakes Swallow their Young?

was the title of a paper read by Mr. G. B. Goode, of Middle-town University, in which he referred to the habit observed in certain snakes of allowing their young a temporary refuge in their throats, whence they emerge when danger is past. On this subject, through a note inserted in a monthly journal asking for observations, the testimony of 96 persons had been obtained. Of these, 56 saw the young enter the parent's mouth in 19 cases, the parent warning them by a loud whistle. Four saw the young rush out when the parent was struck; 18 saw the young shaken out by dogs or running from the mouth of their dead parent; 29 who saw the young enter killed the mother and found them living within, while only 13 allowed the poor parent to escape; 27 saw the young living within the parent, but as they did not see them enter, the testimony is at least dubious.

In the opinion of Professors Wyman and Gill and other physiologists, there is no physical reason why the young snakes may not remain a considerable time in the dilatable throat and stomach of the mother. The gastric juice acts very feebly upon living tissues, and it is almost impossible to smother reptiles. Toads and frogs often escape unharmed

from the stomach of snakes. If the habit is not protective, if the young cannot escape from their hiding place, this habit is without parallel; if it is protective, a similar habit is seen in South American fishes of the genera *arius*, *bagrus* and *geophagus*, where the males carry the eggs for safety in their mouths and gill openings.

Professor Gill, in commenting on the above, said that the popular idea that snakes are sometimes swallowed by men and live afterwards in the stomach was an error which he was glad of the opportunity to denounce.

Professor Burt G. Wilder, of Cornell University, read several papers on the general subject of

The Brain.

This organ has been studied with three objects: the descriptive anatomy of its parts, the comparison between the brains of man and apes, the illustration of function. The proper method of preserving specimens was explained and the study of fissures especially commented upon. The speaker said in conclusion: After a pretty careful study of the specimens at my command, and the consultation of all works in which brains are accurately delineated, I feel justified in asserting that we cannot as yet characterize the fissural pattern of any mammalian order, family, genus, or even species, without the risk that the next specimen will invalidate our conclusion: that our studies in this direction should be based upon the careful comparison of accurate drawings of a much larger number of specimens than now exists in any museum; that nearly allied forms of carnivora should be compared; and that the most satisfactory results are obtainable from large series of fetal and young brains of the same species, and if possible, family and sex, in order to eliminate minor differences.

An Automatic Filtering Apparatus

was exhibited by Dr. H. W. Wiley, which consists of an ordinary filter stone with two arms. The upper arm carries a large funnel of from one to three quarts capacity, an electro-magnet with a system of levers for working a stop to the funnel, and a glass bulb and mercury cup. The lower arm is fitted with an ordinary Bunsen funnel, in which floats the glass bulb attached by a platinum wire to a lever carrying the mercury cup. As the fluid in the small funnel falls, the float sinks, and the mercurial cup rises, until the mercury touches two platinum wires, which are the poles of a small galvanic battery connected with the electro magnet. This completes the circuit. The armature of the magnet is pulled down, the stop in the large funnel is raised, and the liquid runs through into the small funnel until the connection is broken. This continues until the whole of the fluid runs through into the small funnel. By means of this apparatus the quantitative analyst can save several hours daily.

Dr. J. S. Newberry exhibited a series of exquisitely preserved small scaled

Fishes from the Cannel Coal of Ohio.

In these fishes every scale and fin ray is shown; and the whole animal is coated with a thin film of sulphide of iron and thus "gilded." Sharks' teeth and spines, scales and teeth of large ganoids, and skeletons of many carnivorous salamanders are found all preserved in the same beautiful manner. Dr. Newberry also read a paper in which he said that the different strata which compose the geological column have been divided into several groups or systems, of which the base is formed by the old crystalline rocks called Laurentian and Huronian. Each of these systems consists of circles of deposition; first, sandstone, Potsdam, Medina, etc.; second, mixed mechanical and organic sediments, the calciferous, Clinton, etc.; third, a limestone, the Trenton, Niagara etc.; and fourth, a mixture of mechanical and organic sediment, the Hudson, Helderburg and the coal measures. Dr. Newberry claimed that each of the circles of sediments was formed by an invasion of the land by the sea, producing, first, a sheet of sea beach sand and gravel; second, the offshore deposits following and covering the first; third, the open sea calcareous organic deposit—a limestone; fourth, a mixed sediment—shale and limestone, or an earthy limestone—the product of the retreating sea. Between these submergences perhaps millions of years elapsed, in which the fauna of the sea and the flora of the land were changed. Hence the different fossils of the different geological systems.

Dr. Hill of Portland related a striking anecdote of a toad which had swallowed one end of a large earthworm, and had become so tired in its attempts to get the rest down that it was in danger of losing the whole, the worm crawling out of the toad's mouth faster than it could be swallowed. The toad then brought up its right hind foot, and grasping its stomach and the worm in it, held the worm in with its foot, taking a fresh grip after every gulp, until the job was finished.

In closing the session, Professor Lovering delivered a speech congratulating the members on the extent and variety of their labors during the past year. The usual resolution of thanks to everybody concerned in the affair were adopted, and it was afterward decided to hold the next meeting at Hartford, Conn., on the second Wednesday in August, 1874. The President elected is Dr. Le Conte, of Philadelphia; Vice President, Professor C. S. Lyman, of New Haven, Conn.; Secretary, Dr. Hamlin of Bangor; Treasurer, Wm. S. Vaux of Philadelphia.

Section Q—Scientific Fun.

A burlesque session, in which a number of the members participated, was attended by a large audience, which several learned professors managed to keep in convulsions of laughter for an hour or more.

Professor Morse, taking the chalk, stepped to the blackboard and began the reconstruction of an unknown animal,

a fragment of bone belonging to which had been found. Proceeding step by step and speaking as he sketched, he quickly built up the figure of a hideous toad. Then he suggested certain anatomical objections and improvements which produced amusing changes in the drawing. Finally he concluded to restore the fragment on a different hypothesis, and by a few strokes revealed the true character of the fossil, which proved to be the handle of a jug. Professor White, discoursing on ancient shell heaps, produced a heavy bag, which, he said, contained specimens collected near Portland. A broken shovel, a stone bottle, a lobster, and a pile of clam shells were recognized, amidst peals of laughter, as relics of the recent clam bake participated in by the Association. Each separate article was then described in connection with the peculiarities of the race that had used it, as indicated by its condition. Perhaps the most amusing of these was a corn cob, which indicated the size of the mouth by the bite that had been taken out of it. A blackboard drawing was then made to illustrate a race with these peculiarities. "You can infer," said the speaker, alluding to a paper of no great value read the previous day, "that the length of this mouth indicates that its maternal grandmother must have been very long lived."

Several other speakers read ludicrous papers, their remarks being illustrated by Professor Morse with grotesque sketches on the blackboard.

VIENNA PREMIUMS AND SEWING MACHINES.

We copy the following from the New York Herald of August 12th:

THE REGION OF THE SEWING MACHINES.

If Dante had been gifted with the spirit of prophecy, he would have set apart a region in his *Inferno* to illustrate the rivalries and emotions of the sewing machine manufacturers of the United States. The conflicts, the misunderstandings, the ambitions, the yearnings for approbation and notoriety, the odd, incessant efforts to win medals of progress and renown and merit and honor, which inspire the gentlemen who manage this industry, have given constant motion and life to the American department. So, when His Majesty came into the sewing machine department, every effort was made by our Commissioners to introduce him to each special machine and explain its peculiar qualities. Let me give you a list of the machines in the catalogue, so you may know what His Majesty was asked to do. First, the Howe Machine Company, New York; then the Singer Manufacturing Company, New York; the Whitney Sewing Machine, Paterson, N. J.; the Wheeler & Wilson Sewing Machine Company, New York; the Wilson Sewing Machine Company, Cleveland, Ohio; the Wilcox and Gibbs Sewing Machine Manufacturing Company, New York; Ezra Morrill & Co., Derby Line, Vt.; George N. Bacon & Co., London, England; the Weed Sewing Machine Company, Hartford, with the patent effective stop motion of Fairchild's attachment; the Secor Sewing Machine Company, New York; the Mackay Sole and Shoe Machine, Cambridge; the Universal Feed Sewing Machine Company. Every exhibitor expected a special visit from the Emperor, and His Majesty, with a patience and courtesy that should be commended, endeavored to visit them all.

After waiting a few minutes to comprehend the explanations to him of the advance of the industry so largely represented in America, the Emperor continued his tour of the other departments, especially inquiring of his attendants what different principles were presented by each separate machine, in what respect one machine differed from the other—all of which was explained to him, especially the new principle of the patent stop, or the application invented by Mr. Fairchild, and now owned by the Weed Machine Company, by which the action of the needle is arrested by the pressure of a spring, without stopping the motion of the wheel.

In the New York Herald of August 19th, we find awards were made as follows:

To the Wilson Sewing Machines of Cleveland.

Elias Howe Sewing Machine Company, for sewing and stitching.

Wilcox & Gibbs Sewing Machine Company of New York, for best single thread sewing machine.

The Weed Sewing Machine Company, for best stop motion applied to sewing machine treadles.

The Wilson Sewing Machine Company being the only exhibitor that received a grand prize medal for the best sewing machine, and medals of honor.

Small Fast Steamers.

J. G. X. states that he and a friend are building a small steamer, of the following dimensions: Length 24 feet, width amidships 6 feet 4 inches, height amidships 3 feet and at stern 4 feet. She has a white oak keel, her ribs are of hickory, and she is built up with a double thickness of half inch white pine boards, all joints being lapped and tarred. She is covered with sheet zinc, the joints being lapped and soldered. The boiler is an upright tubular, 3 feet high, 20 inches diameter, and has 19 two and a half inch flues, with a fire box 18 inches diameter and 1 foot high. The engine, attached to the boiler perpendicularly, is of about the same power as the boiler, and has double cranks set at right angles. The boat will be propelled by a 20 inch screw of four blades, each blade having a pitch of 6 inches, with space between each blade of one third the size of blade, and is so constructed as not to make any wave towards the banks of the canal. She is expected to run at from 8 to 12 miles an hour. The boat and all the machinery have been constructed by us two, it being our first piece of carpenter work. We are both machinists, and everything was done between work-

ing hours, and together we spent twenty days on the wood work. She is to be used as a pleasure boat on the Schuylkill canal, and will carry about 30 passengers."

DECISIONS OF THE COURTS.

United States Circuit Court—District of Kentucky.
PATENT BALING PRESS.—WENDELL E. KING vs. THE LOUISVILLE CEMENT COMPANY.
BALLARD, J.

The complainant in his specifications declares that his "invention consists in the arrangement in one apparatus of two presses, which are operated alternately by a single screw in such manner that turning the screw in one direction to compress the bale in one compartment of the press retracts the follower and releases the bale in the other compartment of the press, so that said bale may be readily removed as desired, thus by said simultaneous and alternating action avoiding all loss of time in operating the press." The complainant does not claim any of the separate parts of this machine. He claims only the combination of the several parts as described. The machine used by the defendant, like that of complainant's, is provided with two boxes, a screw between and extending into both boxes, and a gear by which the screw and the follower are operated. The mechanical powers employed in both of the machines have been long known, and it is hardly necessary to prove, what the testimony, however, does establish, that it would occur to the most ingenious mechanic that a substitution of the gear employed in defendant's machine for the gear employed in complainant's would enable him to accomplish the same results which complainant's does. As he would substitute strictly mechanical equivalents, it is obvious he would produce the same results, and by an operation really similar, though somewhat different. The question then is—does complainant's patent being admitted to be valid, though it is for a combination—can the defendant avoid the charge of infringement by substituting, in lieu of some of the parts of the combination, well known mechanical equivalents? I am quite sure that he cannot, either on principle or authority.

It is not to be disputed that the inventor of an ordinary machine is, by his letters patent, protected against all mere formal alterations, and against the substitution of mere mechanical equivalents. Why should not the inventor of a mere combination receive the same protection? If he cannot, then will his patent not be worth the parchment on which it is written. If no one can be held to infringe a patent for a combination unless he uses all the parts of the combination and the same identical machinery as that of the patentee, then will no patent for a combination ever be infringed, for certainly no one capable of operating a machine could be incapable of devising some formal alteration in the machinery, or of substituting mechanical equivalents. No one infringes a patent for a combination who does not employ all the ingredients of the combination, but if he employs all the ingredients or adopts mere formal alterations or substitutes for one ingredient another, which was well known at the date of the patent as a proper substitute for the one withdrawn and which performs substantially the same function as the one withdrawn, he does infringe.

I have not examined minutely the testimony of the experts produced by the respective parties in this case, because I do not ordinarily attach much importance to the opinions of witnesses so produced. I find them generally advocates of the party producing them—and I have rarely ever derived any assistance from any expert who was not summoned and examined on the suggestion of the court itself. But in this case I have not referred to their testimony, chiefly because the nature of the complainant's invention and of the operation of both his and the defendant's machines is so easily understood that assistance has not been needed. The machine used by defendant is clearly an infringement of complainant's patent, I shall direct a perpetual injunction and give a decree for costs, but as complainant has offered no proof touching the damages, and as they must be small, I shall direct no inquiry concerning them.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From August 19 to August 21, 1873, inclusive.

GAS REGULATOR, ETC.—C. E. Seal, at al., Winchester, Va.
HOLLING RICE, ETC.—G. L. Squier, at al., Buffalo, N. Y.
LAMP, ETC.—J. D. Whidden, at al., Chelsea, Mass.
PANEL AND MOLDING MACHINE.—L. McD. Hills, New Haven, Conn.
STEAM ENGINE.—G. G. Lobdell, Wilmington, Del.
TRACTION ENGINE.—R. C. Parvin, Farmington, Ill., et al.
TREATING FABRICS.—J. T. Waring, Yonkers, N. Y.
TURPENTINE PRODUCT.—R. Lloyd, New Orleans, La.

Recent American and Foreign Patents.

Improved Combined Spade and Fork.

Heber Stone, Galveston, Texas.—The object of this invention is to adapt a fork to be used as a spade; and it consists in a sheet metal sheath or pocket adapted to receive a fork and be secured thereto. When the fork is inserted in the sheath, a ring on the handle thereof is slipped down over projections, and thus the sheath is secured to the fork, and the same is thereby converted into a spade.

Improved Tyre Shrinker.

Robert Gibbs, Spring Hill, Mo.—This invention consists in a new mode of shortening tyres by means of a slide bar and hook lever, which enable a work to be done very effectively as well as very quickly. The mechanism easily and cheaply prepared, and without liable to get out of order.

Wood Filling.

Jerome B. Dittenhaber, Chapleau, Ohio.—This invention relates to a compound for filling wood previous to the application of paint or varnish, and consists in a preparation, which is entirely devoid of color and will not therefore change the characteristic hue of the wood, which can be applied with an equally favorable result to all varieties, and which permeates so thoroughly the pores and fills so completely the interstices between the fibers that a single coat of varnish or paint will be generally sufficient to produce the designed outside face upon the wood.

Improved Washing Machine.

Henry H. Mercer and Samuel McHaffey, Cambridge, Ohio.—This invention consists in a machine possessing in an eminent degree three essential elements of a good washing machine, namely: Friction, pressure, and concussion. The lower roller being composed of polygonal rolls, each of which has an independent movement, a greater amount of friction is produced than by a cylinder composed of round rolls. The shape of the rolls results in carrying the materials under the pressure roller, instead of drawing or pulling them under, as is the case with solid rollers composed of round rolls, thereby preventing the clothes from stretching or being torn or in anywise injuring or interfering with buttons, buckles, etc. It is also much easier to operate than any other machine now in use, as it requires less power to carry materials under the pressure roller than it does to drag or pull them under the same, by the kind of motion common to the kind of rollers now in use.

Improved Cotton Press.

Michael M. Scherer, Batesville, Ark.—This invention consists in providing with a gravitating cover the press box, and winding it up by a windlass mechanism; in supporting the follower on the outside ends of the press box upon a wheeled carriage; and finally, in the peculiar construction and location of the press box.

Improved Ice Casket.

Frederick N. Troll, Baltimore, Md.—This invention relates to burial caskets for preserving the bodies of deceased persons until it is convenient for their friends to bury them, and consists in providing, between the body receptacle and casket, a pipe connection through which the air may be exhausted; also, in applying a rubber lining to the inside of the casket and cover to exclude all air from the outside.

Improved Car Coupling.

E. N. Gifford, Cleveland, Ohio.—This invention is an improvement upon the coupling for which letters patent were issued to A. Fritz, March 25, 1872, and consists in forming a right angled slot or recess in the side of the coupling or catch, and a right angled notch in its forward edge to adapt it to be held in place, and also guided in its movements by a short cross bolt projecting through the side of the drawhead.

Improved Paint Compound.

Charles Campbell, New York city, assignor to himself and James H. Davidson, of same place.—This invention relates to a new composition for paint, whereby the paint is held perfectly in solution without settling, combining the pigment and oil, producing a glossy and consistent covering for the preservation of wood work and other bodies, and effecting a considerable saving in the pigments employed. The solution is prepared by dissolving bicarbonate of soda and borax in water. This is then mixed with dry oxide of zinc, linseed oil, and benzine, and thoroughly ground together, producing a glossy, cheap, and durable paint compound, which may be used as a base for any desired shade or tint by adding the necessary color to it.

Improved Terret and Martingale Ring.

John Geraghty, Jersey city, N. J.—This invention consists of a fitted roller and pawl to be used in the terrets and martingales in substitution of the ordinary check rein rings for guiding and controlling the reins; also, for aiding the driver in controlling the horse by turning freely with the rein when pulled backward by the driver, but not turning in the other direction, so that when the horse gets advantage of the driver he must also overcome the friction of the reins on the rollers.

Improved Trace Buckle.

John Kennedy, Osage Mission, Kansas, assignor to himself and John Moffit, of same place. This invention consists in a trace buckle in which the tongue is pivoted and provided with a lock. As the trace is passed forward the tongue enters the hole therein; and as it draws back it pulls the tongue plate into the angular recesses in the lugs of a plate, and thereby locks the same. This movement of the tongue is effected by slots in the plate. With this buckle the trace is kept straight and smooth, without cracks or wrinkles.

Combined Fender and Ash Sifting Attachment.

William C. Dobbin, Zanesville, Ohio.—This invention is a combined fender and ash sifting attachment, to be used in connection with an ordinary fireplace grate, for the purpose of separating the ashes from the unburnt pieces of coal that fall from the fire grate, so that the latter can be readily replaced upon the fire freed from ashes.

Improved Car Coupling.

John Crist, Tiffin, Ohio.—This invention relates to automatic car couplings wherein the link lifts a catch hook by its own forward movement, and consists in attaching said hook to a bar pivoted at the rear end, held down by a spring and lifted by a vertical rod. It also consists in a novel and effective mode of raising the lifter rod.

Improved Cotton Bale Tie.

William J. Orr, Charlotte, N. C.—This invention relates generally to bale ties, but particularly to that class consisting of a strap of thin metal having one end turned into the form of a hook, and the other end broadened into a transversely slotted eye piece provided with a side stop at the outer end of the slot. There has been experienced, practically, with these bale ties a good deal of difficulty in turning the band after it is tightened sufficiently to secure the hook and eye together, while there is necessarily more or less play of the hook in the eye afterwards, which causes the sleeve to become displaced and the bale to become loose and even untied. The invention consists in the peculiar mode of arranging and constructing this eye piece so that it can be easily inserted within the hook of the strap and be securely held, with or without the sliding sleeve or loop which is sometimes used.

Improved Composition for Waterproofing Wall Paper.

Cornelius Van Herwerden, Williamsburgh, N. Y., assignor to himself and Cornelius Jansen, of same place.—This invention has for its object to furnish wall paper which shall be so prepared that, when applied to the wall in the ordinary manner, the papered wall may be washed, and which will leave the colors upon the paper wholly unaffected. The invention consists in first dissolving white soap in warm water. When fully dissolved, white wax and isinglass are added and the mixture stirred continuously until it boils. When fully cold it is ready for use. To apply the mixture, the paper is spread upon a smooth table, and the former is applied with a soft brush, care being taken to cover the paper evenly by rubbing it well with the brush. The paper is then rubbed with a dry brush to give it a gloss.

Improved Glove Fastening.

Charles H. Hall, Trenton, N. J., and Robert Knott, Brooklyn, N. Y.—This invention consists of a little bar with a series of notches in each edge and wide portions between the notches, hinged to a clip fastened to the glove at one side of the wrist, and a notched hook on a clip fastened to the glove at the other side, so arranged that it can engage the bar behind any one of the enlargements to fasten the glove tight or loose, as may be desired. The clips by which the bar and the hook are fastened to the glove consist of thin plates of silver, gold, or any ductile metal, with spurs formed on them, to fasten them to the glove, by punching them out of the metal in the ordinary way of making such fastenings.

Improved Ice Shaving Machine.

James D. Freeman, Abbeville, Ala., assignor to himself and James Gillespie, of same place.—This invention furnishes an improved machine for attachment to the counter in soda water and other saloons for shaving the ice. The forward parts of the downwardly projecting sides of a hopper are cut away to allow a tumbler to be placed beneath said hopper to receive the shaved ice. In the lower part of the hopper is placed a small cylinder, to which are secured a number of knives or cutters, rotated by a crank. The piece of ice is placed in the hopper, rests upon the cylinder, and is held down by a plate which is placed upon it, and which is attached to a lever. The lever passes through slots in the hopper, and its forward end is pivoted to a plate which slides up and down in a groove. The latter plate may be raised and lowered to adjust the position of the lever and plate according to the size of the piece of ice to be operated upon. The rear end of the lever projects so that the operator can grasp it in one hand to hold the ice down with the requisite pressure while he operates the crank with the other hand to shave the ice.

Improved Insect Powder Gun.

William Henry Ball, Brooklyn, N. Y.—The object of this invention is to provide a commercial package for insect powder, which may also be used as a gun or ejector for discharging the powder into crevices, etc., at the same time that the cost will not be much more than common packages. The invention consists of a cylindrical box, of light and inexpensive material, and a short piece of flexible tube joined together at one end, the paper or wood box having a cap at the other end, and, by preference, a hopper, shaped bottom at the end connected to the flexible tube, with a small hole for the powder to pass from it into the said flexible tube. The latter has a small nozzle through which to eject the powder by compressing the tube, the nozzle being detachably connected so as to pack the packages economically. The hopper bottom is employed to retain the mass of the material in the paper or wood box in which it is packed and deliver it into the flexible ejecting portion in small quantities as the box is shaken.

Improved Steering Apparatus for Vessels.

Amie Siebenthal, Yvay, Ind., assignor to himself and F. R. Dufour, of same place.—The object of this invention is to construct for river and ocean vessels an improved steering apparatus, by which the power transmitted to the rudder is equalized, and the same more fully within the control of the helmsman. The invention consists in the hinge connection of the tiller with the rudder post, together with a supporting guide arm of the same. The nearer the tiller approaches the center, the quicker turns the rudder post, so that the rudder moves rapidly when in position at either side of the axis of the vessel, where also less power is required. On the approach of the tiller to a horizontal position, the rudder moves with decreasing speed but with increasing power, as the pivoted arm relieves the strain on the steering rope by supporting the end of the tiller.

Improved Composition Filling for Painters.

Richard Sharp, Pittsburgh, Pa.—The object of this invention is to provide for carriage manufacturers an improved "painters' rough stuff," which is put on after the paint, and leaves a smooth and solid surface after rubbing. It consists of a mixture of pulverized pumice stone and white lead, thinned by coachmaker's japan and rubbing varnish. The wood is first filled with from three to five coats of keg lead, and then coated with this surface protector, which causes the work to take a fine polish.

Improved Cotton Bale Tie.

William Crone, Galveston, Texas.—This invention consists of a small S shaped bar for tying the bands and cross ribs on the bands, both lower and upper sides, at short distances apart near the ends, which are fastened together. This is effected by inserting the band in the notches of the S-shaped bar, one part on each side, in a very simple manner.

Improved Straw Cutter.

Thomas Webb, Elyria, Ohio.—This invention is an improvement in the class of straw cutters having feed rolls, one of which is adjustable vertically, and yet so geared with the stationary roller as to continue its revolution, whether they are separated by a small or large quantity or thickness of the material to be cut.

Improved Tool for Seating Bung Bushes.

Lomax Littlejohn, New York city.—This invention has for its object to furnish an improved tool for bevelling the bung hole of a cask and counter-sinking said hole to adapt it to receive a bung bush. The body of the tool is cast hollow, and of such a taper as will give the desired bevel to the bung hole. In one side is formed a recess to form a seat for the knife cutter, in which, directly opposite the edge of the cutter, is a slot for the chips to escape through. Around the upper edge of the tapering body is a flange of a breadth equal to the desired breadth of the counter-sink of the bung bush. Upon the upper side of the flange are formed two projections, one of which is so arranged that its face may be nearly flush with the edge of the flange, so that the cutter attached to said face and the cutting point may project below the flange to cut around the edge of the counter-sink. The other projection is arranged across the flange so that the cutting edge of the cutter may project through a notch in the flange to cut the counter-sink. Upon the upper edge of the body is formed a rigid ball, having a socket formed upon its upper part to receive a handle, by means of which the tool is operated.

Improved Saw Swage.

Andrew J. McCollum and George D. Emery, Indianapolis, Ind.—This invention consists of an improved attachment of a saw swage, by means of which the swage will be held perfectly square across the tooth, so as to make all the cutting points exactly alike, and thus enable the saw to be filed much more quickly than it could otherwise be done. The invention consists in the guide arms connected at their upper ends by a back, and pivoted to the stock of the swage. The guide arms are provided with a set screw which passes through one of said arms and screws into the other arm, so that the lower ends of the arms may be adjusted closer together or farther apart, as the thickness of the saw plate may require. By using the swage upon the teeth of a saw partly filed, and then filing the teeth by the marks of the swage, it is claimed that the saw may be filed in less than half the time that would otherwise be required.

Improved Inside Blind.

Elliott Metcalf, Rome, N. Y.—This invention has for its object to improve the construction of Venetian or inside blinds, and it consists in the arrangement of an upper roller, carrying front and rear ribbons, attached to the slats of the blind, and provided with cords for suspending the same, so as to enable the blind to be lowered and raised from the top. This, together with the angular adjustment of the slats is effected by turning the roller. The vertical movement of the slats from the bottom is accomplished by elevating cords. The invention further consists in a novel method of attaching the slat-shifting ribbons to the latter, dispensing with the use of rivets, staples, or other fastening devices, and insuring, also, a more perfect closing of the slats; and it consists in passing or looping the ribbons through slots near the edges of the slats, so that when the latter are in a vertical or closed position the edges of the same will abut more perfectly than in ordinary blinds.

Improved Paint Brush.

Amasa S. Thompson, Little Falls, Minn., assignor to himself and Louis Vasaly, of same place.—This invention is intended to furnish ready and convenient means for raising and discharging paint and similar substances, which are applied with a brush, through the brush, so that the fluid may be readily spread by the operator. The invention consists in a rubber syringe and flexible tubes provided with suitable valves and arranged in the handle of the brush. A tube conducts the liquid from the reservoir to the apparatus.

Improved Plow.

Thomas G. Andrews and Andrews Ilvire, Barnesville, Ga.—This invention consists in the construction of plows, so that the plow plates may be secured firmly to the standard without bolts, and in such a way as to prevent no unevenness for the soil to catch upon, and which will enable the plow gate to be quickly attached and detached. It consists of a lever brace, pivoted at its rear end to the slotted lower end of the plow standard, secured at its forward end detachably to the plow beam, and provided with a shoulder or pin for securing the plow plate detachably to said standard.

Improved Spark Arrester.

Michael Zech, Pittsburgh, Pa.—The cinders and sparks are deflected by an inverted cone (the upper parts of the stack) drawn through a perforated flange, and ascend and pass through a circular opening and then strike a horizontal disk, and are thrown in each direction. They are still further retarded before they escape by an interior flange around the top of the hood. Before reaching this point the sparks or cinders are broken up, so that when they escape from the hood any fire which they may retain is instantly extinguished by contact with the atmospheric air.

Improved Reed Organ Swell.

John R. Lomas, New Haven, Conn., assignor to Bernard Shoninger, of same place.—The design of this invention is to make a clear and open passage for the escape of the sound from the reeds through the case of the instrument; and it consists of a movable board or outside swell in the case, with a suitable connection with the ordinary swell, or the lever which operates it, to be opened by or with the said ordinary swell, and allow all the sound waves a clear, open, straight passage through the case, whereby a large gain of power is obtained without any extra exertion on the part of the player, at any desired time, giving nearly double the effect of the frost reeds.

Improved Carpet Lining Machines.

John R. Harrington, Brooklyn, N. Y.—This invention relates to a combination of revolving screens, carding cylinders or scratchers, and feeding and condensing rollers, the object of which is to receive the cotton, flock, or other fibrous material from a willow or breaker, form it into a smooth lap of uniform thickness, and deliver it between sheets of cloth or paper, which form the upper and lower surfaces of the complete fabric and confine and secure the lap. The inventor, we believe, is the originator of carpet linings made with one or more continuous sheets of paper or cloth united together by mullage or sewn. The capacity of the machines is claimed to be 5,000 yards per day. Mr. Harrington has taken several patents on the same subject, but he asserts that the invention now under consideration is preferable to any other.

Improved Railway Rail Chair.

Samuel Huber, Danville, Pa.—The main object of this invention is to prevent the ends of the rails of railroad tracks from being battered or damaged by passing trains, and it consists of a cavity or recess beneath the joint of the rails, whereby a certain degree of elasticity is allowed the ends of the rails.

Improved Manufacture of Boots and Shoes.

John Boyle, New York city.—The object of this invention is to provide an improved clamping connection of textile or other fabrics with hard and unyielding materials, as wood or composition soles, etc., so that shoes or other articles of manufacture may be produced quicker and cheaper by means of machinery, and the hand labor, hitherto necessary for such work, be dispensed with. The invention consists in grooving the wood sole or other material at the upper edge, and binding the fabric, by a suitably shaped metallic clamp, firmly thereon, so that a strong and intimate connection of the parts is obtained.

Improved Printing Press.

Calvert B. Cottrell, Westbury, N. I.—This invention consists in gearing the sliders with the frame of the press, also with the reciprocating type bed to maintain the proper relation of said sliders to the table at all times, and prevent the overrunning of one by the other, which now happens in consequence of the irregular action of the bed on the sliders, caused by the pressure of the cylinder on the bed when going one way and the freedom from pressure when going the other way.

Improved Rubber Shoe.

Lewis L. Hyatt and Jared H. Canfield, New Brunswick, N. J.—This invention consists of india rubber boots and shoes, the uppers of which are made considerably thicker and stronger at the junction with the sole than at the top and in the upper portions, and gradually lessening in thickness from the bottom upward. In carrying out the invention dies, are sunk in the rolls, by which the sheets for the upper portions of the shoes are made deeper in the parts in which the lower portions of the uppers are formed than in the parts whereon the upper portions are formed, and thus the required variations in the thickness are produced at the same time that the sheets are made.

Business and Personal.

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

Dry Steam for best Lumber Dryer, and best House Furnace, Circulars free. H. G. Bailey, Cleveland, O.
Wanted—Address of parties who mould and finish small iron castings. E. C. Bidwell, Savannah, Ga.
Mechanic's best tool yet: strikes 12 in. Circle, Caliper and Dividers in one, of Steel, by Mail, 75 cts.; 2 pair, \$1.40. Barnes, 18 Ash-st. Place, Boston, Mass.
Situation wanted by a practical Brass founder and finisher, capable to take charge of works. No objection to go West. Box 72, Lawrence, Mass.

Wanted—A man of Experience or ability to handle two heavy Valuable demonstrated Inventions. Address Harper, 1623 N. 17th street, Philadelphia, Pa.
Pleasure Steamer for Sale, Cheap. Carries 10 persons comfortably. L. T. Burnham, Waltham, Mass.
Makers of Steel Bar Bells, address, with prices, F. S. Boynton, La Porte City, Iowa.

Wanted—Partner in a number of valuable patents. Patent right salesmen and manufacturers, address, for 30 days, J. E. Garside, Hennepin, Ills.

A valuable patent for sharpening planing or other machine knives without removing them from the cylinder, or cylinder from the machine, for sale. Address J. J. Grant, Greenfield, Mass.

R. R.—in Broughton's Oil Cups, it matters not whether Oil be thick or thin. They can be graduated in a moment to suit all purposes. For particulars, apply to the manufacturer, H. Moore, 48 Center St., N. Y.

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Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

Scale in Steam Boilers—How to Remove and Prevent It. Address Geo. W. Lord, Philadelphia, Pa.

Williamson's Road Steamer and Steam Plow, with rubber tires. Address D. D. Williamson, 32 Broadway, New York, or Box 1829.

Gear, Boston, Mass., sells the latest Improved Machinery.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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

For best Presses, Dies and Fruit Can Tools Bliss & Williams, cor. of Plymouth & Jay, Brooklyn, N. Y.

Stave & Shingle Machinery. T. R. Bailey & Vail.

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Fine Machinery Oils.—We take pleasure in calling attention of our Manufacturing readers to E. H. Kellogg's advertisement in another column, and saying that we believe his claims in regard to fine Engine, Spindle, and Signal Oils are fully justified by the facts, and that parties who try his goods will not have cause to regret it.

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Drawings, Models, Machinery.—All kinds made to order. Towle & Unger Mfg. Co., 30 Cortlandt St., N. Y.

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Catalogue on Transmission of Power by Wire Rope. T. R. Bailey & Vail.

Bolt Makers, send for descriptive cuts of Abbe's Bolt Machine, to S. C. Forsyth & Co., Manchester, N. H.

Mills for Flour, Feed, Paint, Ink, Drugs, Spices and all other purposes. Ross Bros., Williamsburgh, N. Y.

Boring Machine for Pulleys—no limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

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The Best Smutter and Separator Combined in America. Address M. Deal & Co., Bucyrus, Ohio.

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

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Engineering and Scientific Books, Catalogues mailed free. E. & F. N. Spon, 48 Broome St., N. Y.

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

Cabinet Makers' Machinery. T. R. Bailey & Vail.

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J. E. R. should try to blue his steel articles by the process mentioned on p. 107, vol. 25.—C. H. D. will find a method of making bone phosphate detailed on p. 243, vol. 26.—R. W. should read the answer on p. 262, vol. 25, for a good black dip for metal articles.—E. C. M. will find a description of the horticultural fertilizer on p. 401, vol. 28. It should be phosphate of ammonia, not biphosphate.—D. R. is informed that the published accounts of phospho-bronze do not mention the proportion of phosphorus, which can doubtless be ascertained by experiment.—H. J. H.'s query as to the names of the steam engine is incomprehensible.—T. A. C. can find the proper weight of ball proportioned to length of lever for a safety valve by applying the formula on p. 106, vol. 25.—S. H. W. should read some elementary work on chemistry, and had better advertise for the other information.—J. T. L.'s query is a trade matter; he should consult an engineer.—We are obliged to G. & C. for their correction; the mistake was not ours.—P. P. can bronze cast iron by using the process described on p. 58, vol. 26.—B. L. B.'s equation is a catch; the answer may be either 18 or 2, as the data are not properly expressed.—W. B. J. will find the needed information as to mold for plaster ornaments on p. 138, vol. 29.

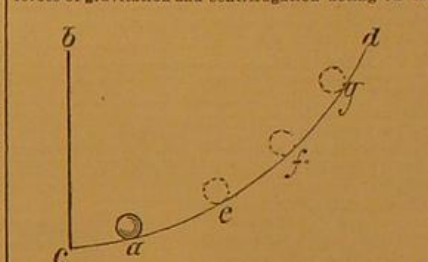
E. F. L. asks: Would two steam boilers of equal capacity, one an upright and not walled in, the other a horizontal and return tubular, walled in, each having thirty-three feet of smoke stack, do the same work with the same coal? Which would be the most economical, and what per cent will the one save over the other, and why? Answer: We suppose the horizontal boiler would be the most economical, because it would be better protected against loss of heat.

G. D. asks: Does it require more force to bring a moving body to rest than it does to give it the motion? I should say not; yet it would seem to be so, if I rightly understand your reply to J. B. T., page 77 of the current volume. I reason that if an engineer can jump from his engine at the rate of 15 miles an hour, it makes no difference, so far as his relation to the engine is concerned, whether it is in motion or at rest. If the engine is moving west at the rate of 15 miles an hour and the engineer jumps east with the same velocity, when he strikes the earth he will be motionless. Is not this so? I think J. B. T. mistaken in thinking that "engineers, etc., invariably jump in the direction of the moving train." It is true that they face in that direction, but they usually jump with a swinging backward motion, making the head and body move as rapidly as possible in the direction opposite to the train. If an engineer jump backwards with a velocity of ten miles an hour, and the train is moving in the opposite direction at the rate of 25 miles an hour, he strikes the earth with the velocity of only 15 miles an hour, the force of which can easily be resisted by an ordinary man. Active base ball players frequently fall without injury when running with a speed of from 15 to 20 miles an hour. Answer: It is true that it takes no more force to stop a moving body than is required to impart the motion to it; but the question of time plays an important part in many cases. We will try and make this plain, by a few simple illustrations. Suppose a train is moving at the rate of 30 miles an hour, and strikes against something which stops it instantly. Now if a man were standing up in that train, facing to the rear, the effect would be the same as if he were to jump with a velocity of 30 miles per hour; and on our correspondent's theory, he ought to remain standing and uninjured. On the contrary, we know that he would perform a few involuntary somersaults, and the chances would not be very favorable for his escaping with his life. This is because, though just as much force was brought to bear to stop his motion as had been used in producing the motion, there was an amount of work stored up that required time as well as force to overcome it. A train moving from a station starts slowly, and gradually acquires speed, so that the passengers are not much affected by the increasing velocity. But if the train started abruptly at a speed of 30 miles an hour, couplings would break, passengers would be thrown in all directions, and general havoc would be the result, for the same reason as before, that time is required to impart a rapid motion to a body, if it is to be done without shock. We might multiply these illustrations to any desired extent. Suppose we have a fly wheel with a heavy rim and crank attachment, and that a man working on this crank makes the wheel revolve at a high velocity. Now let him try to stop it suddenly, and he will find that the power stored up in the wheel is sufficient to lift him off his feet, and throw him to some distance. The case instanced by our correspondent, of base ball players, will also serve as an illustration. Probably one of these players rarely runs faster than at the rate of 15 miles an hour, and so many accidents have happened at first base by the difficulty of stopping suddenly without injury that the rules have been amended, and a player on reaching first base does not have to hold it, but may run over it and cannot be put out, until the ball has been returned to the pitcher. Our correspondent is right in remarking that persons jumping from a moving train face in the direction of the motion, and hold back. Some years ago, a man in Schuylkill Haven used to excite the admiration of all who saw him by jumping from a train which was moving at the rate of 25 miles an hour. He may still display his agility and nerve, for aught we know, although it must be confessed that this proceeding was somewhat risky. His plan was to go to the rear platform, place his feet on the buffer and his hands on the rail, leaning back as far as this position would allow. When he reached the place where he desired to stop, he would dexterously release his hands and feet simultaneously, and reaching the ground in an upright position, would walk off to his work with an unconcerned air. We are not relating this incident to induce our readers to go and do likewise. If they are very desirous of experimenting let them try it on a street car, where the only results of

failure will be a few bruises and the derision of the bystanders. We once knew a man who jumped from a canal boat, in a direction contrary to that in which it was moving. He made some miscalculation, apparently, for, instead of landing gracefully on his feet, his head collided with the ground, and he went home a wiser and a sadder man. We think there is one case in which a person could jump backward from a moving train, if everything were propitious. Let him start at the front end of a platform car, and run back as fast as the train was moving forward; then he could jump with safety. But a slight miscalculation might disarrange the experiment.

W. H. M. says: In your answer to M. C., in No. 8, Vol. 29, you say: Multiply the diameter of the cylinder by the decimal .7854; is this not an error? Should it not be the square of the diameter? Do you deduct anything for friction? 2. What books should a young man read so as to get a good idea of machinery in general, and about what would they cost? Answers: 1. It should be the square of the diameter, of course. In calculating the indicated horse power of an engine, no deduction is made for friction. We endeavor to avoid mistakes of this character, and will thank our readers to point out errors whenever noticed. 2. Appleton's "Dictionary of Mechanics," price \$30.00, will give you a good general idea of machinery. Spon's "Dictionary," now in course of publication, by the same author, is later and more complete.

C. H. A. says: Suppose a ball, a, to be revolving around an axis, b, say 60 times a minute; is it possible to draw a curve, from c to d, such that its tangent shall be at right angles to the resultant of the forces of gravitation and centrifugation acting on the

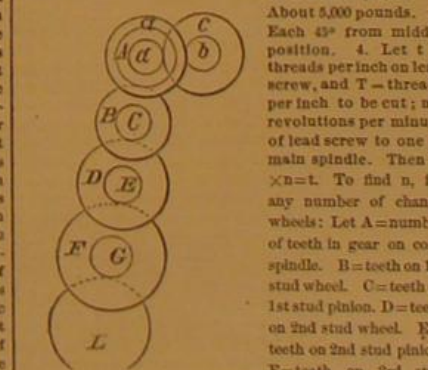


ball at whatever point of the curve the ball shall be placed, say at e, f, or g, the number of revolutions being constant? Answer: The curve is a parabola, with vertex at the lowest point. We would be glad to receive a solution of this problem (which is quite simple) from some of our readers.

R. L. asks: Can a correct test of the strength of a bridge be made from a model, one inch to the foot and in exact proportion to one of full size? Answer: Small models are generally stronger, in proportion to their size, than the actual works.

F. P. says: In constructing a pair of scales, as sensitive as possible, (1) is there any rule as to the relative length of beam, and chains or threads to which the cups are attached? 2. The two holes being made at each end of the beam, and a straight line drawn, how far above the line in the center of the beam should the pivot be, to make the most sensitive results? Will the scales be more sensitive with the pivot just as near the line as the beam will equipoise than if the pivot were farther? 3. Will the knife-edged pivot be as delicate a mode as any? 4. A friend says that the index above the pivot must be of a certain length and weight to make the scales sensitive. I contend the index is merely a pointer and has nothing to do with the sensitiveness. Which is right? Answers: 1. This does not affect the sensibility. 2. By placing the pivot as close to the center of gravity of the beam as is practicable, the sensibility will be increased. 3. Yes. 4. You are right.

N. H. T. asks: 1. What is the cost of a first class locomotive? 2. What number of pounds strain will it produce in a rope or chain fastened to some immovable body? 3. In what position should the cranks of a double engine be placed, to act to the best effect, they being keyed on to the shaft at right angles to one another? 4. Give a rule for compound gearing used on large engine lathes with four change gears. Answers: 1. About \$12,500. 2. About 5,000 pounds. 3. Each 45° from middle position. 4. Let t = threads per inch on lead screw, and T = threads per inch to be cut; n = revolutions per minute of lead screw to one of main spindle. Then $T \times n = t$. To find n, for any number of change wheels: Let A = number of teeth in gear on cone spindle. B = teeth on 1st stud wheel. C = teeth on 1st stud pinion. D = teeth on 2nd stud wheel. E = teeth on 2nd stud pinion. F = teeth on 3rd stud wheel. G = teeth on 3rd stud pinion. etc. L = teeth in wheel on lead screw. Then if N = number of revolutions of lead screw to one of cone spindle, $N = \frac{A \times C \times E \times G}{B \times D \times F \times L}$. And if M = number of revolutions of main spindle to one of cone spindle, $m = N + M$. To find M, a = teeth in wheel on cone spindle, b = teeth in 1st wheel on back speed shaft. c = teeth in 2nd wheel on back speed shaft. d = teeth in wheel on main spindle. Then $m = \frac{a \times c}{b \times d}$. The accompanying engraving will probably make the rules clear.



F. E. H. asks: What would be the average difference in weight of a loaded freight car and one unloaded? Answer: Weight, nine tons empty, nineteen tons loaded.

A. K. asks: 1. Would it pay to own and run a grain separator where coal is cheaper than wood? Coal is \$3 per ton at the bank, distance to be hauled from 2 to 12 miles. 2. How much coal would be consumed by a 20 horse power engine in a day's work of 12 hours? Answers: 1. We think so. 2. Probably between 1,500 and 2,000 lbs.

W. H. L. asks: How can I get a grease spot from a book? Answer: Apply refined benzine with a sponge or rag, to the grease spot.

H. F. U. asks: What shaped nozzle will send the longest and most solid stream from a fire engine, *ceteris paribus*? Answer: The nozzle which has the form of the contracted vein, (see article on "Efflux of Steam," page 118, current volume.)

A. K. asks: How much of an inch square must a steel bar be made, to support a weight of 3,000 lbs the bar to rest on supports 2 inches apart? What are the formulas, if weight or the distance of the supports be increased? Answer: The amount of cross section will depend upon the form, and the distribution of the weight. We will give you two rules for a steel bar, and you can assume different depths, weights and distances between supports, to find the various widths required under different circumstances. 1st. If the weight is suspended at the center the width of the bar in inches is equal to the clear span in feet multiplied by the weight in pounds, divided by the square of the depth in inches multiplied by 1,000. 2nd. If the weight is uniformly distributed, the width of the bar in inches is equal to the length of clear span in feet multiplied by the weight, divided by the square of the depth in inches multiplied by 2,000.

A. B. asks: Why is it that a saw heats on the rim in sawing hard timber, when in soft timber it runs very well? 2. Ought a circular saw to be hollowing on the log side, or perfectly straight? Answers: 1. Your saw is undoubtedly what saw makers call open on the rim, or possibly it may not be in proper line with the carriage; generally board circular saws are lined with the front or cutting portion a little nearer to the carriage than the back part of the saw, in order to prevent the teeth cutting or scratching the timber; this causes the saw naturally to incline towards the log and bear against the guide. The harder the timber, the more resistance it requires to keep the saw in proper position; consequently the greater friction, in sawing hard than soft timber, causes it to heat on the rim. If it is more open at the rim than in the body of the saw, the least amount of heat expands it, and causes it to heat still more. 2. A saw should be flat on the log side, and not hollowing. It had better be a very little full or convex on the log side, but in no case so much as to permit any portion of the plate to touch the timber.—J. E. E., of Pa.

L. S. says: I noticed in your answer to J. H., page 124, current volume, you recommend him to use Davies' "Algebra" and Legendre; but you will find that although they were the best in your day and mine, they are far behind Robinson's "Algebra," especially his "University Algebra," and Greenleaf's "Geometry," which, on examination, you will find very practical. However, the Legendre style (which they follow) never satisfied me. There is none of that solid reasoning found in Playfair's "Euclid" or Potts' "Geometry." The latter is an English work reprinted in New York. Answer: We are quite familiar with the works you mention, and mentioned the most suitable text books, according to our judgment. At the same time we are glad to receive the opinion of others. In an article recently published we have intimated that it was of more importance how the subject was studied, than what text book was used.

N. D. H. asks: In building an engine to propel a boat with twin screws, would friction gear work to more advantage than cog wheels? The latter are often used on such boats on the Western canals, and make a rumbling and disagreeable noise, and are liable to get out of order. Answer: Friction gear will work very well, if properly constructed. It is well to have V shaped grooves in the wheel or pinion, having V shaped projections on the other.

D. asks: 1. How can I make chloroform, and how is it administered to make a person sleep one hour? 2. How is acridulous mineral water made? 3. How is lemon syrup made? 4. Whose work on chemistry would you advise me to get, that is, whose is the most complete? Answers: 1. Chloroform is made by distilling a mixture of alcohol and chloride of lime. It is administered by means of a saturated sponge or handkerchief placed over the mouth of the patient, but we would advise you in no case to attempt to experiment with reference to its anesthetic properties, as serious results might follow. Its administration should be left entirely to an experienced physician. 2. By charging water, with which the proper chemical ingredients have previously been mixed, with carbonic acid gas. 3. By mixing lemon juice or citric acid with sugar syrup. 4. As an elementary work, Roscoe's or Bixham's.

J. P. asks: Is there any method of preparing cloth or thin leather so as to render it impervious to air without destroying its pliability? The ordinary rubber cloth is not, and I am told cannot be made, thoroughly air tight. Answer: We should judge that the cloth, from which what are known in England as mackintoshes are made, might serve your purpose. This cloth is prepared by coating two sheets of cloth on one side only with India rubber varnish and then pressing the varnished sides together by means of rollers so as to make one sheet. Thin leather might be treated in the same manner.

R. C. asks: 1. What is the difference between gold-bearing quartz and common quartz? 2. How is gold separated from quartz? 3. Does common sand contain gold; if so, about how much to a bushel of sand? 4. What are crucibles made of? 5. How can I separate brass? 6. What work on chemistry is the best? 7. How is phospho-tungstic acid made? Answers: 1. No difference, except that one contains gold and the other does not. If gold is present, it can generally be detected by the eye. 2. Gold is generally separated from quartz by crushing and grinding the rock into a fine flour; then by means of water the quartz is washed away, leaving the heavier gold in the vessel. There are other methods of separation. 3. Common sand does not contain gold. 4. Crucibles are made of black lead or graphite, also of clay. 5. By heat. 6. One of the best is Bixham's. 7. We do not know what our correspondent means unless it be a mixture of phosphoric and tungstic acids.

J. H. K. says: I have an orchard of apple trees about 15 or 20 years old. For the last two or three years I have been greatly troubled by the ravages of the canker worm; and unless a stop is put to them, I shall probably lose the trees in a year or two. Please inform me if there is a remedy. Answer: The female of the canker worm is fortunately without wings, and is obliged to crawl up the trees to lay the eggs. If you can prevent this, you can put a stop to the depredations of this insect plague. Various methods have been devised for this purpose, such as the application of tar either directly to the bark itself, or on strips of cloth, paper, etc. wound around the trunk. Melted India rubber has been recommended in England, but we should think tin troughs filled with cheap oil, fixed to and encircling the whole trunk, near the ground, would be a good plan. This plan indeed has been tried with success on a small scale. When the worms are on the leaves, showering with a mixture of whale oil soap in water (1 lb. soap to 7 gallons water) will kill the worms without injuring leaves or fruit. See Dr. Harris on "Insects Injurious to Vegetation."

F. T. H. asks: What will take nitric acid stains from cloth? Answer: Try strong ammonia or hartshorn. Apply with a small piece of sponge or cloth and afterwards wash the place with water.

J. C. M. asks: How are grass and bouquets crystallized, so that they preserve the same form and color? Answer: What you mean is probably that the grasses or flowers are covered with some crystalline salt. This might be done by dipping them into or sprinkling upon them a strong warm solution of sugar or alum, letting each portion crystallize before the next is applied.

I. C. asks: Will a suction pump work satisfactorily in supplying water taken from a well about 300 feet distant horizontally, with a perpendicular rise of say 22 or 23 feet? If so, what should the size of the pipe be, to cause the least outlay of labor in using the pump? Would it be preferable to lay the pipe according to the contour of the ground, or go to the additional expense of laying it nearly as regular in ascent as practicable, by deep cutting? Answer: A pipe one inch in diameter will answer, and it will be just as well to lay it according to the contour of the ground. The pump must be kept well packed, and will work satisfactorily, except that it will probably be a laborious operation for any one to furnish the requisite power. A small belt air engine, working a pump placed at the well and forcing the water to the house, is quite often employed in cases of this kind.

J. S. P. says: In your issue of July 19, C. M. P. says: "I have devised a machine which will grind a perfect lens of any size or shape." I should like to know how his machine is made, if he has no objection to publishing a description of it. I should like also an explanation of Professor Boyle's experiment which you referred to in the same paper. I don't understand how a polisher moving in cycloid curves can correct a spherical surface. Can you give a fuller description of Boyle's machine, or tell me where I can find such a description? Answer: A spherical refracting or reflecting surface must be converted into a paraboloid of revolution, before it will converge parallel rays to the same focus. This correction is accomplished by hand in the following manner: A disk of wood coated with pitch or rosin is worked with rouge in strokes across every diameter of the lens. The glass rests on an optician's post around which the operator walks, continuing the motion until the radius of curvature of the central part of the lens has been sufficiently shortened, so that the section curve becomes a parabola. Mr. Clark, who uses this method, makes the final correction by placing the lens over a paper disk marked with numbered concentric circles at intervals of a quarter of an inch; then, with his forefinger dipped in rouge, he rubs the glass gently in zones, guided by the numbered circles on the paper beneath. From time to time the glass is lifted upon a star; wherever the zones are long focus, the touches are light; where they are short, the finger is pressed on hard. The machine for local correction, which Clark says works too rapidly for his use, moves the local polisher to and fro, and at the same time turns the lens gradually, so that the polisher traces hypocyloid curves of greater or less extent upon the glass. The finger, as it instantly detects a particle of grit, is not so likely to scratch the surface as the machine. The touch of the skilled optician as, with his forefinger dipped in rouge, he wipes away the superfluous glass, finds a curious parallel in that of the phalaris, or burrowing mussel, which tunnels into granite with its soft foot, aided only by the abraded particles of the rock itself.

J. M. says, in answer to J. G., who asked how to solder broken pipes: They can be soldered with a common spirit lamp and blowpipe with common tinner's solder, after first cleaning the broken parts with muriatic acid.

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

P. S. H.—It is blue clay, a silicate of aluminum. If it burn white, it might be of value to the potters, in the manufacture of earthenware.

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 Hot Air Engine. By F. O. C.
- On the Pulsometer. By E. D. W.
- On the Patent Right Question. By W. F., and by C. H. A.
- On a Device for Saving Fuel. By R. F.
- On Interchangeable Parts. By B. F. S.
- On the Million Dollar Telescope. By X. P. M.
- On a Word to Apprentices. By F. H.
- On the Manifestation of Energy. By W. D.

Also enquires from the following:

P. H.—H. J. H.—B. L. B.—J. M. S.—C. de A.—A. B. C.

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

Correspondents in different parts of the country ask: Where can a magic lantern, for home use, be obtained? Where can machinery for making cheese boxes be had? Where are small rubber articles made? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

[OFFICIAL.]

Index of Inventions

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August 19, 1873,

AND EACH BEARING THAT DATE.

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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:

- 26,222.—PAPER PULP.—J. B. Palmer et al. November 5.
- 26,229.—BOOT TIPS.—N. Silverthorn. November 12.
- 26,264.—CARRIAGE TOP PROP.—G. Cook et al. Dec. 10.

EXTENSIONS GRANTED.

- 25,181.—NAIL MACHINE.—Daniel Dodge.
- 25,181.—PAPER BAG MACHINE.—W. Goodale.
- 25,199.—FEEDING PAPER TO PRESSES.—R. M. Hoe.

DESIGNS PATENTED.

- 6,802.—HAND SAW FRAME.—L. M. Collins, Lebanon, N. H.
- 6,801.—GLASS GORLETS.—J. H. Robbs, Wheeling, W. Va.
- 6,803.—GLASS DISH.—J. H. Robbs, Wheeling, W. Va.
- 6,806.—SEAL PRESSES.—C. A. Mathieson et al., N. Y. city.
- 6,807.—SAFETY STIRRUP.—R. Renfrew, Bloomington, Ill.
- 6,808.—GARALIER.—J. F. Travis, New York city.
- 6,809.—GAS BRACKET.—J. F. Travis, New York city.
- 6,810.—OIL CLOTH.—J. Barrett, New York city.
- 6,811.—CARPET.—J. Dornan, Philadelphia, Pa.
- 6,812 to 6,818.—OIL CLOTHS.—J. Hutchinson, Newark, N. J.
- 6,819 to 6,821.—CARPETS.—C. A. Richter, Philadelphia, Pa.
- 6,824.—CARPET.—J. T. Webster, Philadelphia, Pa.

TRADE MARKS REGISTERED.

- 1,410.—COTTON GIN.—Gullett Gin Mfg Co., Amity City, La.
- 1,411.—FERTILIZERS.—M. J. Solomons, Savannah, Ga.
- 1,412.—PACKED OYSTERS, ETC.—Wentzel et al., Baltimore, Md.
- 1,413.—SELECTED NAILS.—J. Coyne, Pittsburgh, Pa.
- 1,414 to 1,415.—FANCY AND DRY GOODS.—E. Flaxland & Co., Paris, France.
- 1,416.—WINES, ETC.—S. McCullagh, London, England.

SCHEDULE OF PATENT FEES:

On each Patent.....	\$10
On each Trade-Mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
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VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors.

ROBABLY 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, Howe, 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.

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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 MURKIN & 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.

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 MURKIN & 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.

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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 MURKIN & 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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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.

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Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

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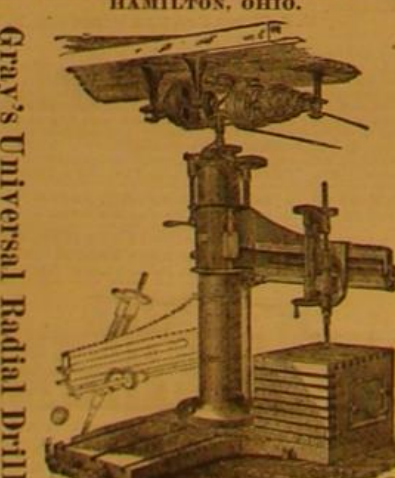
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