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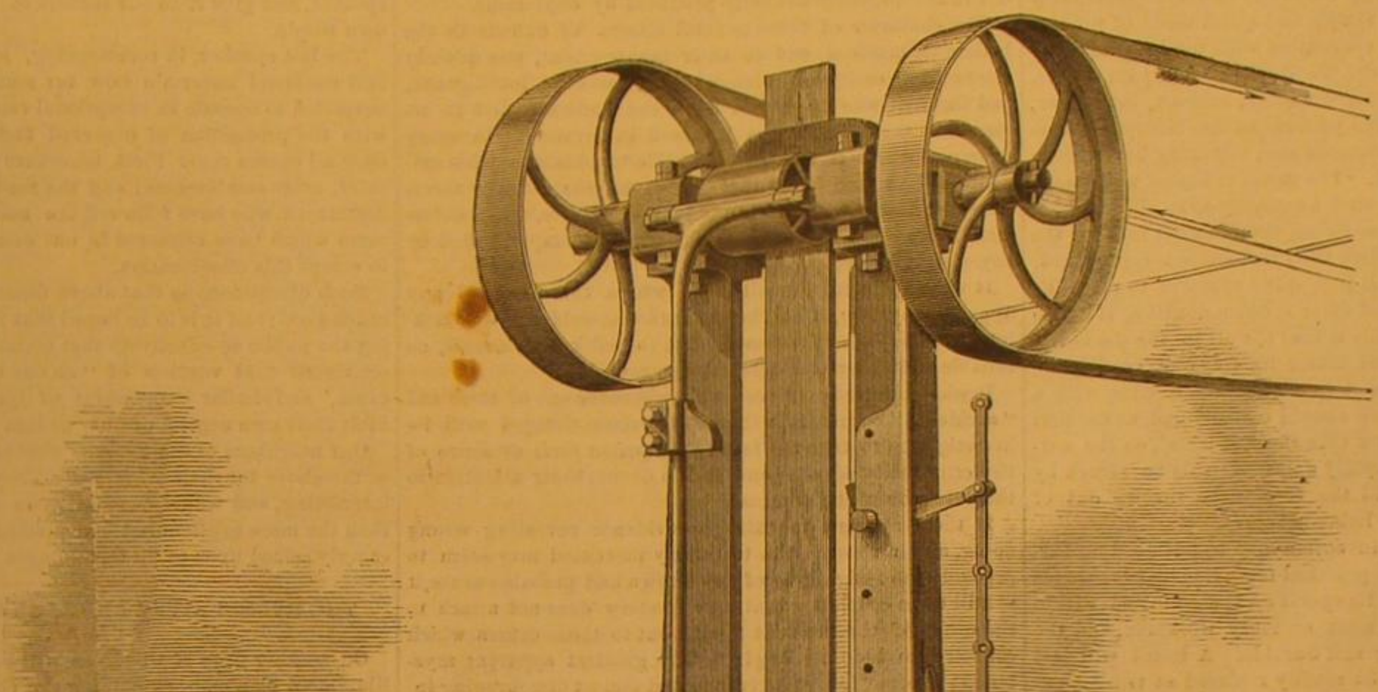
IMPROVED DROP HAMMER.

A volume might be written upon the hammer and its uses. The historian, if adhering to the Scriptural tradition, would doubtless begin with the labors of Tubal Cain, in the days before the flood; or, if inclined to Darwinism, with the probable efforts of our simian ancestors to break the thick envelope of the cocoanut by pounding it with stones in order to reach the food within; or, if noncommittal to either belief, his opening sentences would tell of the stone implements of the cave dwellers (inhabitants of the world ages ago) which now are found mingled with the bones of strange creatures long since passed from the face of the earth. Tracing the history of the hammer from the rude pestle of the barbarian, through the ages of stone and ron, up to the present day, he would find its use a necessity in every trade, its forms of infinite variety, extending from the tiny implement of the jeweler, barely a fraction of an ounce in weight, to the colossal mass of a hundred tuns of solid metal, delivering its blows with almost terrific might.

It is to the worker n metals that the hammer is the most important of tools, and it may be interesting, especially in connection with the subject of this article, briefly to note the adaptations of the implement to meet the requirements of the forge. The hand sledge, swung by the powerful arms of the smith, no longer able to cope with the increasing size of the work to be fashioned, gave place to the apparatus driven by machinery.

The most ancient form of forge hammer is probably the tennant helve, known in France as the *marteau frontal*, a heavy mass of cast iron, lifted by projecting arms fixed in a cam ring and falling through a certain space by its own gravity. Then came the tilt hammer, which, instead of being raised at the front end, was depressed by a cam ring from a part projecting behind. Another improvement on the original tennant helve was to lift the helve between the head of the hammer and the pivots on which it works. The last innovation, and the one which has remained longest in use, is the belly helve, which is raised under the bottom part of the helve by means of a bray, which could be lengthened or shortened according to the size of the piece to be acted upon. After all appeared the steam hammers in their various forms, possessing capabilities to the future extent of which no limit can be set. With these, however, we have not now to deal: for it is our object, at present, to refer simply to efforts made to drive hammers in connection with motors, and not by the direct application of the source of power to the implements themselves. While the steam hammer is susceptible to a great variety of uses, there are circumstances under which a device of the first mentioned class may serve certain purposes with even better results, while in other respects the latter may be sufficiently efficient to meet all requirements. As a particular instance of this, we take occasion, in the following description, to direct attention to a new machine for the making of forgings by a single blow, by forcing the metal into suitable dies. Hammers, both hand and power, have been always used for thus molding plates of metal, and one of the best known mechanical forms is the Oliver, an apparatus governed by the action of a spring pole controlled by the foot of the workman. The difficulties, however, with the large majority of the old implements in use preceding the introduction of the steam hammer, and indeed in many now employed, seem to be loss of power by gearing, trouble in regulating pressure or adapting it to work required, and the fact that the head, moving as it does in the arc of a circle, does not, on thick metal, strike a direct blow.



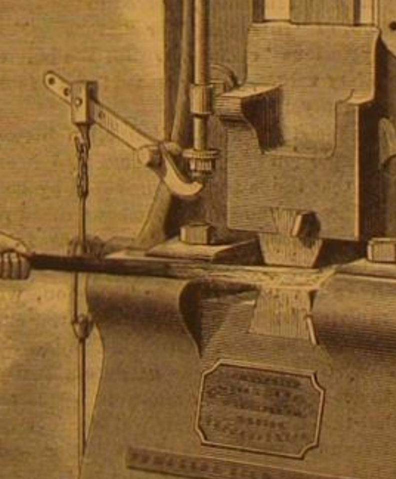
MERRILL'S IMPROVED DROP HAMMER.

A glance at the engraving of the machine herewith presented will at once demonstrate that two of the disadvantages above cited are absent, namely, the complicated gearing and the indirect stroke; and the following explanation will show that the force and extent of the blow can be governed with the utmost certainty and ease.

The heavy hammer head, which is constructed to weigh from 300 to 1,800 lbs., travels between two uprights and to it is attached a board of white oak or other suitable wood, which passes between two smooth friction rolls located in the upper portion of the machine. These rolls revolve in opposite directions, and each is driven by a separate pulley from one driving shaft, with cross and open belts. When they are closed together and pressed against the board, their friction upon each side of the latter raises it, and thus elevates the hammer; then, when the rolls are separated, the head is free to fall by its own gravity. The mechanism by which the operation is effected will be understood from the sectional view, Fig. 2, in which A A are the rolls, and B the board between them.

The shaft, upon which the front roll is keyed, runs in eccentric sleeves, one of which is shown at C, which are placed in stationary boxes. Hence, when these sleeves are rotated a small portion of a circle, the front roll is moved nearer to or further from the rear roll. To the arms of the sleeves is attached a drop rod, D, which connects with a lever, and the latter with a treadle. We will suppose the hammer to be at the upper portion of the frame and to rest upon the latch shown at the right. This latch, it will be seen, is adjustable, and may be pivoted at any elevation, and is connected with the treadle bar. When the workman presses the treadle down with his foot, he raises the drop bar, D, and, as is evident, at the same time pulls back the latch. Raising the drop bar causes a separation of the rolls; and the latch also being removed, the hammer, being unsupported, falls. At that instant, the blow being delivered, the operator removes his foot from the treadle, the drop rod then falls, and the eccentric sleeve turning the front roll, aided by the pull of the belt, is forced against the board, raising the hammer up again. If it be desired to give a series of heavy blows, the latch is thrown back out of operation and the hammer allowed to rise until it strikes a projection upon the drop rod; this it impinges against and rises, and so lifts the rod, causing, as we have shown, a separation of the rolls. The position of the projection on the drop rod is such that the latter will be lifted by the upper surface of the head when the hammer rests upon the latch, so that the machine may

Fig. 2



be left thus set, the rolls not griping the board until the rod is lifted by the treadle. The hammer, as a moment's consideration will show, follows the motion of the foot, and blows of any degree of shortness or lightness may be delivered. It may be instantly arrested at any point of its stroke, by simply removing the foot from the treadle, and thus caused to rise without delivering its blow. In a word, the machine is under complete control of the operator and is managed with perfect facility. In order to compensate for the gradual wearing down of the plank, the movable box, in which the rear friction pulley has its bearing, is provided with two screw bolts, as shown to the right of Fig. 2. The upper of these bolts extends through the box, but the lower one, only to its outer side. After loosening the upper screw bolt, the lower one can be turned in, thus pushing the box closer up to the board. Then, by tightening the upper bolt again, the box is rigidly secured in place.

As we stated in the outset, although the apparatus is excellently suitable for any variety of forging, it is especially adapted, by reason of its quick sharp blow and the means provided of instantly catching the hammer and preventing rebound, for the making of drop forgings. The articles which can thus be formed by the aid of dies are remarkably numerous; and when this simple and quick mode of producing them is considered in connection with the labor of casting or cutting them from the metal, the economy is obvious. Numbers of articles, such as wrenches, scissors, set screws, rings, bolts, hooks, and small portions of machinery, are thus instantly and accurately stamped out, requiring but a little finishing to complete them. The metal is heated and placed in the lower die, but not in such a quantity as to fill the same. As the drop falls, the blow forces the material into all the recesses of the mold, of which the exact shape is reproduced. We would remark here that it is quite common to place the hot metal above the die and drive it down, doubling it up, so to speak. The result of this is that the air in the die is tremendously compressed and forces its way out, scoring the cast steel of the latter almost as sharply as if done with a file. Again, but a single blow should be delivered, as the first stroke usually spreads out a thin sheet of metal, on the surface of the die, which rapidly cools. If this be struck by the hammer, not only will the forging be thrown out of shape, but the die itself is liable to injury.

The uses to which this invention may be put need no further explanation, as to the practical mechanic its advantages will be clearly apparent. Its operation is simple and within the comprehension of the most ordinary workman, and the materials used are strong and durable. A board will last several months and may be readily replaced at trifling expense. The manufacturer informs us that a large demand for the machine has already sprung up. The Prussian government, through Messrs. Pratt and Whitney, have already ordered thirty machines, and others have been shipped directly to the Spanish and Turkish governments; the Baldwin Locomotive Works employ five, and the Providence Tool Company twenty-five, while some 180 hammers have been in all made during the past two years. For further particulars address Messrs. Charles Merrill & Sons, No. 556 Grand street, New York city.

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Contents:

(Illustrated articles are marked with an asterisk.)

BOILER EXPLOSIONS NO MYSTERY.

We had the pleasure, recently, of listening to a lecture by Mr. McMurtrie on the subject of steam boiler explosions, delivered before the Polytechnic Club of the American Institute.

The speaker is a well known citizen of Boston, an engineer by profession, and formerly of the United States Naval Engineer Corps. He is one of the working friends of the Massachusetts Institute of Technology, and is considered, by the members of his profession, to be one of its ablest representatives.

The lecturer gave a succinct and very intelligent account of the principal of the many known causes of explosions, showing that they were all very simple and very easily understood, and that the mystery of steam boiler explosions arose merely from a difficulty in determining, from the scanty and usually conflicting evidence presented, to which of the known causes the disaster should be ascribed, rather than from the existence of any mystery in the nature of the cause itself.

It was stated that, out of thousands of cases of explosions which had been examined by experts, but a limited number, which might be counted on the ends of the fingers, were still involved in uncertainty as to cause; and even in these cases, the evident difficulty was insufficiency of testimony.

Neglect of boilers which required repair, ignorance of the proper methods of management, defective safety valves and other appurtenances, and the innumerable other causes arising from gross faults in those having boilers in charge, were shown to be invariably chargeable with the terrible loss of life and property annually produced by explosions.

The character of these several classes of defects in the boilers themselves, and in their management, was plainly shown to be easily comprehended by average intelligence, and the fact was impressed upon the audience that in no case was the phenomenon involved in mystery. In every example, where it had been possible to obtain reliable evidence, it had been found that the cause was readily ascertainable; and it was also found that the cause, when determined, was perfectly simple and readily comprehended by any well informed person.

It was shown that, in all cases where there existed any apparent mystery, it had been found that evidence was lacking, and that, were the disaster due to well known causes, no reliable testimony was obtainable to reveal it.

It was therefore concluded that, whenever one of these sad "accidents" occurs, it is the duty of those charged with its investigation to take the fact to be *prima facie* evidence of the criminality of some one, and to devote their attention to the detection of the criminal.

If there appears to exist no evidence revealing wrong doing, and although the testimony presented may seem to preclude the assignment of any known and probable cause, it is still to be concluded that the mystery does not attach to the cause of the accident itself, but to those causes which conspires to hide its origin. The greatest apparent mysteries are often found, after long and almost discouraging investigation, to be explainable by absurdly simple trains of circumstances.

The lecture occupied an hour in its delivery and was listened to by the crowded audience with a degree of attention which showed very plainly that the subject was one of public interest.

In the discussion which followed, Mr. Montgomery, the well known engineer and inventor, referred to the phenomena of electrical action, of "furrowing" or "grooving" and the formation of "mysterious" cyclones within the boiler by the opening of the safety valves, and presented them as examples of still unexplained mysteries.

Other gentlemen insisted that the distinction between the bursting and the explosion of steam boilers had been overlooked, and urged that the latter was produced by some still unknown cause, since no known phenomenon could possibly be the cause of such tremendous violence as frequently characterized explosions.

The chairman called up Professor Thurston, who was present, and, complying with the request, the latter explained the several apparent mysteries. Electrical action was considered to be a cause of some cases of exceptionally rapid corrosion, and to act in a greater or less degree in all cases. It was stated that the slightest difference, whether chemical or physical, between different parts of the boiler, causes the formation of what electricians call "local circuits" and the acceleration of oxidation. It is even supposed that all corrosion is due to electrical action, and the less rapid oxidation (which is noticed when surfaces are most perfectly uniform in character, as, for example, when zinc is amalgamated) is simply a consequence of the reduction of voltaic action by lessening the number and the intensity of action of local circuits.

Furrowing and grooving, which occur so frequently and to so serious an extent along the laps, and adjacent to lines of exceptional stiffness throughout the shell of locomotive and other boilers, was shown to be the evident result of long continued and frequently repeated bending (along lines of weakness where the action is concentrated by the stiffness of the adjacent seam), this change of form being a consequence of the continually occurring variations of pressure and temperature of steam and changes in the water level, which naturally produce considerable alteration in the shape of so flexible a structure as a boiler shell of quarter or three eighths metal, loaded with tuns of water and subjected to variations of internal pressure amounting to hundreds of tuns.

A statement of the almost obvious, yet seldom recognized, fact that steam, issuing from an open safety valve, possesses ten times the velocity of the heaviest hurricanes known among the West Indies or in the Chinese seas, and that the pressure of the wind in a real cyclone is but a fraction of a pound per square inch, showed that cyclones in a boiler, when the safety valves were raised, were not to be catalogued among the mysteries of steam boilers, and that the "entrainment" of mingled steam and water, or "priming," even to the extent of emptying the boiler, were no more mysterious than the boiling over of a tea kettle.

The apparently mysterious phenomenon which the French call a "detonating explosion," with its fearful power and disastrous effects, was shown to be perfectly free from all mystery by a simple calculation of the amount of energy pent up in the steam boiler which was exploded by Mr. F. B. Stevens at Sandy Hook. Had it all been expended in raising the whole boiler directly upward, without waste in other directions, this confined force would have raised the mass to the tremendous hight of five miles. The mystery, if any exists, is therefore that such explosions are not usually far more terrible than they actually are.

Finally, a short explanation was given of the nature of the "internal strain," as it is called, which is so common a cause of weakness in large masses of cast iron, and which seriously affects large pieces of steel, and even of malleable iron. The bearing of the recent discoveries and investigations of the speaker upon the existing theory of rupture was briefly given, and the conclusion was drawn that the greatest care should be taken to select the purest and most ductile irons, wherever changes of form and dimensions, such as had been described, were to be met. We have obtained a short description of the process of rupture, as it was given by the speaker, and give it to our readers in another column in his own words.

The last speaker, in commencing, stated that, although it still remained uncertain how far some causes, which were suspected to operate in exceptional cases, were to be credited with the production of observed facts, he was inclined to class all causes thus: First, ignorance; second, carelessness; third, utter recklessness; and the readers of the SCIENTIFIC AMERICAN who have followed the many discussions of such cases which have appeared in our columns will be very apt to accept this classification.

Such discussions as that above described cannot fail to do much good; and it is to be hoped that they will aid in educating the public so effectively that coroners' juries will become convinced that verdicts of "no one to blame," "unknown cause," and similar expressions of ignorance, will only exhibit their own neglect of duty or lack of intelligence.

Our neighbors of the *Tribune* should secure such lectures as the above for their "extras." They would be hardly less interesting, and would be even more useful to the world, than the more brilliant but less practical essays which are so eagerly seized upon to fill those pages.

THE HUDSON RIVER AND LAKE CHAMPLAIN SHIP CANAL.

On another page of this issue will be found a description, illustrated by a map, explaining the scheme now before the Legislature of New York, for the construction of a navigable water way between Troy and Lake Champlain. The work, it will be seen, includes the deepening of the Hudson River from Troy to Fort Edward, and the excavation of a canal from the latter point to White Hall on the lake, the entire length of the improvement being but sixty-three and three tenths miles. The advantages to be gained by the work are of such immense importance that its cost is rendered a matter almost insignificant. By an outlay of a sum which at the highest is estimated at $10,000,000, water communication from the Missouri and Mississippi rivers, and from all the ports and navigable inlets of the great lakes, to tide water at the cities of Troy, Albany, and New York, for vessels of a burden up to 2,000 tuns, is to be secured.

In view of the strenuous endeavors which are being made by Boston, Philadelphia, and other cities of the Atlantic sea board to bring to their markets the enormous commerce of the West and Northwest, the necessity which exists for the people of New York, and more especially of the metropolis, to put forth counter efforts to maintain the most feasible highways through their own State is becoming more and more apparent. Boston, by her recent railroad connections, claims to have gained, over the Erie canal, six days in time from Chicago and fifty per cent of transportation; while it is a fact that the grain receipts of the city have trebled during the past three years. Burlington within ten years has risen to a position to rival Albany in her great lumber trade. On the other hand, the Controller of this State in a late report shows that New York does not keep pace with the commerce of the West, and that the ratio of increase of tunnage is far from what it should be.

We need not refer to the high cost of transportation of western produce per railroad, or the immense waste of crops, which has taken place during several years past, owing to the inability of the present facilities to carry off the excess. No facts, we believe, are more generally understood. Hence it is certain that, not as a rival, but as an addition, to the Erie canal and other great highways now taxed beyond their limit, some other grand outlet must be opened. We cannot have too many such and that their construction will be forced by the constantly increasing amount of western productions which must find markets in the East, we believe to be only a question of time: while the State first in the field to offer the best facilities will find, in the great consequent augmentation of its commerce and revenues, the richest rewards for its enterprize.

The work contemplated, in the bill before the Legislature, is nothing, either in point of labor, time, and expense, beside the construction of the Erie canal. It could be entirely completed, it is stated, within four years; and estimating the transportation carried over it for the next twenty years at five million tuns per annum, a toll of forty cents per tun would within a decade repay its entire cost. The latter is within the means of many individual citizens of the State, and when distributed by taxation would be scarcely felt. It is small enough for the merchants of New York city to raise it by subscription, a project which appears worthy of consideraon, if another session of the Legislature pass by and no pro vision be made for initiating operations.

We would bespeak for the details of the plan, which we take from the able speech of Hon. Smith M. Weed, member of assembly from Clinton county, N. Y., the careful examination of all our readers. It is certain that no great work of internal improvement is now contemplated which is of more pressing importance, not merely to the metropolis or the State of New York. but to the vast section of the country whose commercial needs it must so materially meet.

CHAMELEONS.

There is a curious little lizard, the name of which is so coupled with fable that many believe it has never even existed. We mean the chameleon, which, though never seen on this continent, abounds in the old world. It is generally imagined that the reptile is capable of changing its color at will to the brightest of rainbow hues, and there is a wide spread popular belief that it lives on air, both of which ideas, though naturally arising from the peculiar appearance and habits of the animal, are far from the truth. Some years since, we captured a pair of these lizards among some ruins in Asia Minor; and for the three months during which they lived very comfortably in a wooden birdcage, we were enabled to study their strange peculiarities, and notably the phenomena for which M. Paul Bert, a member of the French Biological Society, has recently suggested some interesting explanations, which to us seem more in accordance with appearances than any yet adduced. The chameleon measures from five to eight inches in length and has a curious pyramidal shaped head, apparently separated from the neck. Its body is short and thick and ends in a prehensile tail of medium length. The ears are concealed under the skin, the mouth is large, and the eyes, which are very prominent and full, are closely covered by a circular lid in which is a small round perforation just in front of the pupil. The legs are long and slender, and terminate in a hand formed of five toes, divided into two bundles so as to resemble one broad finger and a thumb. By the aid of these members, and by winding their tails around the branches, the lizards climb about shrubs and trees in search of insects. Their motions are, however, very slow, and their habits sluggish in the extreme. They will cling to bars of their cages for days at a time, giving not the slightest sign of life, except perhaps the occasional twinkle of one eye. Handling them does not seem to disturb their equanimity, as they rarely struggle as long as they are permitted to cling to a finger, while they are perfectly harmless.

The strange peculiarity of the animal, however, is its faculty of changing its color, not in bright tints, but from a pale gray to light green, yellow, brown, reddish and violet shades, all, however, dusky and undecided. These changes sometimes occur very rapidly and are apparently provoked by anger and fear. In handling the lizard, we have noticed that, although it would, as we have already intimated, show no symptom of uneasiness, the clear light tint which covered its whole body would give place to dark brown blotches, some of which shaded curiously into black, resembling in form the spots of a leopard. The cause of the phenomenon has generally been considered to be soft granules, under the skin and of different colors, which are more or less extended according to the quantity of blood which reaches them; but the recent investigations of M. Bert show clearly that the nervous system acts directly without the intermediation of the blood. If the arteries of a member be tied so that no blood can pass, and the nerve affected, the colorations still continue; while on the other hand, if the nerve be destroyed, the tissues assume a black tint from which they do not change. It is very probable that the nerves thus acting are of the same order as the vaso-motors; for when the animal is poisoned by curare, and the other nerves are consequently paralyzed in their functions, it at once becomes black. If the sciatic nerve be electrified in a thickness at which the nerves of color should exist, the muscles do not contract but the tint of the member changes, proving that the current acts separately on the color nerves. The action of the latter also persists exactly as does that of the vaso-motors in spite of the curare poison. The microscope shows tubercles beneath the skin, which become differently colored through the singular bodies, of which they are composed, contracting or expanding as governed by the nerves.

Another curious feature of the chameleon is the independence of its eyes. It moves them separately; and when the animal sleeps, it seems as if but one half of it were awakened at a time. If a light be placed before one eye, the half of the corresponding side of the body becomes of a different color from the other side; but the tint becomes uniform all over when the light is carried before the other organ. It would seem from this that the reptile has two distinct luminous perceptions.

So sluggish a creature, it might be supposed, would be hardly suited for catching insects, and such indeed would be the case were chasing the latter the only way of entrapping them. The chameleon, however, resorts to strategy, and grabs its prey from a distance over which the unsuspecting fly or bug hardly deems it possible that its enemy can reach. The lizard's mode of seizing the insect is not only peculiar but also gives further proof of the dull nature of its perception. It never uses but one eye, and, while its body is perfectly motionless, will follow the movements of its prey with intense attention until it comes within about three inches of its nose; and then a tongue will dart out, more like a streak of pink lightning than anything else, strike the insect, and carry it back into the mouth. This tongue, which is out of all proportion to the size of the animal (sometimes twice its entire length), is a hollow tube terminated by a fleshy knob which has a cup-like cavity on its anterior surface, always covered with a viscid fluid. It shoots out a perfectly straight rod, and strikes the insect with unerring accuracy.

M. Bert, who has dissected the operating mechanism, says that the tongue is squeezed out, just as a cherry stone can be forced out by pressing the fruit between the fingers. Strong bands of muscles, surrounding the tongue, serve to apply the necessary pressure.

THE BEHAVIOR OF METALS UNDER STRAIN.

BY PROFESSOR R. H. THURSTON.

The resistance of metal to rupture is dependent upon two conditions: the first is the magnitude of cohesive force; the second is the homogeneousness of the material.

A metal is homogeneous in composition when all portions exhibit the same chemical constitution; it is homogeneous in structure when all parts exhibit the same arrangement of particles; it is homogeneous as to strain when all portions exhibit the same degree of what is called "internal strain."

This internal strain is produced whenever particles are given positions which are not those of equilibrium, and, consequently, such that they exert greater or less force to change their relations with surrounding molecules. The character, and the occasionally serious amount, of this kind of strain is exhibited by the weakness of large masses of metal, whether cast or forged, which is so frequently observed. Every one who has seen much of large work has known instances in which castings have cracked while cooling in the mold, and every pattern maker and every molder understands the necessity of making allowance for "shrink," and the advisability of avoiding the combination of thick with thin parts in the same piece of casting.

In brass and bronze castings, the difficulty is less than with cast iron, and in iron forgings the difficulty is still less. This condition does, however, sometimes exist to a serious degree, even in wrought iron when worked in large masses; and the steel rods, several inches in diameter, which it was attempted to make some time ago for one of our great bridges, were found in some cases to possess but a fraction of the strength, per square inch of section, which the same metal exhibited when cut into small pieces.

It follows, therefore, that, to secure the most reliable metal for purposes of construction, uniformity in composition and structure and freedom from liability to internal strain must be secured, if possible, as well as high cohesive strength.

It is, however, usually impossible to avoid the presence of internal strain, since artificially produced materials, like the metals, cannot be given form except by external force. It becomes important, therefore, to study the character, the effects, and the means of relieving or avoiding internal strain in order that we may know where to look for it, and how to prevent difficulties consequent upon its existence.

The existence of internal strain in castings has been long well known, and the large masses of cast iron frequently produced in every foundery are always either very slowly cooled in order that uniform contraction and solidification throughout shall prevent dangerous strain occurring, or they are carefully annealed, or they are artificially cooled—as in making the Rodman gun, for example—in such a manner that the strain which may occur shall be of actual service by aiding in resistance of external forces.

The extent to which wrought iron may be weakened by internal strain, and the behavior of the various qualities as affected by its presence have only recently attracted much attention from engineers.

A somewhat extended experimental research, made by the writer, has resulted in the discovery of some interesting facts and leads to some useful deductions. The limits of a short article like this forbid such an extended account of these investigations, as is given at length in more purely technical journals*; and a mere *resumé* of the work and of the conclusions derived from it must suffice.

It was found that all metals exhibited the presence of more or less of this cause of weakness, the harder varieties being most seriously affected, and the ductile and soft kinds showing it least. The same grade of metal was found to contain an amount of internal strain, which varied according to the treatment to which it had been subjected during, or subsequent to, its manufacture.

The harder kinds of iron were capable of taking up additional strain when subjected to the process which produces hardening in steel, and all grades were found to lose it by the operation of annealing. The harder metals were found to be more liable to injury, by reduction of their ultimate strength in consequence of the presence of internal strain, than were soft varieties.

It was found that internal strains could be modified by external forces, and that this fact has a most important influence upon the behavior of the metals, and consequently, upon their availability for purposes of construction.

It has already been stated in the SCIENTIFIC AMERICAN that the discovery was some time ago made that a piece of iron or steel, left for some time under a load, acquired an increased power of resisting further change of form†. It has become very evident, as further experiments have been made in studying this remarkable action, that this is the effect of the gradual relief of pre-existing internal strain. It is unobservable in bodies free from such strain, and is noticed in cases where internal strain exists, sometimes producing a very large variation of resistance.

This relief occurs by the "flow" of particles, as it has been called, a well known property of solid bodies subjected to great force, and which is best illustrated by the process of "squirting" lead pipe, and less strikingly whenever metals are worked in the rolls or under the hammer.

A piece of metal being placed under the action of external force, some of its lines of particles are more strained than others, and the mass does not resist change of form or ultimate fracture with its maximum power. Its forces are overcome in detachments. Left under a load not capable of breaking it, however, the particles are gradually shifted by the applied force and "flow" into new positions with a rapidity which is greater as the material is more ductile. The available forces of cohesion are now combined, and, pulling together, can offer more resistance than at first.

After this fact had been discovered and its probable cause had been ascertained, it was considered very likely that the converse might be true, and that rapid change of form and sudden rupture might be less resisted than a slow action. Experiment promptly proved the correctness of the conjecture, and it was found that a very serious loss of resistance frequently took place under such sudden strains as those produced by blows. The second discovery, which had been made by Kirkaldy* at an earlier date, although apparently not accepted by the profession on account of the possible action of inertia in his experiments, is even more important than the first, since it shows that structures and machinery exposed to shock are not as safe as they have been supposed, although the first described effect of internal strain would appear to produce an increase of resistance to static forces.

Dead loads can therefore be sustained with greater safety than had been previously supposed, while with live loads the contrary is the fact.

It would seem that rapid change of form introduces internal strain more rapidly than it can be relieved, and thus weakens the metal, while very slow alteration permits a certain amount of "flow" and relief of strain, and gives a higher strength in consequence.

The effect of relief of internal strain was discovered nearly forty years ago by Professor Johnson, while conducting the Franklin Institute experiments on the causes of boiler explosions. He does not, however, seem to have suspected the cause, and speaks of the phenomenon as "anomalous." He relieved internal strain by what he called "thermo-tension," heating the metal to a high temperature, applying a heavy load, and allowing it to cool under tension. He states the amount at about 15 per cent for Salisbury iron, and 20 per cent for some specimens of Tredegar. It would appear that we find here the secret of the exceptional behavior of wrought iron, in exhibiting a gain of strength at high temperatures.

From this fact, and from the experiments of the writer, the inference has been drawn that, the more ductile the material, the more readily and completely may internal strain be relieved, and the safer is the material against shock.

I conclude also, that parts should always, if possible, be so proportioned that all parts shall stretch uniformly if liable to accidental injury, in order that the reduction of strength, due to rapid distortion, may not weaken it on several lines of strain successively, and produce rupture by thus taking the parts at a disadvantage.

Where parts are liable to injury by shock, they should also be slightly thickened up near the part exposed to the blow.

In selecting material for constructions peculiarly exposed to injury by shock, we see that it is particularly necessary to obtain pure and ductile iron.

For structures like steam boilers, which are continually changing form with variations of temperature and pressure, it is even more necessary to select the best of iron.

STEVENS INSTITUTE OF TECHNOLOGY, March, 1874.

* See current volumes of *Trans. Am. Soc. C. E.* and *Journal Franklin Institute*.

† See *Trans. Am. Soc. C. E.*, Vol. II, p. 230 *Journal Franklin Inst.* March 1874, pp. 150, 151.

* "Experiments on Strength of Iron and Steel."

SCIENTIFIC AND PRACTICAL INFORMATION.

RAISING WRECKS.

In raising sunken vessels, it has been common to use flexible airtight bags, which, when properly secured to the vessel, are inflated with air by pumps. A recent improvement, by Mr. Sowerbutts, of England, consists in supplying acid and alkali to the bags, which, on being mixed, generate carbonic acid within the bags and produce the necessary inflation, no air pumping being necessary.

NEW APPARATUS FOR REGISTERING THE DIRECTION OF CLOUDS.

M. de Parville proposes for this purpose a board some 12 inches long by 8 inches broad, fixed on a suitable support. A square of unpolished glass, placed vertically, divides the plane in two equal parts. The left hand side of the latter is covered with a mirror; on the right is a sheet of paper. As the clouds pass above the horizontal glass, they are reflected; and at the same time the observer sees their images on the vertical glass projected on the paper. It is only necessary to trace their direction on the latter with a pencil. On the mirror is engraved a compass card, which is also reproduced on the paper, and a small magnetic needle is suitably arranged so as to adjust the apparatus.

THE WASTE OF COTTON SEED.

Mr. Aikin, of South Carolina, says that the loss by neglecting to save cotton seed is immense; piles of seed are allowed to decompose and waste at nearly every gin house, and yet the seed is a valuable manure. For cultivated crops, 30 bushels of cotton seed in the drill, or 50 bushels broadcast, to the acre will increase the crop considerably. Seed can be rotted by composting it in alternate layers of leaves, straw, and stable manure; 100 bushels of green cotton seed, mixed in bulk with a tun of soluble phosphate and allowed to remain a fortnight, will make a capital compost for 10 acres of any cultivated crop.

THE LIGHTNING SCREW PLATE.

The chief feature of the invention represented in the annexed engravings, to which the reader's attention may be first directed, is that the die does its work in a single cut, thus forming the screw thread at once, instead of by several trials, as is the case with the implement in ordinary use. In order to compensate for wear, the die is capable of proper adjustment, so that it is claimed to keep its size with accuracy until used up, or over a long period of constant employment.

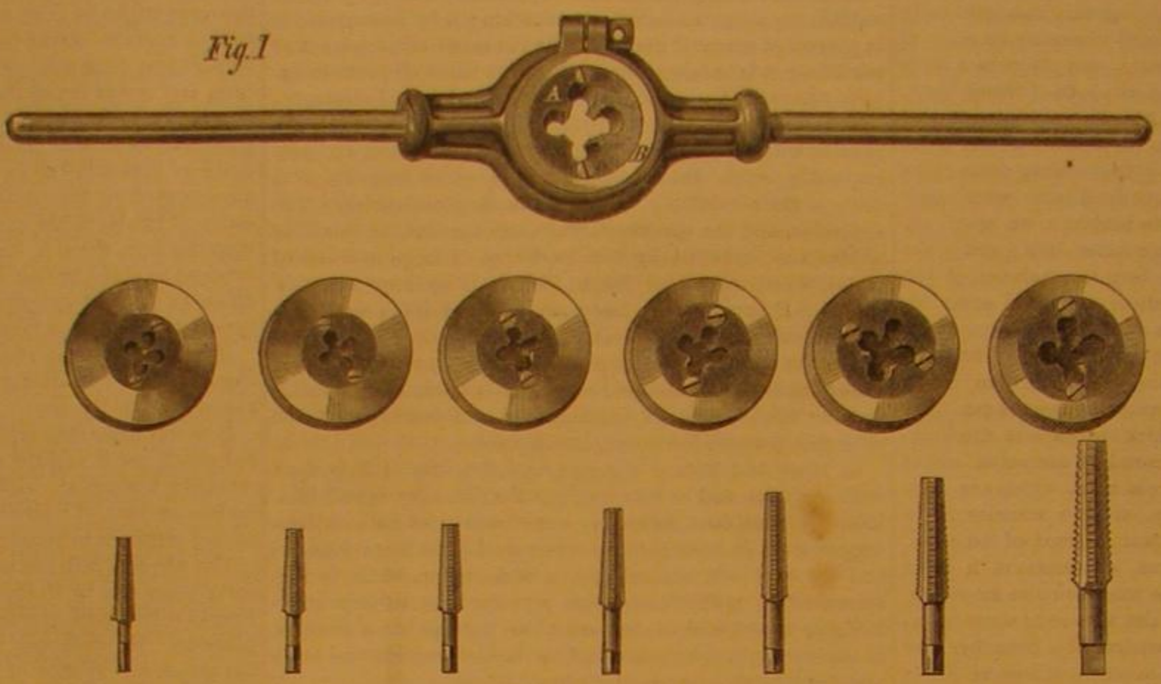
The complete tool is represented in Fig. 1. A is the die, which is secured in a suitable collet, B, which, in turn, is held by the set screw, C, in the plate. A $\frac{3}{4}$ inch die, that being the largest size, is represented as secured in the latter, and below are shown the remaining six sizes of dies with their corresponding taps, namely, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$, $\frac{1}{2}$, and $\frac{5}{8}$ inch, all of which are supplied with the tool.

In the sectional view, Fig. 2, the construction of the die and its mode of adjustment are depicted. D are taper headed screws, which spread the die when driven in, while the screws, E, serve to close the parts of the latter together from the sides. The taper screws govern the size of the cut; and after they are regulated, the binding screws hold the portions firmly in place.

It is claimed that this invention will accomplish five times the work possible with any other screw plate. The threads are cut neatly and sharply into the bolts, and not, as is frequently the case with the common tool, jammed out of the iron so as to raise the threaded portion above the normal surface, thus impairing the accuracy and regularity of the operation. The dies allow of nuts and bolts for different purposes being made to fit together tightly or loosely, as desired. When worn out they can be replaced, the plate and collets remaining good. The articles threaded need not be matched and kept together, as they always correspond without being tried or fitted. The collets holding the dies have guides, as shown at F, Fig. 2, for starting bolts true, though, when it is desirable to cut close under the heads of the latter, the face side is used. The design of the plate combines ample strength with remarkable lightness; and in quality, style, and finish, the device appears to be an excellent tool.

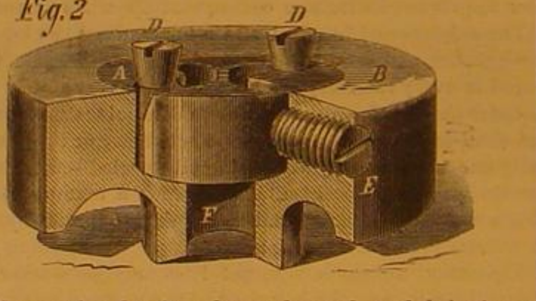
For further particulars address Messrs. Wiley & Russell, Greenfield, Mass.

Fig. 1



THE LIGHTNING SCREW PLATE.

Fig. 2

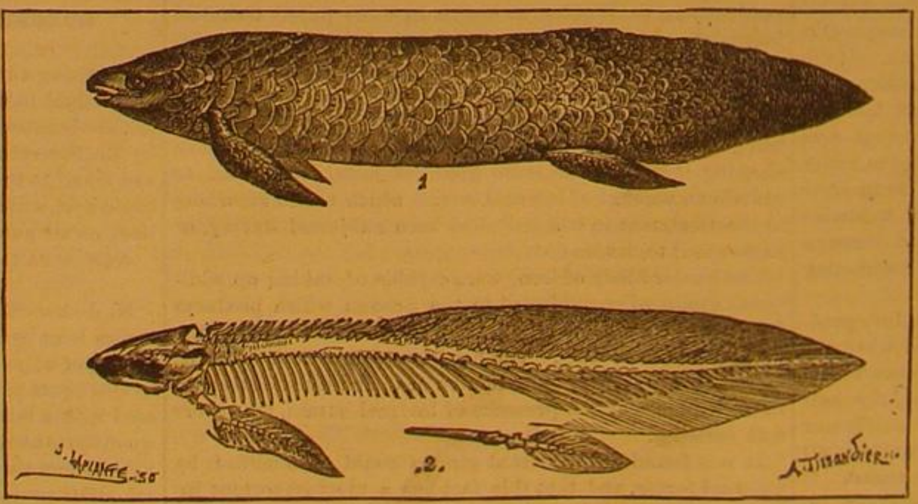


THE GRASS EATING FISH.

Nature makes no leaps; on the contrary, she appears to fill up, by design, the gaps which appear to exist between each parallel series of beings. Numerous examples exist, or have existed, of these odd connecting links; the Australian ornithorincus, a quadruped with a bird's beak; the apteryx, a bird with hair and no wings; the pterodactyl, or winged lizard of antiquity; the fossil turtles, with teeth, found in the Cape diamond diggings—are illustrations in point, and still another is found in the queer fish represented in our engraving. It is called the *ceratodus Forsteri*, and is allied to the fishes through the *lepidosiren*, a singular animal found in the streams and ditches near Bahia, Brazil. The *lepidosiren* is popularly termed the caracurus, and is known by its odd shaped, elongated body, covered with scales, appearing to terminate in a fish's tail, while its means of locomotion consist in four fins located underneath. French naturalists have placed this animal in a distinct class of amphibious reptiles. Owen, on the other hand, pronounces it a fish, and the connecting link between fishes and reptiles.

The discovery of the *ceratodus*, however, adduces an even closer connection between the two families. The genus was established by Agassiz, who found the fossil teeth and jaw bones of the animal in the jurassic and triassic formations of many parts of Europe. It was supposed that, save in these ancient remains, the creature did not exist, until a few years since, when living specimens were found in the rivers of northern Australia, exactly corresponding to to the fragmentary relics.

In the annexed engraving is represented the appearance of the living fish and also of the skeleton. Its length is about 38 inches, and its diameter 7 inches. Its habits are as peculiar as its form. Although living in the rivers, it rarely ascends above the brackish water, and finds its sustenance in the vegetation which, growing in shallow places, is left uncovered by the ebb of the tide. At night the fish leaves the water, crawling in among the plants and feeding. The quantity of nourishment it needs is enormous, and it is said that the amount of half-digested myrtaceous and graminaceous foliage found in its intestines is out of all proportion to the apparent requirements of the animal. In order to pursue its habits, it is evident that air-breathing apparatus must be present in the organization, and such is the case. Its gills are a sort of porous lung, of very complicated construction, having ramifications which expand into cavities filled with a coagulum, the function of which has not been definitely determined.



THE GRASS EATING FISH.

Inventors' Mistakes.

Inventors are too liable to think that upon the granting of their patents success is certain, which it would be if they would display as much business tact as they have done inventive ability. Upon the granting of a patent the inventor thinks his "future made" and thereupon sits down, waiting for the dollars to come without any effort on his part to induce a flow of coin into his treasury. After a season of such inactivity, with poverty finally staring him in the face, he parts with his patent for a small sum to a shrewd business man, who places the matter before the public in a business-like way, advertises it in mediums through which it reaches the attention of all in need of that particular invention, eventually creating for it a large demand, and bringing a correspondingly large revenue to the advertiser.

The day has passed when people having any desirable thing to sell may expect to reap success by waiting for the public to seek them out. At the present day, every important branch of manufacture has its own special organ; if an inventor has anything to sell which is worth buying, the attention of purchasers is expected to be called to the fact through such publications, as well as through the mailing of circulars, etc. A large proportion of the patents granted are for inventions of real merit, and of value to the public, and inventors and the public are alike sufferers for this very want of business tact on the part of inventors, who should, immediately upon the issuing of the patent, have it properly engraved and published in such journals as reach readers who require the use of such particular inventions. "Masterly inactivity" has ruined many an inventor who might otherwise have been to-day in the possession of a fortune.—*Newark (N. J.) Manufacturer.*

No pillar or support of brick or stone should ever exceed in hight twelve times its least thickness at its base.

Hints on House Papering.

This is the season, among good housewives, for cleaning, whitewashing, painting, papering, and otherwise renovating the domicile.

After the cleaning, whitewashing, and painting is accomplished, comes the process of papering the walls; but the first thing, frequently, to be done is the removal of the old paper. To do this successfully, wet the wall thoroughly; and, when well soaked, the old paper can be stripped off very quickly. After the paper is removed, wash the wall to get off all the particles of paper which may remain, and leave the walls till nearly dry before commencing to lay the new paper. If the walls have been whitewashed instead of papered, wash the walls with vinegar, which will make the paste and paper adhere more securely. A bench is easily made for measuring and cutting the paper, by placing boards of suitable length across two flour barrels. The paper should be unrolled and cut to proper length and in sufficient quantity to cover the room, before the pasting process commences. These sheets should be laid one over the other, to be readily at hand when the paster is ready to begin work. The liability of turning the edges or damaging the paper will be greatly obviated by adopting this course. Flour paste is the usual article for the purpose, and rye flour is considered better than wheat, as it has more adhesion. Mix the flour in cold water thoroughly, by stirring, until the paste has a thin creamy consistence, and then boil, when it will thicken, according to the length of time it is submitted to the heat. If found too thick in cooling, add boiling water till the desired degree of thickness is obtained; then add a little carbolic acid to prevent the paste from souring or becoming moldy. A broad white wash brush is the best to apply the paste with, and the paper should be laid quickly after pasting, to prevent its becoming soft and tender to handle.

Two persons are required to lay on paper with rapidity, one to paste and one to apply the paper. When the paper is pasted it should be handed to the person on the ladder, who holds it about a foot from the top end, and lays it evenly against the wall at the top, allowing the upper end to hang over on the backs of the hands. By looking down the wall, it may be seen when it matches the previously laid length; and after adjusting to match, it should then be brought gently to the wall, the backs of the hands then pressed against the wall and passed upwards towards the ceiling, spreading them out towards the corners of the length of paper. The scissors are then run along at the juncture of the wall and ceiling, making a mark which can be easily seen, when the top of the paper is removed for a little distance, and it is cut off even and replaced. Then a soft cloth is gently passed downwards and the paper pressed against the wall to the bottom, where it is cut off as at the top.

Iron Electrotypes.

A brief item on this subject appeared in a former issue of the *Journal*, to which we may now add the additional declaration that M. Klein, a Russian chemist, has succeeded in obtaining very satisfactory results from a series of experiments in this direction.

The process followed by him is described as follows: The bath employed consists of a concentrated solution of sulphate of iron and ammonia, and the battery of four Meidinger cells. For an anode, an iron plate is used, with a surface about eight times that of the cathode; and connecting this with a copper plate, a perfect coating of iron is obtained. On leaving the bath, the iron, it is said, is as hard as tempered steel, and very brittle. When heated, however, to a cherry red, it is said to become malleable, and may then be engraved as easily as soft steel.—*Journal of the Franklin Institute.*

[Our readers will find a full account of M. Klein's process, above alluded to, for the production of iron electrotypes, in the SCIENTIFIC AMERICAN of November 18, 1868. The invention was patented in this country by M. Klein, of St. Petersburgh, Russia, September 29, 1868. The Hon. Cassius M. Clay, then United States Minister to Russia, brought home some examples of the new process, consisting of iron electrotype plates for printing, being copies of engraved copper plates. These examples were very perfect. They were for some time on exhibition in this office and were noticed in this paper November 27, 1869, a full account of the process being then also given.—EDS.]

THE Choctaws and Cherokees of Indian Territory raised 5,000 bales of cotton last season, more than twice as much as the crop of 1872. Most of it went to the St. Louis market.

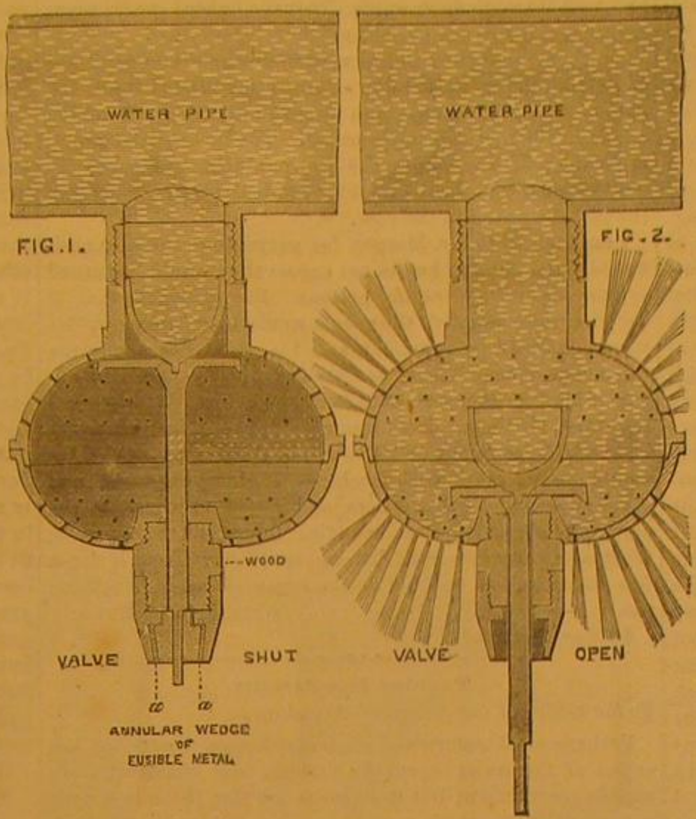
SELF-ACTING FLOOD PIPES FOR BUILDINGS.

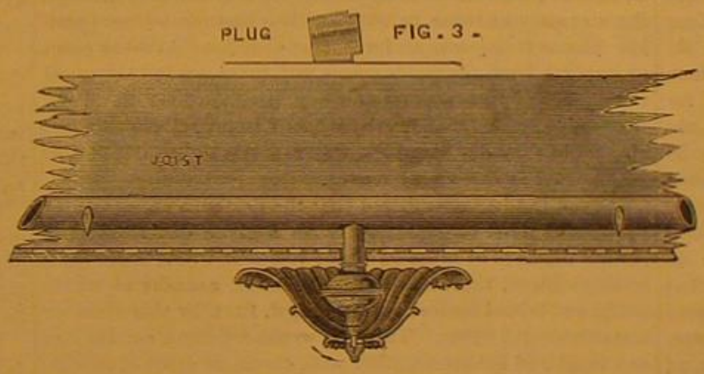
We herewith publish engravings of a device, designed by Mr. Stewart Harrison, of London, England, for the purpose of automatically flooding with water the interior of a building attacked by fire. It is exceedingly simple, and its operation may be understood at a glance.

The self-acting preserver valve (Figs. 1 and 2) is so constructed that the valve is held in its seating, so as to prevent the efflux of water, only by a conical brass plug, carrying the stem or spindle of the valve, and retained in position within a suitable conical recess or seat by an annular wedge of fusible metal. Between the valve and the plug there is a perforated hollow spheroid, which acts like a rose, to distribute the water when issuing under pressure on all sides; and this rose and the plug beneath it necessarily project downwards below the ceiling, for obvious reasons, the supply pipes being affixed by holdfasts to the joists above. Then, in case of a fire occurring by accident, generating flames and elevating the temperature, so soon as the boiling point of water is attained the fusible plug melts, the plug drops out, the valve falls, and water in continuous streams is at once discharged upon the fire and flame, extinguishing them before they can spread or gather strength so as to become uncontrollable; in fact, the fire is the immediate agent and exciting cause of its own destruction.

So far it is clear there is nothing out of the way or impracticable in the scheme; nothing involving any departure from existing practice, as in the case of gas and water pipes, bell wires, speaking tubes, and the like; of which, indeed, it is the corollary and extension. But it obviously involves the absolute existence of a constant public water supply, at high pressure, accessible and available; or, in default thereof, of adequate storage of water in cisterns, of sufficient dimensions, suitably placed, to give the requisite supply and pressure. It is obvious also that some expedient in adaptation to the circumstances of a frost, by saline ingredients and due circulation, would be advantageous or necessary.

Individuals of an inquiring turn of mind may speculate upon the case of a fire breaking out at night, and being thus extinguished, of necessity without being discovered; when, of course, the water would continue to flow, to the serious injury of furniture, goods, merchandize, etc. Without entering on the discussion as to which of the two evils, excess of fire or water, be the least, it will suffice to remark that Mr. Stewart Harrison has at least not neglected this aspect of the case. He provides for the difficulty (says *Iron*, to which we are indebted for the engravings) by a very simple contrivance, the adoption of an arrangement to give warning of the occurrence of a nascent fire, by the flow of water being made to depress a piston, releasing and setting in action a suitable alarm on the premises; which, by the very simple aid of making a connection with a galvanic battery, and completing a circuit, might, if required, be made to ring an alarm bell situated anywhere, these alarms continuing until attention is aroused, and enforcing the active agency of a human being to turn off the water and stop the flow and the alarm simultaneously.





LESLEY'S ZERO REFRIGERATOR.

We remember reading, some time ago, a queer story—very much on a par with the veracious recitals of Baron Munchausen—about a party of hunters in the arctic regions, who, while pursuing the chase, suddenly discovered two strange objects protruding through the frozen soil. Closer examination proved the articles to be nothing more or less than a pair of boots, and a still more rigid scrutiny indicated the fact that said boots contained legs. Setting to work with axe and pick, the hunters proceeded to dig out the balance of the body, and finally un iced a remarkable individual, dressed in the garb of centuries back, and, of course, frozen stiff. The story goes on to tell how, while they were debating as to the disposition to be made of the odd discovery, they left the body by the camp fire, where it thawed, and its owner, to their astonishment, signalized his return to existence by a howl for brandy. Then the romancer recounts the yarn, which the resuscitated ancient tells his deliverers, of life a few hundred years back, and how he became frozen in the ice and had slept a Rip Van Winkle sleep, preserved by the intense cold. The sequel is that the old gentleman tells entirely too many stories, and becomes a bore, whereupon the afflicted hunters suggest that he is sufficiently indurated to cold to sleep out of doors. He does so, and again freezes stiff, in which condition the party very gladly leave him to his fate. While the return to life of an individual who had been frozen several centuries is rather without the bounds of probability, the fact of his keeping that length of time is not. In the frozen earth of Northern Siberia, the bodies of mastodons, still covered with flesh and skin, have been found in a state of such preservation as to furnish food to living animals—a circumstance which doubtless, in some way, gave rise to the foregoing story; and, in general, it is a well known fact that, in organic substances, when kept at a cold temperature, decomposition is arrested. If, in addition to cold, the atmosphere be both dry and uniform in temperature, decay may be prevented by artificial means for an indefinite length of time.

The necessity of securing, as complete as possible a freedom from humidity in the air, of receptacles in which meats and vegetables are to be preserved, is a point of importance which deserves to be widely understood. In some climates, as in South American countries, parts of Texas and California, and in special localities where a naturally dry atmosphere prevails, articles of food are kept without the aid of the refrigerator and with little trouble. Generally, however, in the climate of the United States, moisture is present, a circumstance plainly exhibiting itself by the condensation on the cold surface of pitchers containing ice water in summer, or on the exterior of the window panes of warm rooms in winter. Hence, it must be one of the principal objects of a refrigerator, which imitates the action of Nature, to keep its contained air in as dry a state as possible. This manifestly cannot be done if meat, vegetables, milk, butter, and other substances are all packed in a single compartment with the ice.

Professor Loomis points out that if moisture is present, no temperature greater than the freezing point can wholly prevent decomposition. Meat, therefore, once placed upon ice, prepares itself to decay at that temperature, and if removed spoils quickly. Hence it is that, when removed from the butcher's chest, in hot weather, it frequently becomes unfit for use in a few hours. It needs no argument to prove the dampness present in single compartment refrigerators, and from their close earthy smell, the mingling of odors within them, the neglect of servants to keep the blankets used to cover the ice perfectly clean, and from similar defects, their sanitary value is at best questionable. In receptacles where the ice is in one division, and the articles in another, a point of advantage is aimed at; but, clearly, if the moisture in the food compartment be allowed to condense on the cold surface of the ice box and then to flow back on the meat, etc., the object sought is not secured.

A full knowledge of the considerations above advanced has, however, been brought to bear in the construction of an improved refrigerator, manufactured by Mr. A. M. Lesley, of 224 and 226 West 23d street, in this city, the newest form of which is represented in the annexed engraving. The Zero refrigerator, as heretofore made by Mr. Lesley, differs from that illustrated herewith in having less ice space, the ice compartment being in the center of the top, and having curved sides meeting just below the faucet in front. This necessarily gave more room for articles in the lower divisions; but as, in many cases, it is desirable to secure a supply of ice which will last a considerable time, the section for the same has been enlarged. In this division the blocks are placed, upon a wooden tray, through which the water runs to a charcoal filter, which covers a small central compartment, shown through the right hand open door. This gives a supply of pure ice water, which may be drawn off as needed by the faucet. The moisture condenses upon the surface of the ice box adjoining the food receptacles, and thus leaves the air in the latter in an almost dry state. It then runs to a trough, and thence is conducted, to a pan located under the apparatus, by a suitable pipe, in which a trap or siphon is placed so as to prevent an escape of cold or an influx of warm air. On top, and beside the ice box, is arranged a receiver for wine bottles, milk, etc. Each compartment has its own door, so that access may be had to any one without disturbing the others, and hence no warm air gets to the ice except while the supply is being replenished. The inventor states that moisture is never seen on the inside lining, and that the provision chambers are always sweet and clean. Matches, we are informed, which absorb dampness readily, have been placed in the refrigerator, as a test, without injuring them in any wise. The consumption of ice is said to be remarkably small.

The Zero refrigerator is constructed of clean, well seasoned lumber, filled with cork, lined with zinc, and is provided with a galvanized iron ice box.

Mr. Lesley submits a very large number of commendatory testimonials, together with premiums from three American Institute fairs, and from many expositions throughout the country. Further particulars may be obtained by addressing the inventor as above.

The Artificial Production of Low Temperatures.

BY PROFESSOR EDWIN J. HOUSTON.

By the Windhausen process, a steam engine is employed to condense air to, say, two or three atmospheres. The heat developed by the compression is drawn off during the passage of the condensed air through pipes in a series of chambers, in which cold water is flowing. The cooled air is then allowed to expand into a cylinder under a gradually diminishing pressure, the expansion being attended with the development of great cold. It is claimed that under a pressure of but 35 pounds to the square inch, a reduction of —54° Fah. has been obtained, a surprisingly low temperature, considering the means employed.

The following modifications of the apparatus would render its cold-producing power almost unlimited:

1. A communication between the expansion cylinder and the chambers through which the condensed air is conducted before it is allowed to expand. Supposing this outlet regulated by a cock, a blast of very cold air could replace the running water, and reduce the condensed air to a very low temperature.

2. The introduction of a second compressing cylinder, with which the condensed air, after being cooled, could be still further compressed, again cooled, and finally conducted into the expansion cylinder. Under a pressure of, say, 60 atmospheres, a considerable mass of air at the temperature of say —100° Fah. would, in its expansion, produce a reduction of temperature greater perhaps than any yet obtained. Since by means of the communication between the expansion cooling chambers, the condensed air can be lowered to any temperature obtainable in the expansion cylinder, there would appear to be no other limit to the reduction of temperature save what would arise from the strength of materials, or the liquefaction and subsequent freezing of the nitrogen, or the oxygen of the air, or of the air itself. Among the advantages that we may rationally expect to accrue from the apparatus thus modified are the following:

1. The confirmation or otherwise of the "absolute zero," as determined by the expansion or contraction of gases by heat or cold.

2. The liquefaction and subsequent solidification of many of the incoercible gases, the determination of their physical peculiarities as liquids or solids, together with their crystalline form.

3. The action of intense cold on the chemical affinities of certain gaseous compounds.

4. The action of intense cold on the color of certain chemical compounds.—*Journal of the Franklin Institute.*

[In the SCIENTIFIC AMERICAN, September 28, 1850, is given a description of a refrigerating apparatus, by Dr. Gorrie, which presents an arrangement apparently analogous in idea to that suggested above by Professor Houston.—EDS.]

THE FROG BAROMETER.—In some countries frogs are used as barometers: the species employed for this purpose is the green tree frog. They are placed in tall glass bottles with little wooden ladders, to the top of which they always climb in fine weather, and descend at the approach of bad weather. This is a cheap and highly interesting weather glass where the green tree frog is to be procured in its natural state.—*Science Gossip.*

Correspondence.

The Ventilation Question.

To the Editor of the Scientific American:

I am glad my remarks on the present mode of ventilating the senate chamber, Washington, have called some attention amongst your scientific correspondents.

Some time ago I was requested to examine the lecture hall of the Paisley Free Library, with a view to its ventilation. This choky place had become proverbial for its insanatory state with even a thin audience. The hall is well proportioned, and will seat 400 or 500 people. On examination I found the "sarking," whereon the slates are fastened, to be grooved and feathered, and as tight as a cask. The plastered ceiling is pierced with open fretwork. Several air grates are in the masonry below the level of the floor, but the floor itself is as tight as the sarking. When the hall was filled, no indraught could be detected at the air gratings. In the center line of the floor and along its whole length is a strip of iron grating over the hot water pipes. These pipes lie in a boxed channel, airtight except at top. From this arrangement, it will be seen that no fresh air could enter the hall unless by an occasional opening of a door or window. To effect a cure, the first thing was to get a hole made through the roof. Luckily there is a hatch in the roof for repairs. Here was the very thing wanted. This hatch was tilted a few inches and kept partially open by two small blocks of wood. This secured the "outlet," and so far no more was required. Under the floor a few of the "dwangs" were then knocked out from between the joists. These dwangs formed the sides of the channel where lie the hot water pipes. A communication was thus made between the outer wall gratings and the hot pipe channel, and consequently to the hall itself. Having thus made an opening between the hall and the outer fresh air, and having secured an escape for the warm foul air by the hatch in the roof, the arrangement was complete. Next lecture night, the audience no sooner began to assemble than the inevitable result manifested itself. The inward current at the wall gratings was not to be mistaken. A paper torch flame was sucked in. It worked lively to begin with, and got more so as the hall filled. At the same time, the hatch outlet did its work to a wish. The result of this simple and inexpensive plan is that everybody is satisfied. To arrange this did not take much longer time than it has taken to describe it. One hall ventilated in this way and found to answer is as good as a thousand for conviction, and Nature knows no difference between the senate chamber and our lecture hall. It only requires the same arrangement to obtain the same result. A trial by objectors would save them the trouble of creating bugbears against its adoption, for the arguments against my plan by your correspondents are simply nothing. "Prove all things" is as good in this as in higher matters, and would be more philosophical than railing against an untried plan.

It would not be difficult to answer every objection raised by Messrs. Morgan and West; and if I were unable to do this, the fact remains that the plan has been tried and has not been found wanting. It has worked, is working, and will work so long as the laws of Nature remain as they are.

Mr. West supposes I allude to summer ventilation only; but I include all seasons. So long as a crowded hall is warmer than the outer air, the upward current is bound to flow. The dread of cold can only come from the unnecessarily large supply of air forced into public halls by such philosophers as suppose that it is required that each person should have twenty-five cubic feet per minute, that is, fifty times more than he can consume. The rapid lowering of the cosy warmth of a hall by the admission of a large quantity of cold air in winter is not to be feared in my plan. To keep a crowded place sweet, not much fresh air is required; and if it be admitted under the hot water pipes, it will keep the place snug and comfortable.

Mr. Morgan, "purposely ignoring the special subject of my article, the senate chamber," shows a wise discretion. He says, misquoting me: "If our halls, like the ancient Greek houses," etc. I never spoke of Greek houses. I only instanced halls, which were very different. My remarks referred to a crowded place—the senate chamber—with probably 1,200 people in it. Mr. Morgan's tall glass jar is no proper illustration of the senate chamber, which, looked at as a vessel, is not tall but flat. Its narrowest diameter is more than twice its depth, so that an old-fashioned punch bowl or a wash hand basin would better represent it than a tall jar. He says: "If a bit of lighted candle be placed at bottom of a tall glass jar and subjected to a stream of carbonic acid from the lungs, the light will be extinguished." Likely enough. But this is no illustration of the action of natural ventilation in a roofless hall. I did not say that if a flood of carbonic acid were poured into such a place, the people in it would live. What I said was that pure air would descend and replace that vitiated. Nature does not supply carbonic acid in the manner of Mr. Morgan's experiment.

But I also offer the same experiment, *minus* the impossible carbonic acid, as a proof that my position is correct. Place a bit of lighted candle at bottom of a tall glass jar open at top, and it will not be extinguished so long as any of it remains to burn. This is the position of an audience in a roofless hall. The vitiated air produced by the lighted candle, being lighter than the atmosphere, rises and escapes at the jar's mouth, while pure air at the same time takes its place through the same opening. This jar experiment reversed shows that carbonic acid whilst warm rises. Hold the same jar mouth downwards, and thrust a lighted candle half way up. The foul air will collect at top; and when it has filled the jar down as far as the flame, the candle will be extinguished. Light the candle again, and hold it only a little way up; and when the carbonic acid has filled the jar, the candle will go out. According to Mr. Morgan's false theory, the carbonic acid should have fallen out of the jar and left the candle to burn.

Another experiment with the tall jar, and I will lay it aside. Cut a hole, say half an inch, in the bottom of the jar, and hold it mouth downwards. Thrust a lighted candle up as before and it will not be extinguished. And why? Because the carbonic acid rises and escapes by the hole, and a current of pure air enters by the down-turned mouth and feeds the flame. The same events take place in a crowded hall having a hole in the roof and inlets below. The inverted jar represents the hall; the candle, the heat-producing audience; the down-turned mouth, the inlet for fresh air; and the hole in the jar, the outlet in the roof.

I am obliged to Mr. Morgan for suggesting these experiments, but I daresay he did not expect they would be turned against his crude scientific notions. His statement that, if my plan were adopted, the people would be "frozen out" by warm air needs no comment, and his platitudes about the "destroying angel" need as little, as nobody denies them. About my running counter to Reid and others, if it be so, all the worse for them. Reid knew well enough the principles I have laid down, but he failed to put them in practice. He would help Nature with machines, engines, exhausts, and other superfluous contrivances, and failed to ventilate the parliament houses, after spending thousands of pounds; whereas a carpenter with his saw could have done it for a few shillings, and so could he the senate chamber, Washington.

WILLIAM MACKEAN.

Paisley, Scotland.

Turbine Limitations.

To the Editor of the Scientific American:

Perhaps most waterwheel engineers have a theory of the action of the water upon the turbine, and construct their wheels accordingly; but it seems to me that there is a very important item (which may be called "turbine limitation") generally overlooked. It is simple enough, and as follows: The guides of all turbines divide the water into jets impinging upon the buckets in a forward direction. It is generally conceded that these jets in passing through the wheel,must be deflected from their forward to a perpendicular direction (neither more nor less;) also that the wheel buckets must be as thin as possible,and shaped so as to enter and pass through them exactly endwise, or with as little disturbance as possible. Hence it becomes an important question; At what point or how far,from the guide issues,will these jets have changed their forward into a perpendicular direction? for here, and here only, is the point for the wheel's issues, since nowhere else could they discharge the water in the right direction, or just so fast as the wheel moves.

It need but be remembered that the pressure necessary for propulsion must of necessity cause a given deflection in a certain distance or lapse of time; hence it would seem that, in all turbines, there is a limited distance asunder at which guide and wheel issues can be placed, fixed by this time or distance of deflection. This law would require a certain size and length of bucket,together with distances apart of guides, irrespective of the size of the wheel, a practice very different from that at present in vogue. Good wheels are made that do not comply with this idea; yet I am convinced that, as turbines have evidently improved as more guides and thinner and smaller buckets are used, it is because of a nearer approach to compliance with this law.

Springfield, Mo. J. B. REYMAN.

The Attraction of the Sun and the Earth.

To the Editor of the Scientific American:

That the relative attractions of the earth and the sun on the same terrestrial body are subjects of calculation, the tides furnishing the data, is well known. The only question in my mind was: Are the data so exact as to render nothing further desirable? In making the experiments suggested by me, the object sought would be an accurate measurement of these forces, respectively, by means of the same instrument. Of course common lever scales would not answer; and it is a question whether springs could be constructed of sufficient strength and delicacy combined.

Two expedients have occurred to me: First, the use of a delicate spring balance having a mirror attached, by means of which effects, insensible to the eye on an ordinary register, may be made sensible and measurable by the reflection of a beam of light to different points of a graduated arc. Secondly: I can see no reason why the minutest difference in these attractions may not be accurately measured by means of the pendulum. This instrument serves us in determining the spheroidicity of the earth,the earth's density, and the hight of mountains, and it certainly would serve for the purpose of measuring the solar attraction also.

Brownville, Neb. W. B. SLAUGHTER.

Railroad Curves.

To the Editor of the Scientific American:

The radii of curves, with their corresponding deflection angles, can be more readily found from the relations between the arc and diameter than from those between the chord and diameter, the latter being the method in use at present by railroad surveyors.

If we assume the lineal value of 1° of arc to be 1 foot, as the measuring unit, then the radius is known to be 57·29578 feet. If, instead of calling the arc of 1° equal to 1 foot, we call it 100 feet, then the above radius is also 100 times greater. Hence we have the radius of a 1° curve, by simply removing the decimal point of the above figures two places to the right, that is, the radius of a 1° curve is 5729·578 feet. It is also known that, if a given amount of arc be developed lineally, on circles of different radius, the angles subtended will vary inversely as the radii. Hence, to find the radius of any other deflection angle, we have only to divide the radius of a 1° curve by the number of degrees in the given angle. The radius of a 4° curve is thus one fourth that of a 1° curve; and for a 7° curve, one seventh and so on.

Again: If the deflection angle is less than 1°, we have only to multiply by the fraction of the degree inverted, thus: Multiply the radius of a 1° curve by 60 for that of 1′ curve; for a 4′ curve, multiply by 15; for a 10′ curve, multiply by 6, and so on. By reversing this process, the deflection angles corresponding to different radii may be found.

Furthermore, we may compute any of the trigonometric functions for the radius of a 1° curve, and then pass, by the method of inverse ratio,to the corresponding function of any other deflection angle. Thus the tangent of 38° of arc on a 1° radius would be 4476·43 feet. On the radius of a 4° curve, it would be but one fourth as much, namely 1119·11 feet. To find this element by methods in present use, we should be obliged to resort to trigonometry, or be satisfied with some approximate method. In the same manner,other functions may be determined.

Among the many advantages resulting from assuming a portion of arc rather than of chord, for the constant quantity,are the following,namely: 1. The saving of immense labor in the computation of radii for different deflection angles; 2. the method of inverse ratios, much in use by surveyors because of its simplicity and ease of application, but which gives only approximate results, will then become rigorously correct; 3. the total deflection of a curve is known from its length in feet. If for a 1° curve, we have only to cut off two figures to the right,and we have the total deflection in degrees and decimals. If for any other curve,we have only to further multiply by the number of degrees in the deflection angle.

A hint to the practical man is sufficient.

Ferrysburgh, Mich. H. C. PEARSONS.

[For the Scientific American.]

Poisons and their Antidotes.

BY O. J. ROCKWELL, A. B.

Fatal results of poisoning are most frequently occasioned by delay in applying, or by ignorance of, the antidote. The following is a list of the antidotes of the common poisons, and I suggest that chemists, dyers, druggists, and others who are brought daily in contact with poisonous substances, post this list in some conspicuous place in their laboratories.

For alkaloids, such as morphine, quinine, etc.: Emetics and the stomach pump must be relied upon rather than chemical agents. Astringent liquids may be administered, such as tannic acid, which precipitates many of the alkaloids from their aqueous solution, absorption of the poison being thus retarded.

For antimony (tartar emetic, etc.): Any form of tannic acid may be administered (infusion of tea, nutgalls, cinchona, and oak bark, or astringent solutions or tinctures), an insoluble tannate of antimony being formed. The stomach pump must be also applied as speedily as possible.

For arsenic (Paris green, etc.): Recently precipitated moist ferric hydrate, best administered in the form of a mixture of a solution of perchloride of iron with carbonate of soda. Emetics should be also given, and the stomach pump applied.

For copper (verdigris, etc.): For an antidote, administer iron filings, also white of an egg (albumen), which forms with copper a compound insoluble in water. Apply the stomach pump.

For hydrocyanic acid (cyanide of potassium, etc.): A mixture of green sulphate of iron, solution of perchloride of iron, and either magnesia or carbonate of soda, is the recognized antidote in cases of poisoning with prussic acid. Inhalation of ammonia is also advised.

For lead: Administer a solution of Epsom salts or alum, and induce vomiting.

For mercury (corrosive sublimate, etc.): Swallow the whites of several eggs. Albumen gives a white precipitate with salts of mercury, which is insoluble in the juices of the stomach.

For oxalic acid: In cases of poisoning with oxalic acid or salts of sorrel, chalk and water may be administered as a chemical antidote, with the view of producing the insoluble oxalate of lime. Emetics should also be applied.

For tin: In cases of poisoning by tin salts (dyer's tin liquor), solution of carbonate of ammonia should be given. White of egg is also said to form an insoluble precipitate with compounds of tin. Vomiting should also be speedily induced.

For zinc: Large doses of zinc, fortunately, act as powerful emetics. If vomiting has not occurred, or has taken place apparently to an insufficient extent, a solution of carbonate of soda (common washing soda), immediately followed by white of eggs and demulcents, may be administered.

A NEW method, by Mr. Wilson, for lighting street gas lamps is as follows: The lamp has two burners; one, very small, burns all the time. When the gas pressure is raised, a small gas holder, on the top of the column, is elevated, affording a passage for the gas to the larger of the two tips, which is lighted by the small jet. Thus all the street lamps in the district may be lit automatically.

SNOW.—More snow has fallen on the Sierra Nevada mountains the present season than ever before known. This looks well for a prosperous season in the milling and agricultural ndustries of that region.

THE PROPOSED CHAMPLAIN SHIP CANAL.

By reference to the annexed map, the reader will be enabled to trace the extended route which it is proposed to open to commerce, by the construction of a ship canal and the improvement of the Hudson River between Troy, N. Y., and Whitehall on Lake Champlain. A perfectly feasible engineering work is contemplated, which, while inconsiderably small beside others of similar nature which have been completed throughout the world during recent years, nevertheless offers beneficial results of the highest importance to the North and Northwest of the United States, in that it provides undeniably the natural and best route from the Great Lakes to tide water.

From New York to Troy, a distance of 150 miles, the Hudson is navigable, as is well known, by vessels of large tunnage. From Troy to Fort Edward, a distance of forty miles, there is an elevation of 116 feet to be overcome; from Fort Edward to the summit, a distance of two miles, an elevation of thirty one feet; from the summit to Lake Champlain, at Whitehall, a distance of twenty-one and three tenths miles (seven miles of which is in Wood Creek), there is a descent of fifty feet to Lake Champlain. Thus it will be seen that the highest point between tide water and the St. Lawrence is 147 feet, and that the entire length of the river and canal improvement is but sixty-three and three tenths miles. Eleven locks and dams are required, the former to be 300 by 45 feet in size, to overcome the elevation and to give ten feet of water in the river. Wood's Creek, which runs into Lake Champlain, is already nearly ten feet in depth, and would require little straightening, so that the canal portion to be constructed is reduced to but seventeen miles, requiring but two locks. The width at the bottom is to be 110 feet and at the surface 150 feet.

The route from Whitehall extends up through Lake Champlain to the Richelieu river, and thence to St. John's, where the latter stream is entered by the projected Caughnawaga canal. For this enterprize a charter has already been granted by the Canadian government, and work is to be speedily begun. The canal extends to Caughnawaga upon the St. Lawrence river, and is twenty-nine miles in length. The country through which it passes is almost a dead level, there being a rise of but twenty-five feet, so that the entire work can be built in half cutting—that is, a cut of six feet and a bank of six feet would be all that would be required to construct a canal of 12 feet in depth. From Caughnawaga the route continues, *viâ* the Beauharnais canal of eleven miles and the Cornwall canal of twelve miles (which canals are constructed around rapids in the St. Lawrence river, and which rapids are now being improved so that vessels on the downward course do not need to use the canals), through the St. Lawrence to Lake Ontario, and thence through that lake and the Welland canal (twenty-seven miles) to Lake Erie. From Lake Erie, vessels of any tunnage can pass into Lake Huron, Lake Michigan, and Georgian Bay; and, *viâ* the Sault Ste. Marie canal, of a little over one mile in length, vessels of 2,000 tuns can pass from the waters of Lake Huron to Lake Superior. From Green Bay, an arm of Lake Michigan, there is now an improvement in process of construction which will, when completed, so improve the Fox and Wisconsin rivers that water communication will be opened between the Mississippi and Green Bay, a distance of 278 miles, and another already concluded by the Illinois and Michigan canal and the Illinois river to the Mississippi river, a little above the mouth of the Missouri. Through this entire distance, from the lakes to tide water, with the exception of eighty-four miles of ship canal, there is, so far as speed is concerned, a free and uninterrupted water way upon which steamers or sailing ships can be propelled at an average rate of eight miles per hour for steam vessel. From all the ports on the upper lakes to the foot of Lake Erie, all vessels whose cargoes are destined for tide water by any route will be upon equal terms. At that point Nature has presented a barrier, and here the products of the west take different routes to different markets. By the Champlain route a boat could come from Port Colborn, near the foot of Lake Erie, to tide water (without breaking bulk) in four days' time, allowing only the same rate of speed in the eighty-four miles of canal as are now made on the Erie canal, as against an average of at least ten days from Buffalo to Albany by the latter. This saving, of time and interest, of the expense of breaking bulk, of transhipment and division of cargo, requires no argument to prove its importance. It is believed, moreover, that a canal adapted for a vessel of 1,000 tuns—as it is proposed to construct that under consideration—will lessen the cost of transportation between the foot of Lake Erie and the Hudson river fifty per cent, a gain of two dollars per tun on the commerce of the west, or at least $20,000,000 annually.

The Canadian government is now contemplating the construction of a water way, known as the Ottawa and Lake Huron canal. This leads by a natural chain of rivers, as a glance at the map will show, from Georgian Bay to French river, thence through Lake Nipissing to Trout river, thence to the Ottawa, and *viâ* the Ottawa to the St. Lawrence at Caughnawaga. It would make a route of 980 miles from Chicago to Montreal against 1,348 miles by the St. Lawrence route, showing a saving of 368 miles. This, therefore, when built, must tend to cut off comparatively the Erie canal and the Oswego canal from competition with the commerce over the Ottawa route, while the Champlain and Caughnawaga canal would be in the direct line and would give New York all the advantages of the saving in distance. There are also local considerations which point to the advantages gained in the construction of the Champlain route. It would afford a highway and materially lessen the cost of transportation of the lumber manufactured in the Ottawa district, nearly 500,000,000 per annum; of the iron ore also from Lake Champlain, 400,000 tuns of which are yearly raised and shipped; of the products of the great fishing trade of Labrador and Newfoundland, and also of the coal from Picton.

The bill before the New York legislature provides for the survey and location of the work at once, and calls for the raising of the necessary sum for its accomplishment, $10,000,000, by suitable taxation.

NOTES ON DYEING.

[From Reimann's Farber Zeitung.]

Nicholson Blue on Cloth.

To 100 lbs. of material use 1 lb. color of the shade required; dissolve in boiling water, filter, and make up a dye bath with the addition of $\frac{1}{4}$ lb. sulphate of zinc. In this the goods are worked for an hour, while the liquid is gradually raised in a bath of warm water at 190° Fah., containing 2 lbs. sulphuric acid and $\frac{1}{4}$ lb. sulphate of zinc. The dye resists acids and soaps.

Nicholson Blue with a Wood Bottom.

One hundred lbs. of woolen cloth are boiled for an hour with 1 lb. chromate of potash and 1 lb. of sulphuric acid, and allowed to cool in the liquid, lifted, rinsed, and dried in a fresh bath with 30 lbs. of cam wood. Two lbs. of Nicholson blue are now dissolved in boiling water, filtered and made up into a dye bath with the addition of $1\frac{1}{4}$ lbs. of sulphate of zinc. In this bath the goods are boiled for two hours, lifted, rinsed and raised in a bath containing 8 lbs. sulphuric acid and 2 lbs. of sulphate of zinc.

Aniline Violet on Woolen Yarn.

One lb. of sulphate of magnesia is added to the flot at a hand heat; the goods (10 lbs.) are moistened therein, and methyl violet is gradually added while the temperature is quickly brought to a boil. For dove color, dye as for violet, using only $\frac{1}{4}$ to $\frac{1}{2}$ oz. of color.

Madder Red, topped with Cochineal, on Wool and Woolen Yarn.

One hundred lbs. of goods are boiled for an hour with 3 lbs alum, 6 lbs. tin crystals, 5 lbs. tartar, $\frac{1}{2}$ lb. flavin. They are then lifted and boiled for an hour in a fresh bath with 15 lbs. madder. Meantime 4 lbs. of ground cochineal, $1\frac{1}{2}$ lbs. of tin crystals, and 1 lb. oxalic acid are boiled up, cooled, the wood entered, and boiled for an hour.

Armand Müller prepares an oil mordant for Turkey reds with an emulsion of olive oil and a solution of glue. Into this solution hyposulphite of soda is introduced, the frothing mass is allowed to stand two or three hours, and immediately used.—*Chemical News.*

Professor Thurston's Investigations on Metals.

Those of our readers who have already perused with interest the valuable papers contributed by Professor R. H. Thurston to these columns, relative to the strength, elasticity etc., of materials of machine construction, will find the subject treated in extended form, and illustrated by a number of carefully prepared diagrams and engravings, in the recent published transactions of the American Society of Civil Engineers. Professor Thurston in the present issue offers still another communication on strains on metals, which will doubtless be read by mechanics generally with much profit.

A Chance for Inventors.

A common, well built country wagon, weighing about 800 pounds, will carry 3,000 on any fair country road, and without injury pass over obstructions which cause it to fall one, two, or more inches, the paying weight being about 79 per cent of the whole. The ordinary box car in use upon our railways at the present time weighs about 10 tuns; its maximum load is generally about 11 tuns, while its average load is about 8 tuns; the paying weight being from 44 to 52 per cent of the whole. It does not seem reasonable that the weight of a car constructed to run upon a smooth even track, without a fall, should be so disproportioned to the load carried. There is here a chance for inventors to devise a light form of freight car, strong enough to carry 11 tuns.

Artificial coral is made as follows: To two drams of vermilion add one ounce of resin, and melt them together. Have ready the branches or twigs peeled and dried, and paint them over with this mixture while hot. The twigs being covered, hold them over a gentle fire, turning them round till they are perfectly smooth. White coral may also be made with white lead, and black, with lampblack mixed with resin.

A Fairlie locomotive with twelve 3 feet 6 inches drivers and 16 by 20 inches cylinders, weighing 62 tons, made to burn either wood or coal, has lately been completed in England for the Mexican Railway. It is equipped with the Westinghouse brake, and also with the Le Chatelier counter pressure steam brake, which acts only on the locomotive. The engine is to work on a long grade of more than two hundred feet to the mile, and the boiler flues are inclined to suit this grade.

IMPROVED POTATO DIGGER.

The invention herewith illustrated is a simple and, it is claimed, efficient implement, by means of which the hills containing the potatoes are broken into furrows; and from the earth thus loosened, the potatoes are separated by suitably arranged clearing teeth. The apparatus is essentially an inside or under digger, and consists in a double mold board plow, A, which splits each hill or row in the middle into two opposite furrows, pushing the latter sufficiently outward and apart for the teeth, B, to act upon them from the inside, as so many little plows or coulters. The plow may be made to raise these furrows to any required angle. The teeth are constructed so as to have about the same inclination forward and outward as the mold boards, so as to enter and remain in the earth readily, in order to give a lifting cut against the furrows to a depth of from one to two inches, causing the dirt and potatoes to cave inward, and thus press against them. The potatoes, as they are loosened, fall into the spaces (about 3 or 3½ inches) between the teeth, which, at the same time, break off the tendrills. The plow is made flat on top for the easier attachment of clearer and beam, and their handier adjustment to the draft. The depth of furrow is regulated by the nuts and bolts at C, in connection with wedges or other suitable devices. The teeth may be made of wood or of round, square, or triangular rods of iron or steel, from 12 to 14 inches in length, slightly tapered from the under side of the frame downwards, and having any suitable form of point. They are firmly inserted in suitable holes or mortises in the arms. Their main object is to deal only with the roots of the vines, weeds, etc., as the points follow in the wake of the plowshares, which remove the principal obstacles from their way.

Draft is applied to the beam in the ordinary manner, as represented in the illustration. The inventor has also devised an ingenious form of gatherer, which is applied to the rear of the digger, and which serves to collect the potatoes into line or in heaps as the implement advances.

Patented January 6, 1874. For further particulars address Mr. Hiram Strait, 18 6th street, Troy, N. Y., or his authorized agents in other localities.

STRAIT'S IMPROVED POTATO DIGGER.

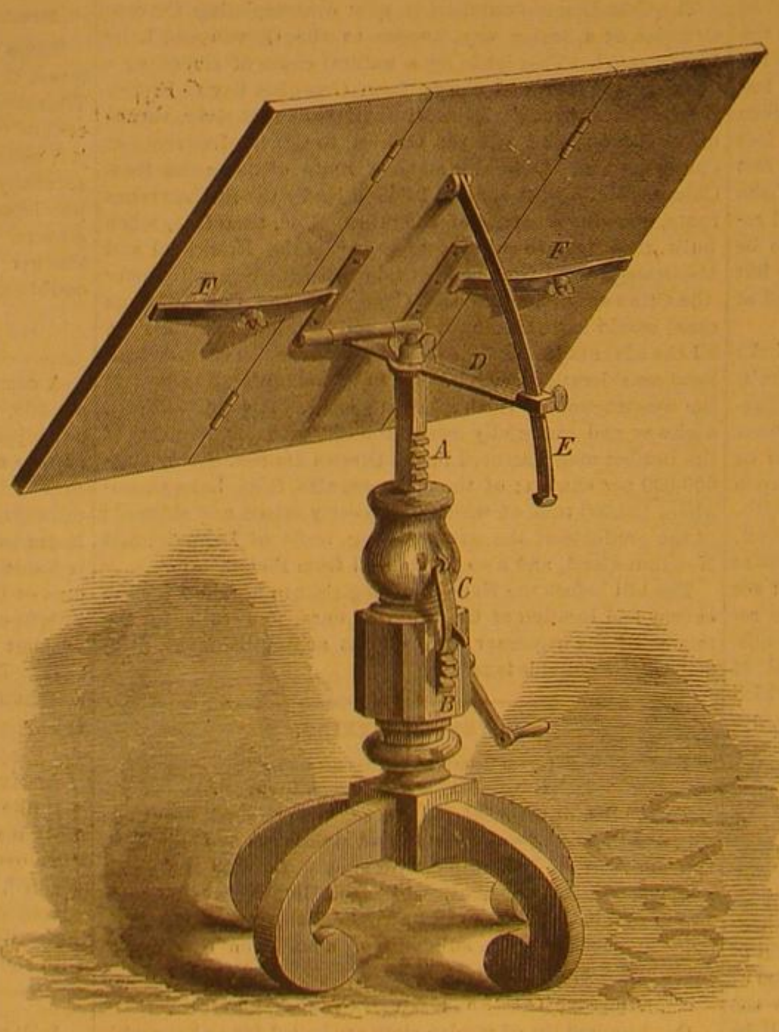
REBER'S PORTABLE BLACKBOARD.

The accompanying illustration represents a rear view of a convenient and useful form of portable blackboard, which may be readily inclined into any position, and raised to any suitable hight. It may also be employed as a table, and when out of use may be folded into small compass so as to occupy but little room.

For teachers and others who have occasion to demonstrate graphically the subjects of instruction, or for engineers and architects who frequently need a handy surface to try the effect of a sketch or to work out a problem occurring during the course of a calculation, a device of this description will, without doubt, be found an excellent assistant. It will also prove useful in churches, Sunday schools, and, in brief, in any locality where wall boards are not at hand.

The standard, which, with the supporting legs, may be made of any desirable form or material, guides centrally a vertical rack, A, which is raised or lowered by the ratchet, B, actuated by the crank shown, and held in any desired position by the pawl, C. To the upper end of this rack is secured, by means of a screw and thumb nut, a horizontal arm, D, one extremity of which is T shaped and hinged to the back of the board, while the other end is slotted and guides a bow-shaped lever, E. The latter is also hinged to the blackboard, as shown. By means of this arrangement the board may be readily plased at any desired inclination and so held by the thumbscrew which binds lever, E, in the slot of arm, D, the movement of the former toward raising the table to a perpendicular position being limited by the projecting lugs at its lower end. The board is made in three pieces, the two outer leaves being hinged to the middle one so as to be readily folded. Levers, F, turning on bolts on the outer sections, secure the same rigidly by thumbscrews, when placed, as shown in the engraving, in an extended position. The whole board turns easily on the rack. To reduce the apparatus to its smallest compass, the rack is lowered in the stand, the table placed horizontally, and the leaves folded down. It may then be rolled into a corner and used as a stand, or for any other convenient purpose.

Patented through the Scientific American Patent Agency, November 4, 1873. For further particulars regarding purchase of rights at wholesale or in sections of territory, address the inventor, Mr. James Reber, Nebraska, Pickaway county, Ohio.



REBER'S PORTABLE BLACKBOARD.

Linoleine.

The activity of modern chemists is very remarkable, and has borne most important fruits. Among other useful work, they have studied almost every vegetable or animal substance that has any active properties, and have sought to isolate or separate their active principles. Thus the pungency of mustard, the exhilarating principles of tea and coffee, the narcotic of tobacco, the coloring essence of madder, and a countless multitude of other such active principles, have been separated and examined, and in many cases their elements have not only been discovered by analysis, but have been put together synthetically, and the active essence has been obtained from entirely new materials, even from oth-wise useless or offensive refuse. Thus the modern chemist, not satisfied with superseding the coloring matter of the cochineal insect by the brilliant dyes he has obtained from coal tar, has separated the dye essence, alizarine, from madder, has laboriously studied its chemical composition and relations, and, after years of investigation, has finally learned how to procure this also from the refuse of gas works. He will soon supersede altogether the cultivation of the madder plant, for his new product is not a mere imitation, but is far better, because purer, than the original substance. In like manner he is now struggling with indigo; he has separated its active principle, and ere long will doubtless supersede the tropical plant by making indigotine from house refuse.

Among such investigations is the search for the principle upon which the painter depends for the adhesion and drying of his colors. To this the name of linoleine has been given. It exists to the extent of about 80 per cent in the best linseed oil, and has some remarkable properties. In its original state, as it exists in the fresh oil, it is a clear liquid, having the property of combining with oxygen and then solidifying without any decrease of bulk. This retention of its bulk is very important, and is one of the sources of its value to the painter. Colors may be ground into copal, mastic, or other varnishes, and when first used these form very brilliant mediums; but varnishes are merely solutions of gums or gum resins in a volatile oil or spirit; and as they dry by the evaporation of the solvent, their bulk decreases, they shrink, and thus, if any considerable thickness is laid on at once, it displays this shrinkage by cracks. Artists who have been tempted by the brilliancy of a copal or other similar medium have had the vexation of seeing their pictures covered. after a year or two, with a network of cracks, and gradually becoming worthless. Hence the necessity, whenever varnish is used, of laying it on in a very thin film.

Another especial merit of linoleine is that it solidifies into a remarkably tough substance, which does not become brittle by further drying. It also has sufficient elasticity to bear a considerable amount of bending. If a picture were painted with a varnish medium, and the canvas bent or rolled, it would crack most ruinously; but with a linoleine medium it will bear a considerable degree of such violence without suffering serious injury. Further than this, linoleine is insoluble in alcohol, in turpentine, in petroleum spirit, in naphtha, and even in the bisulphide of carbon, which so effectively dissolves india rubber and many other stubborn substances of this class. This affords the great advantage of enabling the painter to go over the surface of his work with almost any kind of varnish. If the medium which holds his colors were soluble in the oil or spirit which serves as the solvent of the varnish, his picture would be smeared in the act of varnishing.

The work of the picture cleaner and restorer, and even of the humble housemaid in cleaning painted walls, depends upon this insolubility of the linoleine. Strong solvents may be used to remove the varnish and the adhering dirt, without attacking the picture itself, though in this work some care and skill are required, as even linolein e is not absolutely insoluble in all liquids. It happens, unfortunately, that the most convenient of all cleansing agents, namely, soap, if it contains free alkali, as often is the case, will soften and gradually remove this otherwise stubborn film which holds the painter's colors together, and thus we see that the persevering housemaid may, after many efforts, at last render visible the original woodwork of a painted wainscoat or door. Every practical painter knows that the less turpentine and the more linseed oil he uses, the more durable is the coat of paint laid on. This depends on the fact that it is the oil and not the turpentine which contains the tough and nearly insoluble linoleine; the turpentine merely dilutes it, and renders the drying process somewhat more rapid.

The chemist has not yet succeeded in fairly and practically separating this linoleine, but we may hope that he will do so. Ordinary boiled oil rudely approximates to such separation, but we may hope some day to have a clear, bright, limpid, and colorless medium, consisting of the pure substance, and capable of being brought into the market at a practical price. At present such a thing is merely a chemical curiosity; but so many other useful things have been chemical curiosities first, and commercial commodities eventually, that we are justified in hoping some day to see linoleine in the columns of our price current.—*London Grocer.*

Japan Lacquer.

It has been generally supposed that the beauty of Japan lacquer work was due to ingredients derived from unknown plants, and that the secret was confined to the Oriental workmen. Recently, however, in Holland, objects of art have been produced, lacquered and covered with mother-of-pearl, in pieces facsimiles of those made in Japan. The lacquer used is prepared from the hardest varieties of gum copal, principally that of Zanzibar, which is colored black with India ink. The articles are covered with several layers of this substance, upon which, while still wet, or rather pasty, the mother-of-pearl is inlaid. Drying in a furnace follows, another coat of lacquer is applied, then more drying, and smoothing with pounce. These operations are repeated until the surfaces are perfectly united and smooth, when a final polish is given with tripoli.

Colorado Mines.—The area of land known to be rich in gold deposits in Colorado is about 7,200 square miles, lying in various parts of the Territory, on both sides of the main range. There can be hardly a doubt but that this extent will be largely increased in coming years, for new discoveries are constantly being made upon the foothills and plains.

BETON COIGNET ARTIFICIAL STONE FOR ORNAMENTAL ARCHITECTURE.

Some seventeen years ago, M. Coignet introduced his *béton* stone into France. Although at first encountering popular prejudice, the material speedily made its way, through its intrinsic merit, into favor, and finally, after being experimented upon for a period of two years, was adopted by the French government in the construction of many important edifices and structures. Forty miles of sewers in Paris, the immense aqueduct of Le Vanne, the arches of which cross the sandy valley of Fontainebleau for a distance of thirty-one miles, the supporting arches of the Exposition building, the docks at Bordeaux, and in various other prominent engineering works, the *béton Coignet* has been entirely employed; and also in Egypt the material has been used, for lighthouses and in forming the massive blocks used in the building of the Suez canal. In a large number of private and public edifices in the vicinity of this city, recently erected, this stone has been applied. Prominent instances among these are the arches, columns, and traceries of the great Roman Catholic cathedral, now in progress on the corner of Fifth avenue and 50th street, and in the various architectural ornamentations of Prospect Park, in Brooklyn. Our engraving represents Cliff Ridge Span, in the latter grand pleasure ground, a very beautiful arch, highly decorated, and the design of Mr. Calvert Vaux. This structure it was at first intended to build of granite and brick, but subsequently it was determined to make the whole of artificial stone, the material being especially advantageous for decorative purposes, as it offers great facilities for the reproduction of ornamental detail. A design, once well modeled and prepared for carving, can readily be repeated.

A large new manufactory of *béton Coignet* has been established by the New York and Long Island Coignet Stone Company; it is on Third avenue, between 3d and 6th streets, in Brooklyn, N. Y. The works are very extensive, covering an area of five acres, and are capable, we understand, of turning out fronts of ten ordinary houses per day, besides a large quantity of fine ornamental work, giving constant employment to some one hundred hands. The process of manufacturing consists in first grinding down the constituent elements of the stone to be imitated, and mixing them by machinery until they reach a plastic state. The molds are then filled by a peculiar process which entirely excludes the air, and are immediately removed. The stone, within a few days, is ready for transportation, and continues to increase in density.

The *béton* is impervious to water; and so far as experience proves, withstands the effect of frost or extreme northern climates, and will withstand a crushing pressure of about four tuns to the square inch. Structures composed of it are much lighter than those of natural stone, while the strength is equal, if not, in many instances, greater. A cubic foot of the material weighs about one hundred and forty-six pounds. Walls made of it present a homogeneous mass, and are not liable to the accidents common to brick and mortar structures.

We learn that, since the failure of both granite and marble in the great fires of Chicago and Boston, tests have been made as to the capability of *béton Coignet* to resist intense heat, and the results show that it neither explodes like granite, calcines like marble, nor warps and twists like iron structures. It is, besides, a non-conductor of heat to no small extent, and therefore tends to check the passage of conflagrations from building to building.

General Gillmore, of the U. S. Engineers, some time since visited Europe for the express purpose of inspecting the structures made from this stone, and on his recommendation the government has adopted it for use in the construction of the casemates, sally port, floors, and other portions of Fort Wadsworth, on Staten Island. It would be difficult, we imagine, to limit the employments for which the material appears eminently suitable. As illustrated by Cliff Ridge Span, its peculiar character adapts it to the imitation of the most elaborate tracing and sculpture in the rarest stones; for by admixture of pigments, tiles of any color may be accurately reproduced. The cost of manufacturing is said to be about half that of natural stone when cut.

Photographic Engraving.

The subjects suitable for printing blocks, of the kind now to be described, are those known as line and dot subjects, that is, pen and ink sketches, line drawings, engravings, and such like, to the exclusion of objects in pure graduated tint, like a silver print from a negative of a natural subject having graduation of tint.

A plate of glass is coated with a solution of beeswax in ether, the relative proportions of the two being about half an ounce of wax to ten of ether. This leaves a very thin coating of wax upon the plate, which is still further attenuated by rubbing with a cloth. The object of this waxing is to prevent a too close adhesion of the gelatin coating, to be next applied.

To prepare the sensitive surface, gelatin is steeped in water for half an hour or upwards until it has become swollen from the absorption of water; most of the superfluous or unabsorbed water is now poured off, and the vessel containing the gelatin is placed in hot water, or otherwise subjected to heat, by which the gelatin immediately becomes liquefied. To this is added sufficient of a saturated solution of bichromate of potash to render it of an orange color, yet not sufficient to cause the salt to crystallize out and show itself upon the surface of a glass plate coated with the mixture. The film is dried and then removed from the glass, which is permitted to be done by the agency of the wax substratum. It is now ready for exposure.

Suppose, now, that a reproduction of an engraving or piece of ordinary print or sheet of music be the subject that is to be produced; a transparency—not a negative—of this subject must have been obtained and superimposed upon the side of the gelatin pellicle next to the glass plate. After exposure to light for a quarter of an hour—or more or less, according to the light and the quality of the negative—this gelatin film is pressed into contact with any handy flat surface, such as glass or metal, care being taken that the surface that was next the negative be placed outside. It is now sponged copiously with, or immersed in, cold water, by which a considerable amount of relief is obtained, the parts corresponding with the black of the original print or drawing being seen standing in high relief, while the whites are sunk. This, it will be seen, supplies the conditions for a surface block to print in connection with type, all that is now wanted being the conversion of the soft gelatin into hard unyielding metal.

The gelatin relief or mold obtained in the manner described is, first of all, made surface-dry by means of bibulous paper, and is then lightly dusted over with finely pulverized plumbago or bronze powder. A cast from this surface is then taken by means of molten beeswax, which, when cold, readily parts company with the gelatin relief, owing to the intervening sprinkling of plumbago or bronze. This wax cast is then sent to the electrotyper, who, in a few hours afterwards, will deliver a metallic cast, mounted upon wood and ready for working in the printing press. This process originated with Mr. Thomas West, of London.—*British Journal of Photography.*

Thallium.

The optical process of detecting thallium in a mineral is very simple, says Dr. Crookes. A few grains of the ore are crushed to a fine powder in an agate mortar, and a portion taken up on a moistened loop of platinum wire. Upon gradually introducing this into the outer edge of the flame of a Bunsen's gas burner and examining the light by means of a spectroscope, the characteristic green line will appear as a continuous glow, lasting from a few seconds to half a minute or more, according to the richness of the specimen. By employing an opaque screen in the eyepiece of the spectroscope to protect the eye from the glare of the sodium line, thallium may be detected in half a grain of mineral, when it is present only in the proportion of 1 to 500,000. The sensitiveness of this spectrum reaction is so great that no estimate can be arrived at respecting the probable amount of thallium present.

NEW HOT WATER FUNNEL.—This consists of a tin funnel, with a perforated rubber stopper in the neck, through which the glass funnel is passed; the whole is covered with thick felt; the space between the glass and tin funnel is filled with hot water.

THE CLIFF RIDGE SPAN, PROSPECT PARK, BROOKLYN.

New Fireproof Construction.

A new and cheap plan for renderin buildings free from dan ger of conflagration has been produced in many prominent buildings of Chicago, by Mr. James John, of 457 Wabash avenue, in that city. The mode of application of the invention consists of first nailing rough boards to the underside of the furring, between the wooded joists, and then to fill, in even with the furring, with coarse hair mortar gaged with sufficient plaster or cement to make it set. On the mortar is cemented a row of square boxes, cast also of mortar, above which a second row is laid so as to break joints. The boxes are slightly smaller than the spaces in which they are laid, so that the intermediate crevices can be filled up with a liquid concrete. Finally a coarser composition, like the concrete of lime, cement, plaster, etc., with screened ashes of cinders, is packed on top of the boxes to a thickness of one inch. This leaves about half an inch to the top of the strips on the joists to which the floor is nailed. The ceiling of the room beneath the joists is formed by securing sheet iron strips to the latter, close to the wall and extending, across and between them, iron wires some two or three inches apart, after which more sheet iron strips are nailed on to secure the wires to the furring. Over the latter the plastering is laid. The weight of filling and concrete is 20 lbs. to the foot when dry, and it costs about $2.25 per yard.

The inventor claims that the joists thus protected cannot burn any more than the wood blocks in a paved street.

CHEESE factories are going up rapidly in New England, as well as in the newW estern States. The farmers of Pawlet, Vt., are giving up sheep raising, and going into the manufacture of cheese. Nine factories are already within its limits. The demand for American cheese in England only increases with the supply; as cheese is found to be the most palatable as well es a cheap substitute for animal food.

THE largest pork-packing house in the world has been erected in Indianapolis. That city now claims the third place in the list of the pork-packing cities.

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

PATENT OILS.—JOSHUA MERRILL vs. DAVID M. YEOMANS et al.

[In equity.—Before Shepley, Judge.—Decided February 18, 1874.]

A process cannot be embraced in the same claim with the product as an article of manufacture.

A claim for "the above described new manufacture of deodorized heavy hydrocarbon oils, suitable for lubricating and other purposes, free from the characteristic odors of heavy hydrocarbon oils, and having a slight smell like fatty oils, from heavy hydrocarbons," if it stood alone, would be a claim for an article of manufacture.

If the words "by treating them substantially as hereinbefore described" are added, it becomes a claim for the product when formed by the process described.

To distil petroleum *in vacuo* at so low a heat that the product contains a heavy lubricating oil comparatively free from offensive odor is not an infringement of a patent for the residuum left, after distilling at such a low heat as to drive off the offensively odorous elements of petroleum oil from which the lighter elements have been previously distilled, and the paraffin separated, although the distillate, after being separated from the paraffin contained, cannot be readily distinguished from the patented residuum.

Bill dismissed.

Benjamin R. Curtis, Chauncey Smith, and *Walter Curtis*, for complainant.

Causten Browne, William Bakewell, and *Jabez S. Holmes*, for defendants.

PATENT ABDOMINAL SUPPORTER.—MOODY vs. TABER.

[In equity.—Before Shepley, Judge.—Decided February 13, 1874.]

Defendant is charged with the infringement of letters patent (reissue numbered 2,163) granted to Sarah A. Moody for improvements in corsets and abdominal supporters.

A patent for an abdominal supporter intended to sustain the viscera of well-formed persons will not be set aside upon the testimony of a medical man that, previous to the plaintiff's making the invention, he had made several supporters of the same general character for diseased and deformed patients, as they were primarily intended for the relief of the spine, the support of the viscera being a secondary object, and each was adapted especially to the condition of the patient for whom it was prepared.

No one can justify making and selling a patented article under a license from the patentee after he has repudiated the licence and refused to pay the stipulated royalty.

One who purchases from such licensee with knowledge of his having renounced the contract will also be liable for the sale of the articles he purchases, as well as for the sale of those he makes afterward.

Decree and injunction granted.

T. B. Wakefield and *J. B. Robb*, for complainants.

Chauncey Smith and *W. W. Swan*, for defendants.

Supreme Court of the United States.

PATENT REVERSIBLE LOCK.—COFFIN vs. OGDEN AND WOODRUFF.

[Appeal from the Circuit Court of the United States for the Southern District of New York.—October term, 1873.]

Swayne, Judge, delivered the opinion of the court:

This is an appeal in equity from the decree of the circuit court of the United States for the southern district of New York.

The appellant was the complainant in the court below and filed this bill to enjoin the defendants from infringing the patent upon which the bill is founded. The patent is for a door lock with a latch reversible, so that the lock can be applied to doors opening either to the right or the left hand. It was granted originally on the 11th of June, 1861, to Charles R. Miller, assignee of William S. Kirkham, and reissued to Miller on the 27th of January, 1863. On the 10th of June, 1864, Miller assigned the entire patent to the complainant. No question is raised as to the complainant's title, nor as to the alleged infringement by the defendants. The answer alleges that the thing patented, or a material and substantial part thereof, had been, prior to the supposed invention thereof by Kirkham, known and used by divers persons in the United States, and that among them were Barthol Erbe, residing at Birmingham, near Pittsburgh, and Andrew Patterson, Henry Masta, and Bernard Brossl, residing at Pittsburgh, and that all these persons had such knowledge at Pittsburgh. The appellees insist that Erbe was the prior inventor, and that this priority is fatal to the patent. This proposition, in its aspect of fact and of law, is the only one which we have found it necessary to consider.

Kirkham made his invention in March, 1861. This is clearly shown by the testimony, and there is no controversy between the parties on the subject.

It is equally clear that Erbe made his invention not later than January 1, 1861. This was not controverted by the counsel for the appellant; but it was insisted that the facts touching that invention were such as not to make it available to the appellees, as against the later invention of Kirkham and the patent founded upon it. This renders it necessary to examine carefully the testimony upon the subject.

Erbe's deposition was taken at Pittsburgh upon interrogatories agreed upon by the parties and sent out from New York. He made the lock marked H. E. (it is the exhibit of the appellees, so marked.) He made the first lock like it in the latter part of the year 1860. He made three such before he made the exhibit lock. The first he gave to Jones, Wallingford & Co. The second he sent to Washington, when he applied for a patent. The third he made for a friend of Jones. He thinks the lock he gave to Jones, Wallingford & Co. was applied to a door, but is not certain.

BROSSL. In 1860 he was engaged in lock making for the Jones & Nimmick Manufacturing Co. He had known Erbe about seventeen years. In 1860 Erbe was foreman in the lockshop of Jones, Wallingford & Co., at Pittsburgh.

In that year and before the 1st of April, 1861, he went to Erbe's house. Erbe there showed him a lock and how it worked, so that it could be used right or left. He says:

He (Erbe) showed me the follower made in two pieces. One piece you take out when you take the knob away. The other part—the main part of the follower—slides forward in the case of the lock with the latch, so you can take the square part of the latch and turn it around left or right, whichever way a person wants to.

He had then been a lock maker eight years. He examined the lock carefully. He had never seen a reversible lock before. He has examined the exhibit lock. It is the same in construction. The only difference is that the original lock was made of rough wrought iron. It was a complete lock and capable of working. Erbe thought it was a great thing. Erbe showed him the lock twice afterward at Jones, Wallingford & Co.'s. He saw such a lock attached to the office door there and working, but don't know whether it was the first lock made or one made afterward.

MASTA. In 1860 he was a pattern maker for Jones, Wallingford & Co. Had known Erbe fourteen or fifteen years. Erbe showed him his improvement in reversible locks New Year's day, 1861. He examined the lock with the case open.

"You had to pull out the spindle, and the hub was fitted so that it would slide between the spindle and the plate and let the latch forward. * * * The whole hub was made of three pieces. One part was solid to the spindle or hub shanks, and then the hub that slides between the plate and case and a washer at the other side of the spindle. There is not a particle of difference between the exhibit and the original lock. It is all the same."

He identifies the time by the fact that he commenced building a house in 1861, and that year is marked on the water conductor under the roof.

PATTERSON. Until recently he was a manufacturer of locks and other small hardware. In the year 1860 he was the superintendent of the lock factory of Jones, Wallingford & Co., and their successors in Pittsburgh. He had known Erbe since 1856. About the 1st of January, 1861, Erbe showed him an improved reversible lock of his invention like the exhibit lock.

The improvement "consisted in constructing the hub or follower so that when the spindle was withdrawn the hub would slide forward between the cases so that the head of the latch would protrude beyond the face of the lock, so as to permit its reversal from right to left, the latch head being connected with the yoke by a swivel joint, so that it might be reversed. * * * It was our uniform practice to put our new locks on the doors about the office to test them, and I believe that one was put on; but at this distance of time I cannot say positively that it was."

There is no proof that Erbe made any locks according to his invention here in question but those mentioned in his testimony. He applied for a patent in 1861, and failed to get it. Why, is not disclosed in the record.

The appellants called no witnesses at Pittsburgh or elsewhere to contradict or impeach those for the appellees. Brossl was subjected to a rigorous cross-examination, but, in our judgment, it in nowise diminishes the effect of his testimony-in-chief. The counsel for the appellants asked with emphasis, in the argument here, why the defendants had not called Jones, of the firm of Jones, Wallingford & Co.? The question was well retorted why he was not called by the other side. He does not appear in a favorable light. He prevented Erbe, who was in his employ, from going to New York to testify in behalf of the defendants, and avowed a determination to prevent, if it were possible, their obtaining the testimony of Brossl, Masta, and Patterson. It is difficult not to regard him with a feeling akin to that which attends the presumption *in odium spoliatoris*. We entertain no doubt that the testimony of all these witnesses is true in every particular, including the statement of Brossl as to putting the lock on the door. If that were false, doubtless Jones would have been called to gainsay it. His hostility to the defendants is a sufficient reason for their not calling him for any purpose.

The case arose while the patent act of 1836 was in force, and must be decided under its provisions. The sixth section of that act requires that to entitle the applicant to a patent his invention or discovery must be one "not known or used by others before his invention or discovery thereof." The fifteenth section allowed a party sued for infringement to prove, among other defences, that the patentee "was not the original and first inventor of the thing patented, or of a substantial and material part thereof claimed to be new."

The whole act is to be taken together and construed in the light of the context. The meaning of these sections must be sought in the import of their language and in the object and policy of the Legislature in enacting them. (Gayler vs. Wilder, 10 How., 496.)

The invention or discovery relied upon as a defence must have been complete and capable of producing the result sought to be accomplished; and this must be shown by the defendant. The burden of proof rests upon him, and every reasonable doubt should be resolved against him. If the thing were embryotic or inchoate; if it rested in speculation or experiment; if the process pursued for its development had failed to reach the point of consummation, it cannot avail to defeat a patent founded upon a discovery or invention which was completed, while in the other case there was only progress, however near that progress may have approximated to the end in view. The law requires not conjecture, but certainty. If the question relates to a machine, the conception must have been clothed in substantial forms which demonstrate at once its practical efficacy and utility. (Reid vs. Cutter, 1 Story's R., 590.) The prior knowledge and use by a single person is sufficient. The number is immaterial. (Bedford vs. Hunt, 1 Mason, 302.)

Until his work is done, the inventor has given nothing to the public. In Gayler vs. Wilder the views of this court upon the subject were thus expressed:

"We do not understand the circuit court to have said that the omission of Conner to try his safe by the proper tests would deprive it of its priority; nor his omission to bring it into public use. He might have omitted both, and also abandoned its use and been ignorant of the extent of its value; yet, if it was the same with Fitzgerald's, the latter would not, upon such grounds, be entitled to a patent, provided Conner's safe and its mode of construction were still in the memory of Conner before they were recalled by Fitzgerald's patent."

Whether the proposition expressed by the proviso in the last sentence is a sound one, it is not necessary in this case to consider.

Here it is abundantly proved that the lock originally made by Erbe "was complete and capable of working." The priority of Erbe's invention is clearly shown. It was known at the time to at least five persons, including Jones, and probably to many others in the shop where Erbe worked; and the lock was put in use, being applied to a door, as proved by Brossl. It was thus tested and shown to be successful.

These facts bring the case made by the appellees within the severest legal tests which can be applied to them. The defence relied upon is fully made out.

The decree of the circuit court is affirmed.

NEW BOOKS AND PUBLICATIONS.

THE ANÆSTHETIC REVELATION AND THE GIST OF PHILOSOPHY. By Benjamin Paul Blood. Amsterdam, N. Y.

The author maintains that "there is an invariable and reliable condition (or uncondition) ensuing about the instant of recall from anæsthetical stupor to sensible observation, or 'coming to,' in which the genius of being is revealed." He fails to show the import of this discovery, and indeed seems anxious to return it to its native limbo by smothering it in a collection of meaningless verbiage which no one would attempt to unravel.

A TREATISE ON THE METHOD OF GOVERNMENT SURVEYING, as Prescribed by Congress and the Commissioner of the General Land Office. With Complete Mathematical, Astronomical, and Practical Illustrations. In pocket book form, price $2.50. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

This volume is likely to prove valuable to students of the important branch of civil engineering of which it treats. It is written in a practical and pointed style, and well illustrated; and it contains the necessary logarithm and transverse tables in a compendious and convenient form.

FUEL. By C. W. Siemens, F.R.S. With an Appendix on the Value of Artificial Fuels as Compared with Coal, by John Wormald, C. E. 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

This is No. 9 of Mr. Van Nostrand's Science Series, and consists, in chief of an excellent lecture to working men by Mr. Siemens, already commented on in our columns.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 17 to March 9, 1874, inclusive.

BANK LOCK.—T. B. Worrell, Philadelphia, Pa.
BOLT AND NUT, ETC.—W. J. Reid, New York city.
BRAKE.—W. B. Chapin, Wickford, R. I., *et al.*
BREECH-LOADING FIRE ARM.—E. Whitney, New Haven, Conn.
CENTRIFUGAL MACHINE.—D. M. Weston, Boston, Mass.
COMBINATION LOCK.—H. Clarke, Baltimore, Md.
DRESSING MILLSTONES.—Chisholm Brothers, Ottawa, Ill.
DRY GAS METER.—T. C. Hopper, Philadelphia, Pa.
GRINDING MILL.—Enterprise Manufacturing Co., Philadelphia, Pa.
LIGHTING GAS.—O. Siebert (of New York city), London, England.
PACKING CHLORIDE OF LIME.—M. L. Bush, New York city.
PRESERVING ANIMAL SUBSTANCES, ETC.—G. Napheygi (of New York city) London, England.
PROTECTING THE EYES, ETC.—J. H. Beardsley, Brooklyn, N. Y.
PURIFYING MIDDLINGS.—C. E. Whitmore, Quincy, Ill.
ROTARY HAY TEDDER.—S. Perry, Newport, N. Y.
SHARPENING TOOL.—O. W. Taft, Brooklyn, N. Y.
SNOW CLEANER.—C. H. Perkins *et al.*, Providence, R. I.
STEAM AND SAILING VESSEL.—R. Lo Forte, New York city, *et al.*
STEAM ENGINE.—J. H. McGhee *et al.*, Kansas city, Mo.
STRENGTHENING GUNS, ETC.—J. F. Allen, New York city.
TREATING SPONGE.—P. S. Devlan, Jersey City, N. J.
WRITING TABLE, ETC.—N. Knight, Auburn, Me.

Recent American and Foreign Patents.

Improved Machine for Cutting Glass in Oval Forms.

George Helfrich, Boston, Mass.—This invention consists of a table, on which the glass is secured having on its under side a slotted disk of a trammel or ellipsograph, and supported in a large ring, so as to be revolved to turn the trammel plate around the blocks of the trammel bar, which is held stationary in the frame or base of the machine as to the rotation of the disk, but may have endwise motion; and the trammel supports, by standards rising up from it on opposite sides of the base, a horizontal bar, which passes over the glass-holding plate, and also a holder for the cutter, under which the glass is carried by turning the plate to which it is clamped to cut the glass. By shifting the holder cutter toward and from the center, the tool is adjusted for cutting different sizes, and by shifting the blocks of the trammel bar, which works in the slots of the disks, toward and from each other, the apparatus is adjusted for cutting ovals of any required form. A rack and pinion are arranged with one of said blocks for changing it. Thi invention seems to be well adapted for the purpose for which it is intended, and is a vast improvement over any machine previously invented for cutting oval glass.

Improved Tool Holder.

Frank Funk, Beverly, Ill.—The is a handy little tool for carpenters' and pattern makers' use. It consists in a tube having the bore at one end larger than at the other, and one or both ends internally threaded to receive at the larger end an ordinary lead pencil, with which it corresponds in size, and at the small end a scratch awl or a knife blade.

Improved Car Coupling.

Abraham Rust, Vaca, Cal.—The cavity of the bumper extends inward and is fitted with a sliding block, which is held forward by a coiled spring. The coupling pin passes vertically through a hole in the forward part of the bumper, and moves up and down through a tube. A lug on the upper part of the pin projects through a slot in the rear side of the tube, and to it is attached a short chain which is also secured to the rear of a slide which slides in a recess upon the bumper, so that its forward end may pass beneath the lower end of the tube to support the pin when raised to uncouple the cars. To the slide is attached an arm which projects upward into a recess, and is held forward by a coiled spring. A flat spring holds the slide down to its place. As the pin is raised to uncouple the cars, the rear end of the slide is raised from a small pin by the chain allowing the said slide to be pushed forward by the spring beneath the coupling pin. As the link is withdrawn from the bumper head, the sliding block is pushed forward by its spring, so that the small pin may again enter a hole in the slide, and the coupling is arranged to couple automatically as the cars are run together. As the cars are run together, the entering link pushes back the block which carries the slide with it, allowing the coupling pin to drop into place through the link coupling the cars.

Improved Windlass for Presses, etc.

Melancton Bryant, Northport, N. Y.—The holding pawl, by which the windlass is retained while the pawl lever and its pawl are moved back on the ratchet wheel, is constructed in two parts, which are jointed together by a knuckle joint, which closes by rising upward, but is held open by the weight of the pawl, so that when the latter rests on the ratchet wheel, the pawl has the function of an ordinary rigid pawl of one piece. Below is a trip lever for throwing up the joint to trip the pawl and release the windlass. Before tripping the pawl in this manner, the ratchet pawl is thrown back, so that it will not hold the ratchet wheel, and, in order that it may not be struck by the teeth of the wheel and thrown forward again, it is secured by a pin.

Improved Curtain Fixture or Rolling Shutter.

Charles H. Reynolds, Williamsburg, N. Y., assignor to himself and Henry G. Richardson, same place.—A ring of cast iron is made with two notched lugs upon its inner surface, to receive the bolts by which two disks are secured to each other and to the said ring. The disks are made larger than the ring, so as to project beyond it and form a groove to receive the hoisting strap which is wound around the wheel thus formed. The strap is held to support the shutter in any desired position by a clamp consisting of two corrugated cams which are arranged to move exactly together. A counterbalancing weight to the shutter shaft, consisting of a chain, is attached to one end of a strap, which is wound around the shaft, in the opposite direction from the hoisting strap. As the shutter is raised so as to diminish its downward draft upon the side of the shaft, the lower end of the chain comes in contact with the floor, so as to diminish the downward draft upon the other side of the said shaft. In this way the shutter will be exactly balanced, however much or little it may be rolled up, the weight adjusting itself to the weight of the shutter.

Improved Combined Plow, Planter, and Cultivator.

John Urban, Belton, Tex.—Two parallel beams are connected and held at the proper distance apart by straps bolted to them. To the rear part of the beams are bolted two cross beams, the said bolts passing through holes in the beams, and through longitudinal slots in said cross beams, enabling them to be adjusted as required. The cross beams are connected by bars, attached to the upper and lower sides of their ends. There are also two side beams, to the inner sides of which, near their ends, are attached arms which slide along the inner sides of the cross beams, and are secured to said cross beams by bolts which pass through holes through the cross beams and through slots in the arms. The inner ends of the arms are halved, so that they may overlap each other, and are connected by bars attached to them near their inner ends. This enables the side beams to be adjusted wider apart or closer together. The whole forms a convenient frame adapted to be used with planters, plows, or cultivators.

Improved Car Coupling.

Ransom Hemenway, New Cassel, Wis.—This invention consists of a drawbar at each end of the car, which is provided at one side with a strong outwardly curved part, having a laterally sliding spring catch, and at the other side with a broad vertical hook, which enters into the recess between the curved part and hook of the drawhead of the adjoining car by pressing the spring catch sidewise. The spring catch locks over the hook after the entrance of the same into the recess. As both drawheads interlock with each other, a double coupling is obtained.

Improved Draft Equalizer.

Aaron Wilson, Tekamah, Neb.—This invention is a triple tree pivoted at one end to a projecting bar and centrally to a lever, which is pivoted at its opposite end to a link of the double tree, and centrally to a tongue. By this construction the resultant line of draft will run along the tongue, so that there will be no side draft caused by the use of a third horse.

Improved Cotton Bale Tie.

Edwin W. Whiteman, Bayou Sara, La.—This invention is a bale tie made with a hole in one end, loops or bends upon its other end, and with a tongue on its middle part, to adapt it to be used with a wire. The wire is passed around the bale through one of the loops, bent round the tongue, and is sprung into the other loop. When the bale tie has been put under the compress, the end of the wire is sprung out of the loop and tongue, the slack is taken up, the wire is again passed around the tongue, and sprung into the loop, and its end, which is now long, is passed beneath the adjacent tie.

Improved Lever Motor for Converting Motion.

John Stone, Mill Grove, Mo.—The invention relates to imparting mechanical power to a drive shaft through the pendulum movement; and consists in the mode of combining the pendulum with the crank pitman and an actuating lever, so that the leverage is greatly augmented, while the arc of vibration is brought within shorter and more convenient limits, an extra and horizontal lever producing the first, and the mode of connecting the pitman evolving the second, effect.

Improved Watch and Clock Calendar.

Levi Berger, Danville, Pa.—This invention consists in a clock or watch calendar, in which are exhibited automatically the day of the week, the day of the month, the month, and the year, without cog or gear mechanism, and in such a limited space that all may be confined in the cavity of a comparatively thin plate, the device being thus applicable either to a clock or watch.

Improved Pitman Connection.

Andrew J. Van Atta, of Van Atta, assignor of one half his right to George Van Atta, of Newark, O.—This invention is an improved pitman connection so constructed as to throw the force of the stroke to one side or outward, instead of direct, and to enable lost motion and wear to be taken up, and it consists in a pitman connection provided with one or more eccentric V-shaped ring corrugations upon its adjacent surfaces, fitting into each other, but so formed that the points of the corrugations of the one part cannot reach the bottoms or bases of the corrugations of the other part. The parts are secured to each other by a bolt which passes through the center of the said parts. By this construction the force of the stroke will be received upon the corrugations of the connection, and will be thrown to one side instead of being direct.]

Improved Permutation Lock.

Joseph G. O'Neill, Grass Valley, Cal.—A spindle extends through the door and lock and projects on each side, and has a knob at each end for turning it. Arms on this spindle are inside of the lock case, for throwing back a plate, which withdraws the spring latch bolt. The arms are also to turn a disk for shifting combination rings. All these rings have a notch, and said notches must be adjusted to coincide with prongs of the plate, to allow said plate to be withdrawn for pulling back the bolt. A conical cap is screwed into a hole in the door latch, through which the notches of the rings can be seen when in the right position for allowing the latch to be pulled back. When this cap is removed, the numbers on the dial plate and the number of turns and parts thereof, and the directions for turning the spindle, to set the rings so as to ascertain the numbers for the combination can be readily ascertained by turning the rings till the notches are seen through said opening, and noting the turns and the numbers whereat the pointer stands when the notches are seen. To open the lock at night, when the pointer and the figures of the dial cannot be seen, four deep notches are made in the dial plate equidistant from each other in the circumference, and a series of holes corresponding to the numbers on the dial. These are to guide a feeler to the hole for stopping the pointer at the right number.

Improved Boring Machine.

George W. McCready, Petitcodiac, Canada.—The object of this invention is to provide an improved boring machine, which is to be used in the manufacture of brushes, or for making the internal mechanisms of musical instruments, or for drilling holes into a number of articles made of iron or other metals, or for such other purposes where a number of holes are required to be bored at fixed intervals. Three borer plates are perforated according to the pattern of the article to be bored, and two of them are placed into the case, through which the front parts of the borers are inserted. The third plate is then placed upon the heads of the borers which are made with any one of the approved bits in common use, each being provided at its rear parts with a collar and an oblique crank. The collars hold the borers in position on the second borer plate during use, while the oblique cranks turn the borers. The parallel position of the cranks while turning prevents their interfering with each other, no matter how many be used or how closely they are arranged together. As the borers rotate without advancing, it is necessary to feed the articles against them by mechanical power. For this purpose a feeding apparatus is employed, into which the articles are readily placed and removed, while they are at the same time firmly clamped to prevent their splitting during the boring operation.

Improved Cotton Press.

Matthew Hussey, Troy, Ala.—The object of this invention is to furnish, for the use of cotton planters and others, a powerful press, by which cotton and other material can be rapidly and closely packed. The invention consists of a plunger block operated by pivoted levers in connection with suitable pulleys or windlasses. The upper ends of the levers are of wedge shape, and connected at the pointed extreme ends by a strong hinge. Their lower ends are attached, by strong ropes, to pulleys or windlasses' and by lowering and lifting them the machine is operated. The beam lev' ers transmit the motion to the plunger rods and block, and press the cotton or other material closely into the packing box. The plunger block is raised above the packing box by pressing in an upward direction, the plunger rods yielding and supporting the block above the box till the same is filled with the material to be pressed. The block is then brought down into the box, and the levers applied in the manner described.

Improved Car Coupling.

Walter Stiles, Bloomfield, Iowa.—This invention consists of an elbow-shaped frame, arranged on the drawhead so as to hold up the coupling pin above the link; also to hold the link up level, or a little inclined, so as to enter the drawhead of an approaching car, so that, when the two cars come together, the two frames will push each other forward at the top, so as to release the coupling pins, and let them fall through the link, and couple the cars self-actingly. Full description and illustration of this device will be found on page 195 of our current volume.

Improved Iron Fence.

George Forsyth and Moses R. Counter, Seaforth, Can.—The gate posts and others to which the braces are attached, and which are of iron, are placed with their flat sides parallel with the line of fence. The intermediate posts are placed with their flat sides at right angles to the line of fence. All these posts are perforated for the wire, and the wires are keyed in the intermediate posts to prevent longitudinal motion. The braces are riveted to the end posts, and they reach to the adjacent intermediate posts, and have a toe which passes through a mortise in the latter. All the posts pass through a mortise in angle stakes. This angle stake adds very materially to the support of the fence, and counteracts the effects of the wind. Wire rails are stretched between the posts.

Improved Automatic Gate.

Winston W. Gilbert, East Enterprise, Ind.—To the upper part of the rear cross bar of the gate is attached an eye through which passes a rod, the lower end of which is pivoted to the post, and its upper end connects with a bow, the ends of which are attached to a block pivoted to an arm. The block rocks freely upon its pivots, and to it are attached levers projecting upon the opposite sides. The rod in its movements operates a short lever which acts upon another rod, and draws the latch close to the cross bar of the gate, withdrawing it from a catch, and allowing the gate to be swung open by the movement of the rod first mentioned. As the levers are operated to open the gate, the first effect is to raise its forward end, which frees it from the stops, and allows it to swing freely in either direction. A block is attached to the post, just above the angle of the latch, so that the gate cannot be opened without first withdrawing the said latch. This prevents the gate from being raised and opened by stock. The gate may be raised to allow small stock to pass beneath it, in which position it may be supported by a suitably arranged bar.

Improved Station Indicator.

Daniel H. Close, New York city.—An endless belt passes over rollers and is held taut by springs. By suitable construction, when a rod is drawn back, a cam is released from a pawl, and it is caught by another pawl, allowing a spring to revolve one roller one half a revolution. As the rod is released, the pawls move forward and the roller completes its revolution, bringing the name of the next station into view. One end of the cord connecting with the rod is attached to the bell cord passing from the engine through all the cars of the train. The other end of the cord is attached to a spring roller attached to the rear end of the rear car, and which is designed to take up the slack of the bell cord as the cars are stopped or backed. When the train is about to leave a station, the engineer pulls the bell cord toward the engine. This draws the cords and draws back the pawls, allowing the roller to make a half revolution; then, as the bell cord is released, the rollers complete their revolution and the name of the next station is displayed.

Improved Harvester.

Jacob D. Martin, Frazeysburg, O.—This invention is an improved harvester, so constructed as to deposit the cut grain in the rear of the machine, and at such a distance from the standing grain as to be entirely out of the way of the machine in its next round. By suitable construction, by moving the upper end of a lever to the rearward, the rear edge of the platform rack will be lowered to allow the cut grain to slide therefrom, and, by moving the upper end of the said lever forward, the rear edge of the platform rack will be raised into position to receive the cut grain. As the rear edge of the platform rack is lowered to discharge the grain, a guard rod is moved forward by the same movement into such a position as to receive the falling grain and prevent it from being intermingled with the grain being discharged. As the platform rack is again raised, the guard rod or cut-off is moved back out of the way, allowing the grain to fall upon the said platform rack. As the grain slides from the platform rack, it is received upon the dropper, which is provided with end guards, and is attached to and supported by a pivoted frame. The latter connects with gearing so formed as to swing the dropper back through a quarter of a circle, and then return it to its proper place in the rear of the platform. The movement of the lever to lower the rear edge of the platform also actuates mechanism which swings the dropper, tilts it, and thus drops the grain. The dropper may also be operated automatically, and without its being necessary to actuate the lever.

Improved Machinery for Forcing and Exhausting Air.

William I. Ellis, Manchester, England.—This invention is an improvement on the well known McKenzie blower, and consists in a cranked shaft and revolving inner and stationary outer cylinder. Quadrants are hinged to the inner cylinder, and caused to oscillate through openings therein by means of radius rods connecting them with the shaft. Thus the inner cylinder acts as a driver for the fans or quadrants, carrying them round with it, and by their operation in the space between the two cylinders, drawing in and forcing out the air.

Improved Harvester Rake.

John J. Dewey, Red Wing, Minn.—This invention is an attachment for harvesters for collecting the cut grain and delivering it in compact gavels either to binders or upon the ground. As a rocker begins its return movement, a chain causes a bar to sweep longitudinally along the forward part of a platform, collecting the grain into a compact gavel against the downwardly projecting end of the inner side bar of the frame. As the bar reaches the inner end of its stroke, a trip rod strikes a catch plate, and allows the bar to move to the rearward across the inner end of the platform, carrying the gavel with it to the rear edge of the platform. As the bar again begins its outward movement, the gavel is left upon a spout attached to the rear edge of the platform, whence it is taken by the binders and bound. The binders sit upon adjustable seats attached to the binders' platform, which is secured to the rear part of the platform frame. By detaching the spout and binders' platform, the gavel may be allowed to drop upon the ground.

Improved Wagon Brake.

Jesse C. Coleman, Clifton, Kan.—There are two brake bars of wood hung to the wagon body by chains. One bar extends across the body and connects with a handle lever. The other and shorter bar moves with its curved end in a staple of the cog bar, and presses, by the forward motion of the lever end of the latter, toward the wheels. Skid shoes are attached to the ends of both bars, so as to be adjustable above or below the hubs to the wheels. A metallic guide bar is firmly applied to the short bar, and extends back over the end of the long bar, serving as support for the same. Chains connect the bars from their points of suspension to a double hook, pivoted in the central axis of the wagon. They serve to keep the brake bars from swinging sidewise off the wheels. The whole brake arrangement may be taken off, and every part easily be replaced.

Improved Lozenge Cutter.

James A. Dingwall, New York city.—By this invention, lozenges may be cut with great rapidity, either by hand or machine power. It consists of a supporting frame, to which a perforated main plate, with tubular cutters' is attached. This guides, in suitable holes and recesses of the frame, a perforated spring plate, which passes up around the tubes on pressing the cutter into the dough, and detaches, by its downward motion, the waste parts from the cutter tubes, while the cut lozenges are carried upward in the same.

Improved Running Gear for Vehicles.

William Hemme, Michigan Valley, Kan.—The rear extensions of the front hounds join together at the center, a short distance from the axle, and have a swivel, which connects with the reach by a pivot joint, so that the front and hind parts may oscillate vertically to any extent, and may oscillate horizontally at the center, between the front and hind parts. A spring is combined with the rod and socket of the swivel, so that the draft will be transmitted through it when not too great, so that the irregular resistance of the hind wheels will be less severe on the horses than when positively connected. The axles are also connected by a system of jointed rods, which remain slack, except when the limit of the contraction of the spring is reached, when they come to its aid, and sustain a portion of the draft. By this means, an elastic connection of the two axles is provided for ordinary draft, and an inelastic connection for heavy or sudden draft.

Improved Drying Apparatus.

Benjamin F. Cawthon, Elizabethtown, and Andrew J. Conner, Louisville, Ky.—This invention is applicable to the drying of lumber, peat, or other substances. There are two drying chambers, one of which connects with a furnace so that the products of combustion pass through it. The other is a communication with air pipes in said furnace. Consequently, the heat of the gases, etc., is used in one chamber, and the heat absorbed by the pipes in the other.

Improved Combined Seed Sower and Harrower.

John W. Smith, Nashville, Tenn.—The draft strain is sustained by the axle in such a way that the frame may be raised from the ground for convenience in turning and passing from place to place. Bars are kept constantly moving back and forth as the machine is drawn forward, so that the ground will be thoroughly stirred. These serve, together with the suitably arranged toothed frame and a seed sower of simple construction, as a two way cultivating harrow, for sowing and cross harrowing the seed into the soil.

Improved Method of Preparing Teas for Use.

James Spratt, of the Island of Guernsey.—The tea is to be solidified by placing it in molds of iron, when it is subjected to such a pressure as will reduce it to one third its former bulk, which pressure will reduce the tea to a block, which shall have a smooth glossy surface, and will not crumble. This pressure breaks up the cells or sacks of the tea, so that the strength and flavor in making a decoction can be more thoroughly and much more quickly extracted than is possible when the ordinary loose tea is used. The bottom of the mold and of the follower are provided with V-shaped transverse projections, which enter the tea, and, as the pressure is applied, they pack it more closely, and leave deep transverse grooves in the upper and lower sides of the blocks. The grooves upon the opposite sides of the block should be opposite each other, so that one or more of the sections formed by the grooves may be broken off, according to the quantity required to be used at a time.

Improved Sheet Iron Scoop.

John C. Milligan, New York city, assignor to Lalance and Grosjean Manufacturing Company, same place.—This improved scoop has a short side and a prolonged one, the whole being formed from one piece of ductile metal. It is made from a cylinder with one closed end, by simply making a diagonal cut thereacross and affixing a handle to the closed extremity.

Improved Stalk-Cutting Attachment for Cultivators.

Samuel Crossley, Rock Island, Ill.—This invention consists of a lever combined with suitable mechanism, so that, when raised, it causes bars to lock and hold the caster wheel suspended. When the lever is lowered, the caster wheel is lowered, to bear upon the ground, and the frame is raised, so that the machine may be turned and drawn from place to place without allowing the cutters to touch the ground.

Improved Paper Pulp Screen and Dresser.

John S. Warren, Fishkill-on-the-Hudson, N. Y.—This invention consists in oblique pulsation plates inclined in relatively opposite directions and rotating at different velocities. In these plates, near their centers, are formed openings to allow the pulp to pass through as it passes toward the discharge opening. To the angles of a screen are attached plates, which project toward the shaft between the oblique plates, and are designed to prevent the pulp within the screen from receiving a rotary movement from the friction of the oblique plates. To the angles of the screen, especially when said screen is made with more than four sides, are attached outwardly projecting flanges, to give the proper agitation to the pulp within the vat.

Improved Manufacture of Halters and Bridles.

Theodore L. Wiswell, Olathe, Kas.—The crown piece passes through a slot of a metallic plate, and is fastened at both ends, being made adjustable. The throat band is passed through converging oblique slots of the plate, riveted, then passed down into a groove of another plate and again riveted. One end of the nose piece is carried through two slots, while through the latter the doubled and adjustable rear strap is passed. The throat band and rear strap are connected by a vertical strap, which is trebled and provided with a ring, at the lower end, for the reception of the halter strap. The connection of the crown piece and the throat band by the obliquely slotted plate prevents the throat band from tearing out while it causes a more easy set on the head, any adjustment of the two leather pieces drawing equally on either.

Improved Trace Fastener.

William Rombaugh and James C. Mears, Olivet, Pa.—A hook is swung up sidewise on a shoulder into the longitudinal direction of the single tree, to the extremity of which it is fastened, in which position the end of the trace may be slipped easily over the pointed end. The hook is then turned over, so as to be under right angles to the tree, and forming a link-shaped piece with a shoulder, from which the trace cannot release itself, being held securely inclosed therein.

Improved Boiler Feeder.

Charles Wright, Catlettsburg, Ky.—A chamber, the upper end of which is made close, has a valve in the middle of its bottom. The valve stem rests against the end of a screw that passes in through the closed end of the case, so that, by adjusting the said screw, the valve may be held to its seat with more or less force. In the valve, upon the opposite sides of the stem are formed two passages, in such positions that they may, by suitable adjustment of the valve, be opposite two of four passages in the bottom. In using the device, it is connected with the boiler at a little higher level than the water line. One passage is connected by a pipe with the top of the boiler; another, with the boiler at the water line; the third, with the water cistern, which must be at a higher level than the device, and the fourth, also with the cistern, to convey away the steam or air from the chamber. To the valve in one passage is secured a pipe, the upper end of which projects nearly to the closed upper end of the vessel, so that water may pass into and steam or air out of, and also that water may pass out of and steam into, the said chamber without the two streams interfering with each other. The movement of the valve is limited y a stop pin attached to its edge, and which strikes alternately against a stop pin on the bottom. By this construction, as the valve is turned so as to make the passages correspond, respectively, with the third and fourth ports, the water will flow, by its own weight, into the chamber, while the air or steam in said chamber escapes into the said cistern, or some other receiver. When the valve is so adjusted as to make the passages correspond, respectively, with the first and second ports, the water will flow, by its own weight, into the boiler, while an amount of steam escapes into the chamber.

Improved Machine for Raking and Baling Hay.

John Trout, South Pass City, Wyoming Territory.—One side of a triangular case is hinged to the rear edge of the top, and is provided with short spring teeth at the lower edge, so as to constitute the rake for gathering the hay in front as the apparatus is drawn along the ground. A packing or stuffing fork, also pivoted and arranged in front of the side, is swung forward from time to time by a lever, to press the hay gathered in front of the rake into the case. It can be lifted up when swung back to pass over and drop behind the hay gathered up during a movement forward for stuffing the case. A couple of strong ropes are connected to the swinging side and are provided with clutches geared to the axle, so as to be turned by the horse to force the side on the case for pressing the hay and forming the bale. The tying cords are attached to the lower edge of the swinging side and passed around the interior of the case over spring holders, from which they can be readily detached, also over a rod, which can be pulled out to release them, and around the edge to a shaft having a hand crank by which they can be drawn tightly around the bale for fastening it.

Improved Perch for Dumping Cars.

George Richards, Boston, Mass., assignor to himself and Albert Thayer same place.—This invention is a perch for railroad dumping cars, by which the drawheads may be arranged at standard hight, being stiff and strong enough to support the rocker bed from its ends, and avoiding the continua annoyance from rotting of the parts and consequent rocking of the cars. It consists in making the perch of the dumping car of two bars of channel iron, T beam, or other form of iron, and fastening it laterally, in such a manner that the draw rigging passes between them, and the whole structure becomes stiffer and stronger.

Improved Well Boring Apparatus.

Alfred White Morgan, Brownville, Neb.—The invention is an improvement in well borers of the class in which a spiral flanged auger is arranged to be operated by a sweep or other suitable device, and to be raised from the well to discharge the earth loosened by, and packed upon, the spira flange. By suitable construction, by turning a crank, the driving shaft will be raised from the journal of a drum, and by turning another crank, the driving shaft will be carried over the boring shaft with which it is coupled, an arm enabling it to be readily guided into place. The arrangement is also such that, when the cutter encounters a stone, the boring shaft is slightly raised, so that the cutter may pass over it and again enter the ground at its other side, and so on until the cutter passes beneath the said stone and thus removes it. A flat steel plate, twisted into spiral form, and made pointed, serves as a bit to force its way into the soil when the cutter does not enter the soil freely. A hollow cylinder, of such a size as to slide up and down freely upon the boring shaft, and to which is attached a spiral plate, receives the dirt from the cutter and carries it out of the well hole. Devices are provided which prevent the possibility of the carrier being overloaded or clogged, and from being turned by the pressure of the dirt against the spiral.

Improved Harvester Rake.

William M. Howe and George H. Howe, Lansing, Mich.—This improvement in the raking apparatus consists of teeth arranged to project from the rake head up through slots in the apron, and to swing down horizontally at the beginning of the backward movement to pass under the grain accumulated on the platform during the forward movement. The teeth then swing up and are locked automatically at the beginning of the forward motion, so as to carry the grain forward.

Improved Cotton Chopper.

William J. Johnson, Spring Place, Ga.—In the inner sides of wheels are formed grooves arranged in the form of an equilateral triangle with curved sides. These gradually increase in depth from angle to angle, so that there will be a shoulder at each angle of the groove. This form of the grooves carries the cutters upward, outward, and again downward into position to make a level cut when the ends of levers drop from the shoulders of the said grooves. To the forward ends of the levers are attached the cutters by which the cotton is cut. Springs connect the forward parts of the levers with the frame, and are so arranged as to draw the cutters inward with a sharp and forcible blow to chop the cotton as soon as the rear ends of the levers reach the shoulders of the grooves. The wheels may be adjusted so that the cutters will both operate at the same time or alternately.

Improved Speculum.

Gustave W. Schumacher, Portland, Me.—This invention consists of a single adjusting screw and nut only, in combination with the arms of the speculum plates for forming the latter. The screw-jointed to one of said arms, passes through the other, and receives the nut outside, so that the arms may be forced together, and the plates forced apart by screwing the nut upon the screw. This arrangement gives a wider range of movement to the inner ends of the plates, so as to have either one extend beyond the other, which is very needful in some operations.

Improved Process of Waterproofing Paper.

Ambrose G. Fell, New York city.—This invention is a process of treating paper for paper collars, cuffs, bosoms, show cards, window shades, and other uses, so that it will resist the action of moisture; will not mildew change color, or otherwise decompose; will require less coloring matter; will add brightness to the colors used and render them insolubly fast; will render it capable of being more readily polished by friction, and will require much less material for enameling it than ordinary paper. It consists in treating sized paper with a solution of alumina in sulphuric acid, and afterward in a solution of carbonate of soda, or other precipitant of alumina, in water.

Improved Pruning Shears.

John C. Seger and John Hollingsworth, Jr., Mooresville, Ala.—These pruning shears consist of a main lever, having a curved stationary blade and guard and a sharp curved beveled cutting lever blade and operating lever. A compound lever purchase is obtained on the cutting blade, and a drawing cut is given its edge by the location of the fulcrum pin. The guard is rigidly attached to the stationary blade. Its face is on the plane of the faces of both the blades, and it guides and supports the thin beveled cutting blade and prevents it from twisting.

Business and Personal.

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

For Sale very cheap—Gear Cutter for clock wheels up to 14 inches. B. F. Hope, Sag Harbor, L. I.

Wanted—To know the names of some party or parties who manufacture a machine to shave the hand rived Shingle. T. B. Slade, Whitesville, N. C.

The "Little Monitor" Sewing Machine is the greatest achievement of the age. It uses the commercial Spool without rewinding, & makes three kinds of stitches. Ag'ts wanted. G. L. Du Laney & Co., 769 Br'dway, N. Y.

Wanted—Situation by a young Millwright in a Machine Draughting Room under instruction. References furnished. Address F. S. W., care H. Watters, M. E., Akron, Ohio.

An experienced Mechanical Draughtsman from Glasgow, wants employment. Address G. S., 701 Chestnut St., Philadelphia, Pa.

Lovell's Family Washing Machine, Price $5. A perfect success. Warranted for five years. Agents wanted. Address M. N. Lovell, Erie, Pa.

To Capitalists—To be sold, one half of patent Steam Street Car. Will put a car on the road for the benefit of all concerned. For particulars, address W. W. Crane, Auburn, N. Y.

Brass Castings of superior quality. Send your patterns to Bailey, Farrell & Co., Pittsburgh, Pa.

Wanted, by a Mechanic who has had Experience in Manufacturing and Selling—now going to California—the Superintendency of a Factory, or the agency of some good article not yet introduced there. Address Business, P. O. Box 468, Schenectady, N. Y.

Wanted—To correspond with dealers in manufactured Sumac. Address Geo. Johnston, Caldwell, Burleson Co., Texas.

Notice to Inventors—Our Guide Book for the sale of Patents explains new and improved methods for disposing of rights. Send stamp for circular and synopsis of contents. S. S. Mann & Co., cor. Linden Av. and Hoffman St., Baltimore, Md.

Wanted—To take a small interest, where the services of a Machinist are needed, or a Mfr's Agency. Address "Draughtsman," 28 N. 9th St., Philadelphia, Pa.

Large iron vehicle, with tank holding 700 gallons water. Space for small boiler and engine. Very cheap. Address J. M., 321 E. 41st St., New York.

For Sale—Steel Manufacturing Business. Process is patented. Proprietor's own patent exclusively. One fourth interest for sale; will require Fifty Thousand (50,000) dollars to purchase same—on part, time would be given, if desired. Profits very large. Ample reasons given for selling. Address with full name, which will be confidential. W. E. Tustin, Pittsburgh, Pa.

Buy Boult's Paneling, Moulding, and Dovetailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 227.

For Sale or to Let on Royalty—The Patent Tool Holder described on page 232 of this paper. Sample sent, post paid, for 25c. F. Funk, Beverly, Adams Co., Ill.

Wanted—By a young man who has had two years' experience—a situation in a machine shop, where he can finish his trade, or to learn to run a steam engine. Address M. L. Wheeler, South Gardner, Mass.

Little Giant Tack Hammer, Setter and Puller Combined, makes every man, woman and child smile, and sells to everybody. 300 per cent profit to agents. Send 50c. for sample—mailed free, with full particulars. Rights for Sale. Address G. J. Capewell, Cheshire, Conn.

Emerson's Patent Inserted Toothed Saws, and Saw Swage. See occasional advertisement on outside page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.

Metal Planing Attachment for Lathes—Patent for Sale. W. Earle Cass, 213 Washington St. Newark, N. J.

Spools, Button Molds, and all small turned goods made by H. H. Frary, Jonesville, Vt.

Wanted—A first class Machine, known among Hinge Makers as a Slitting Machine. Address Wheeling Hinge Company, Wheeling, W. Va.

Steam Fire Engines—Philadelphia Hydraulic Works, Philadelphia, Pa.

Bone Mills and Portable Grist Mills.—Send for Catalogue to Tully & Wilde, 20 Platt St., New York.

Paragon Gold Quill-Pens—The best in use. C. M. Fisher & Co., 102 Fulton Street, New York.

Chemicals, Drugs and rare Minerals used by manufacturers, constantly on hand and sold by package and quantities to suit, by L. & J. W. Feuchtwanger, Chemists, 55 Cedar St., New York.

Waterproof Enameled Papers—all colors—for packing Lard and other oily substances, Chloride of Lime, Soda and similar Chemicals, Cartridges, Shoe Linings, Wrapping Soaps, Smoked or Dried Meats, and Desiccated Vegetables, Shelf Papers, and all applications where absorption is to be resisted. Samples on application. Crump's Label Press, 75 Fulton St., New York.

Diamonds and Carbon turned and shaped for Scientific purposes; also, Glaziers' Diamonds manufactured and reset by J. Dickinson, 64 Nassau St., N. Y.

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ANSWERS TO CORRESPONDENTS

S.'s query as to the weight of the locomotive does not give sufficient *data*.—W. H. C. is referred to p. 186, vol. 25, for directions for building an ice house. Galvanized iron will do for maple sugar utensils.—M.M. does not send anything new in his note on the epicycloid.—B. M. will find the description of a waterproof cement for leather on p. 138, vol. 25.—A. S. B. can try watch glasses in his scales.—A. G. M. will find full descriptions of *papier mache* decorations on p. 16, vol. 27. —R. H. F. can harden screw plates and dies by the process described on p. 75, vol. 28.—G. H. W. can find recipes for vinegar on p. 58, vol. 30. This vinegar will keep for an indefinite time in a tight cask. Acetic acid is $C_2H_3O_2$.—W. H. K. cannot remove the tattoo marks from his arm.—T. C. W. A gallon of water contains 277·274 cubic inches.—S. S. will find a full description of nickel plating on p. 91, vol. 29.—A. J. S. will find the pantagraph fully described and illustrated on pp. 99, 179, vol. 28.—E. S. G. will find that meerschaum is fully described on pp. 73, 99, 193, vol. 26.—G. H. will find the answer as to galvanized water pipes on p. 370, vol. 26.—See also p. 264, of the same volume.—P. should address the Girard College, Philadelphia, Pa., where free technical education and maintenance is given to orphans.—J. W. W. will find the description of the fireless locomotive on p. 118, vol. 27. For a red indelible ink, see p. 129, vol. 28.—O. A. F. will find a description of blasting powder on p. 195, vol. 30.

E. K. W. B. says: 1. I have a barrel of molasses that was made from white corn which soured last summer from the effects of hot weather. Can it be put to any use? A. We know of none. 2. Can fish, such as herring, put up in oil in barrels, be of any use, as the fish and oil are dissolved together? A. The oil might be distilled off from them, and used for illuminating purposes.

A. N. asks: How can I kill birds, when caught alive, for preserving, without injuring their looks? A. By suffocating them in a closed box with a little burning sulphur.

T. P. D. asks: Can zinc be plated with brass without a battery? A. We know of no such process.

R. C. C. asks: How can I make artificial ivory? A. Make isinglass and brandy into a paste with eggshells very finely ground. Pour the paste into a mold, which must be well oiled, and leave in till dry. Collodion with oxide of zinc makes another form of artificial ivory.

E. S. asks: How is percussion priming for gun caps made? A. The fulminate of mercury is generally used for this purpose. It is made as follows: 25 grains of mercury are weighed out and put in a half pint pipkin and ½ oz nitric acid, of specific gravity 1·42, is added, and a gentle heat applied. When the mercury is dissolved, hold the pipkin at arm's length and put in quickly 5 drams by measure of alcohol of specific gravity 0·87. When the heavy white cloud which arises has ceased to form, fill up with water, allow the fulminate to settle, and pour off the liquid acid. Collect the residue on a filter and wash till the water no longer tastes acid. This should be taken when it contains about 20 per cent water, and mixed with 2-5 its weight of niter, on a marble surface with a wooden muller. A little of this paste should be put in each cap, and a thin coat of varnish put in to keep the fulminate from moisture.

C. L. W. asks: Which are the largest and purest diamonds known? What are their weights in carats? Is the Koh-I-Noor the largest known diamond? A. The largest are the Pitt diamond (now in France) weighing 410 carats when uncut, 136 cut; the Koh-I-Noor (in England) weighing 186 carats before it was recut; a very large one in Borneo, said to weigh 367 carats; and the enormous stone belonging to the Portuguese crown jewels, but there are doubts as to its genuineness, no one being allowed to see it. It is reported to weigh 420 grains. The Koh-I-Noor is, we believe, the purest of these gems.

W. H. says: Mr. Editor, Please send me A receipt to make Stove and boot blacking I want to make it during Vacation of school if I make any money I will pay you or make you a present. P. S. I am 8 going on 9 years old. A. For stove blacking, use plumbago. For boot blacking, take 1 part ivory black, ½ part molasses, ½ part sweet oil, ½ part hydrochloric acid. Dilute each ingredient with three times its water before mixing.

W. H. C asks: 1. What are the best dryers for paint? Are litharge and sugar of lead good? A. Those named are excellent. 2. I used litharge and sugar of lead, and it ran into very hard lumps in the paint, and effervesced for a length of time. What was the reason? Probably they were not properly made, and sufficient care was not used in mixing. 3. What is the most durable paint for galvanized iron for inside work? A. Use the ordinary paints.

J. P. G. asks: 1. What are the mechanical difficulties in constructing an achromatic lens? A. In so grinding the surfaces of the simple lenses, by whose combination an achromatic is produced, as to cause a perfect union of the rays of different refrangibilities, and produce white light. 2. Where can the flint and crown glass, suitable for a lens 8 or 10 inches in diameter, be obtained, and what would be the probable cost? A. From Alvan Clark, of Cambridge, Mass. 3. Must a lens to be correct be ground to a perfect curve, that is, a segment of a circle? A. The curvature must be perfect. 4. How long should the focus of an 8 inch achromatic lens be? A. This would depend upon the material and form of the parts of the lens. 5. If I strike a circle, 10 feet in diameter, and take a portion, 8 inches from the side of the line, to represent the lens, would a line drawn from the edges of this to the center of the large circle be the focus of this lens, or would it reach the opposite side of the circle? A. At neither point.

J. L. S. asks: 1. What will make soft water hard? A. Lime. It will render the water not palatable. 2. What shall I use to destroy the solvent properties of water? A. Solvent powers cannot be destroyed. Some other less powerful solvent must be used. 3. Can you tell me what chemical substance I shall inject into a tree, to destroy it at this time of the year? A. A solution of chloride of zinc.

W. G. B. says: It is said that the method of refining gold, now used at the United States mint, is a Chinese secret for which the government has paid a sum with the understanding that it shall not be divulged to any one but the refiner at the mint. Is there any truth in the assertion? A. We believe not.

R. B. R. asks: 1. To whom and how does the Agricultural Department distribute seeds and bulbs? A. It distributes them when a written application is made in proper form. 2. I have a red scar on my cheek caused by a wound. Can the red color be removed? A. We think not. 3. What is cryolite used for? A. For the manufacture of caustic soda, of alum, and of cryolite glass or hot cast porcelain, which is composed of silica, 67·19, cryolite, 23·84, and oxide of zinc 8·97 per cent. 4. Will ink mold quicker in one kind of a bottle than in another? A. No.

J. W. asks: 1. How can I make an electric machine so that the armature can be kept in constant motion when the current of electricity is on, so that it will ring a bell, like a burglar alarm? A. By using a mercury interrupter such as is employed in an induction coil. 2. How is dualin made? A. Dualin is a mixture of nitro-glycerin with sawdust or wood pulp, as used in paper mills, both previously treated with nitric and sulphuric acids. 3. What makes the strongest battery? A. A compound battery in which nitric acid is used with a platinum plate in the inner porous cell, and dilute sulphuric acid with a plate of zinc in the outer cell.

P. J. B. asks: How can scrap paper or rags be reduced to a pulp for the manufacture of paper? A. The process is as follows: 1. Cutting the rags by knives suitably arranged in a machine. 2. Cleansing them from dust and other impurities by a sifting machine. 3. Boiling with an alkaline lye or solution of 4 to 10 lbs. of carbonate of soda, with one third of quicklime to 100 of the material.

H. O. P. asks: Why is it that heat from the sun in passing through glass will warm a person, but does not heat the glass? A. Because glass is diathermanous, or allows the rays of heat to pass freely through it, just as it is transparent, and allows the rays of light to pass through it. It does, however, arrest some of the heat, and is proportionately warmed.

T. S. asks: 1. Will a magnet lose its power if kept near a piece of steel, say within about one sixteenth of an inch? A. No. 2. When a magnet loses its power, how can it be charged? A. By rubbing it with another magnet, or by placing it in the axis of a helix through which a galvanic current is passing. 3. What is the best non-conductor to place between a magnet and a piece of steel? A. A short interval of space.

R. S. H. asks: Why does not the secondary current from an induction coil magnetize? A. The secondary current is transient, and is itself in part derived from the magnetization of temporary magnets.

R. E. W. asks: How can I construct an oxyhydrogen microscope? A. By using a calcium light in front of a series of condensing lenses, which will converge the light upon the object placed nearly in their focus, and supported upon the stage of a microscope. The light and condensing lenses in this case take the place of the illuminating mirror in an ordinary microscope. The image is projected by a suitable objective moved by a rack and pinion, the tube of the microscope and the eyepiece being left off.

W. H. B. asks: Is there any kind of solution by which wool and woolens may be bleached by putting them through a bath, as well as in the ordinary way of bleaching with fumes of burning brimstone? A. Yes, by means of chlorine.

M. M. asks: 1. Is there any gas that I can substitute for coal gas in a chemical laboratory? A. Not conveniently or economically. 2. Can I use hydrogen? A. Not for general purposes. 3. Is there a safe way of making a good gas out of petroleum? A. Your best plan would be to purchase one of the numerous forms of machines already made for this purpose. 4. Will commercial zinc do for a Bunsen battery? A. Yes. 5. Could I make coal gas answer my purpose? A. Coal gas is universally employed in laboratories. 5. What would the apparatus cost? A. No estimate could be given until the quantity of gas desired is known.

G. G. asks: Can you give me a good recipe for invisible ink? A. Ink made of a weak infusion of nut galls will be invisible until it is moistened with a solution of sulphate of iron. You will find information about your questions on electricity in Noad's "Text Book of Electricity." Dussauce's "Practical Guide fo the Perfumer" will give you information in regard the other questions.

E. D. E. asks: 1. Has the government or any society offered a premium for making a try square that will square a block perfectly? A. No. 2. Does the earth turn on its axis 365 times in 365 days? A friend of mine says it only turns 364 times. Which is right? A. The solar or apparent day is the time of one revolution of the earth on its axis. Solar days are of different lengths, sometimes longer and sometimes shorter than the civil day. Hence, while the earth would make 355 revolutions in 365 solar days, it might lack a little of having completed its 365th revolution in 365 civil days. You can readily determine whether this will happen in any particular period by consulting the *Nautical Almanac*.

M. B. says: It has been stated that 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 furnished by the escape of the electricity. Is not this a conclusive proof that electricity is matter in actual movement, and not a mere vibration of the adjoining particles of matter which do not move from their places? For example, would it be possible to blow out a light by placing it alongside of a row of adjoining balls and then striking the ball at the extremity of the row? A. It is not the motion electricity that blows out the candle; but electric repulsion being produced in successive particles of air by contact with the point, they make a draft in moving away. The nature of the electric force is no more involved in the mechanical result of its action than is that of gravitation in making a body fall or heat in running a steamboat.

C. B. A. asks: 1. How is the expansion and contraction provided for in the great bridge at St. Louis? A. We do not think that any provision is made. 2. Will wire rope work in pulleys subjected to heavy pressure, and stand the wear and tear better than common seagrass cable? A. Yes, if the pulleys are properly turned. 3. What power does it take to cut 1¼ inches plate iron with shears? A. To find the pressure required for shearing wrought iron in pounds, multiply 50,000 by the thickness of the plate and this product by the length to be sheared, both dimensions being expressed in inches.

L. S. P. asks: 1. Is there any longer a question as to the theory of the earth's internal heat? A. The evidence as to the internal heat of the earth is everywhere accepted as conclusive. 2. Does hydrostatic pressure in artesian wells depend on the degree of heat found in them? A. No.

K. asks: Is there such a thing as a fixed unit of time in music? A. No. The metronome numbers now affixed to classical music are attempts to establish such a standard, but the speed at which music is performed must vary with different conductors, and even with the same conductor at different times.

C. F. asks: 1. What is Draper's process for silvering glass? A. A solution of nitrate of silver and Rochelle salts is applied to the glass, a film of metallic silver being deposited. 2. Does it give a perfect reflecting surface as seen through glass, as well as on its exterior surface? A. Yes.

J. P. asks: How can I make yeast? A. Take 6 ozs. hops, 3 gallons water. Simmer, strain, and (in 10 minutes) stir in 2 gallons ground malt; then reboil the hops in water, as before, and let the strained liquor run into the first mash, stir up, cover, and leave for 4 hours. Drain off the wort, and, when the temperature has fallen to 90° Fah., put in 1 pint of yeast, and stand for 24 hours in a warm place. Take off the scum and strain through a sieve.

G. B. asks: 1. What form of battery is considered the best and is most used by the great telegraph companies and others in large numbers? A Grove's and Daniell's. 2. Which is most used by electroplaters? A. Smee's.

J. D. D. asks: Having an engine that runs our nail factory and will not run up to the speed with less than 90 lbs. to the inch, if we speed our engine at one fourth, maintaining the same speed to our factory as before, can we run with less pressure? If so, how much? A. You can run with less pressure, in all probability, but you do not send enough data to enable us to determine how much.

H. G. says: 1. I have been trying to make some violet ink from aniline, but I cannot get rid of the bronze which appears upon the pens or upon the inkstand. It appears to crystallize, forming a bronze color when dry. Can you tell me how to destroy the bronze without injury to the color itself? A. No. 2. Can you recommend some good work upon anilines? A. "On Aniline and its Derivatives," by M. Reimann.

N. L. F. asks: With what velocity does air flow into a vacuum? A. About 1,300 feet per second. Send a list of the back numbers you require.

T. asks: Why is there so much more difficulty in keeping the fire going when the sun shines on the stove than when the window is darkened with a blind? A. You are mistaken if you suppose that the darkening of the window makes a difference.

H. asks: How can I make objects in telescopic vision look right side up? If I put in another lens of the same size and focus (size 1¼ inches diameter and 48 inches focus) where in the tube should it be placed? A. See Dick's "Practical Astronomer."

J. R. M. Jr. asks: What is the cost for an object glass for a telescope and eyepiece, the object glass to be 3 or 4 inches in diameter? A. Relative prices of the best American objectives are 3 inch, $40, 4 inch, $107, 5 inch, $200, 6 inch, $350.

G. N. L. says: I wish to construct a transit for obtaining the time of day at noon on a new plan; and if I can obtain in New York what I want for the purpose, I think I can succeed. I want a concave reflecting lens of about 12 to 15 feet focus, and about 2 inches in diameter. I think a glass slightly concave on one side and convex on the other, silvered like a looking glass on the convex side, would answer my purpose. I propose to mount that on bearings perfectly level, and have the sun's rays strike the concave side of the glass and throw an image of the sun on a black object (like rubber) with 5 parallel lines directly south of the lens. I propose to do away with the tube, and, by increasing the focal distance, make a large disk discernible at the focal point. What do you think of the plan? A. Your proposed reflecting sundial would be cheap, but inferior to a home made transit.

E. E. asks: Is there any evidence of the horse being aboriginal on the North American continent? Have its fossil remains ever been found, and if so, where? A. Although it is certain that the horse was extinct when North America was discovered by Europeans, it is certain that the animal inhabited this country during the post-pliocene period, contemporaneously with the mastodon and megalonyx. Fossil remains, chiefly molar teeth, have been frequently found, especially in the Southern States.

A. M. Z. asks: Do you know of anything that will prevent the leaves of a scrap book from curling, after an article has been glued or pasted on. A. There should be no curling if the book is put under pressure immediately after the pasting.

E. H. S. asks: Do you know of any good composition, or liquid substance, for dipping or washing coiled steel springs, that will make a thin, dry surface, not sticky, and that will prevent rusting as long as the spring shall last? A. A wash of copper may answer.

W. J. D. asks: To run a Woodworth planer (to plane and match 12 inches wide) and a 12 inch saw, how large an engine will be required? A. These questions are rather indefinite; but for ordinary work, an engine capable of developing from four to five horse power of useful work will answer.

B. asks: Why is it that wood, well glued together, is stronger at the joints than at any other part? A. Because the glue is stronger than the wood.

L. C. M. asks: 1. At what part of a steam boiler is the pressure the greatest? On the bottom, owing to the weight of the water, or is it equal at every part of the boiler? A. Greatest at the bottom. 2. What is the rule for determining the length and breadth of the ports of the steam chest of a steam engine, when we know the area? A. Generally it is best to make the port as long as possible. Having fixed upon the length, divide the area by the quantity, and the quotient will be the width.

H. C. says: In a 10 horse power threshing engine, the valve rod was bent by some accident which broke the outside part of the eccentric; a new piece was procured, and the new valve adjusted by a good mechanic of several years' experience. The engine is controlled by a steam rod raising and lowering the governor stem. When steam is shut off (in gigging back, rolling on logs, etc.), the engine runs spasmodically, alternately fast and slow, doing this most when steam is low, the spasms being at longer intervals and of greater violence. When a good head of steam is on, they are closer together, and the difference in speed is not so great. Can you account for it? A. We can seldom give anything but a guess about cases of this kind, as personal examination is generally necessary. We think the trouble may be in some of the connections of the governor, which stick at certain positions of the balls.

G. C. B. asks: 1. How can a cast iron kettle, badly cracked at bottom, be mended? Patching with boiler iron will not do, owing to unequal expansion. A. Castings are sometimes mended by burning the parts together. 2. Would the boiler of a 5 horse power horizontal portable engine, of the locomotive pattern, be large enough to bring 3 barrels water from 60° to 212° in 1 hour, the steam escaping into the water through perforated pipe? A. Yes, if the boiler can be worked up to the power stated. 3. Would it be consistent with economy, and quicker, in making soda crystals, to lead an electric current through the concentrated clear solution of soda ash? A. Probably not. 4. What is the lowest density of solution at which soda will crystallize at temperatures of 32° and 90°? A. From 30° to 32° Baumé. 5. In your No. 7, current volume, sulphide of cadmium is mentioned as a good material for coloring soap; what color would it give? A. Yellow. 6. Can I make a lighter colored soap by boiling in it a small quantity of oxalic acid, or would the caustic lye neutralize the bleaching effects of the acid? A. Try the experiment.

L. H. B. asks: 1. Will a round chimney, 36 inches in diameter inside, give as good draft as a square chimney 3 feet square? I am told that, in a square chimney, the corners are not utilized. A. Probably not. There does not seem to be much difference in the draft of chimneys having the same cross section, whether round or square. 2. I have an engine with two cylinders 2 inches in diameter x3 inches stroke. What size shall I make a copper boiler to generate steam to run it to its full capacity, heated by spirit lamps? What is the proper thickness for the copper? A. Allow from 20 to 25 square feet of heating surface per horse power.

J. W. A. says: I have a spring distant from my house about 600 feet, and about 90 feet lower, on a gradual descent. The spring furnishes water to fill an inch pipe, with about 6 feet fall in 150 feet. Can any means be devised to carry the water to the house other than a ram, for which I think the flow of water is not sufficient? A. If a ram will not answer, you probably cannot employ any hydraulic motor.

C. O. W. asks: How much can air be compressed? If I take a body of air, say 10 cubic feet, to how small a body will this have to be compressed in order to get 100, 500, and 1,000 lbs. pressure to the square inch, respectively? A. If the temperature is kept constant during the compression, the pressure will vary inversely as the volume, so that the volumes at the pressures mentioned will be: At 100 lbs. pressure, 1½ cubic feet; at 500 lbs., $\frac{3}{10}$ of a cubic foot; at 1,000 lbs., $\frac{3}{20}$ of a cubic foot.

R. L. M. asks: What are the relative heating powers of wood (oak, ash, and hickory) and bituminous coal? How many lbs. of coal will generate the same amount of heat as a cord of wood, in approximate figures? A. A ton of coal is equal to from 1½ to 2 cords of wood.

W. L. B. & S. asks: How can we build a furnace for burning coal under a plain cylinder steam boiler, 30 inches diameter x 10 feet long? The stack is already built, and is about 30 feet high. Size inside, 14x 16 inches. A. Set it in brickwork, with the flue running the whole length underneath, the grate surface being from 7 to 10 square feet.

E. F. U. asks: What weight is there on the hangers of steam boilers in addition to the weight of cold water, when the gage indicates 75 lbs. per square inch steam pressure? For instance, boilers are two thirds filled with cold water, fires are kindled till 75 lbs. pressure is obtained; is the strain then any greater on the hangers by which the boilers are suspended than before? A. The contents of the boiler do not weigh any more when steam is raised than before.

S. L. M. asks: How many cubic feet of heating surface are there to a boiler of one horse power? A. An ordinary allowance is from 12 to 15 square (not cubic) feet per horse power.

J. A. S. asks: How much more back pressure is there in the rotary engine than in the ordinary reciprocating engine? In your opinion, would such an engine, with an adjustable cut-off (by the governor), be practicable, and would it use steam economically? A. We have seen no account of experiments that will enable us to answer these questions.

G. C. P. says: 1. In a quartz mill, we run in the daytime only. Recently, when I stopped the engine, I opened the pet cocks at each end of the cylinder as usual. I saw a stream of electricity coming out of the pet cock with the steam. What was the cause of it? I have tried it over again with the same result. A. It is due to friction. 2. I have some gold that has a coating of sulphur on it; the gold is very fine dust. What chemical can I soak it in to destroy the sulphur? A. Heat it in a retort. 3. Is there anything that I can add to water so as to cause a substance of the specific gravity of 4 to sink, and allow one of a specific gravity of 2·5 to swim? A. We do not know of any.

J. H. asks: 1. How can I tune up an E flat piccolo which is a little flat, the tuning cork being in all the way? A. Get a longer cork made, or put a piece of sole leather on the old one. 2. What can I pad the keys with? A. Chamois leather.

J. H. L. asks: What is the difference between a relay magnet and a sounder magnet? How can I make a relay magnet? What size of wire shall I use? A. A relay is an instrument which receives the circuit current, and brings a local battery into play. You will find the needed information about different forms in Noad's "Text Book of Electricity."

E. says: 1. Will it add to the power of a cheap telescope (p. 7, vol. 30) to increase the diameter of the object glass, say to 2 inches? If so, of what focus ought it to be? A. A non-achromatic object glass of two inches aperture must be of over 10 feet focus; eyeglass, 1·88 inches focus; power 63. (Huyghens). Achromatic lenses are now made so cheaply that a five dollar spyglass should give a good view of the moon, planets, and wide double stars. 2. Would it do to use a compound eyepiece (one composed of 4 glasses) for the eyepiece of such a telescope? A. Yes; for star-gazing the two front lenses of the erecting eyepiece should be removed. 3. If used as a spyglass, of what power would it be? A. The magnifying power is found by dividing the focal distance of the object glass by that of the ocular. 4. Would it diminish the power to use a concave glass for the eyepiece, so as to show an object right side up? A. Yes.

J. asks: How can I put the wavy appearance on a nickel top plate for an American watch movement? A. By polishing with a fine oil stone. There are also machines for the purpose.

H. D. M. asks: 1. In canning maple sirup what shall I put in to prevent it from crystallizing? A. If properly prepared, it will contain sufficient water to prevent crystallization. 2. What solution shall I use for a bath in nickel plating? A. The double sulphate of nickel and ammonium. 3. How shall I clean surfaces for electroplating? A. In a weak solution of acid. 4. I have telegraph wires running from dwelling house to office. I use a very weak battery. The wires are well insulated. I oftentimes hear the instrument click when there is no one near to break the circuit. A. It is due to atmospheric disturbances, strong enough to overcome the power of your battery.

E. G. says: Suppose a fore bay to be 20 feet wide, 21 feet long, with any depth; the breast fronts on a pond extending back or up a creek; is there any difference between the pressure on the breast and side, or is the pressure equal on each side and the breast? A. The pressure per unit of surface is the same on breast and sides, and will be the same, whatever the size of the pond may be, provided the water level is maintained.

H. C. N. asks: 1. What causes the Indian summer? A. It would probably be difficult to assign any reason. 2. Is glycerin soap good for the complexion, and is there anything better? A. We suppose it is as good as any soap. 3. Is bathing the face in milk good to smooth the complexion? A. It is generally so considered. 4. What will remove black worms from the face? A. Purification of the blood. 5. What is the longest lived animal? A. Among fishes the whale, of reptiles the tortoise, and of quadrupeds the elephant. 6. How can I make good sand soap for the hands? A. Take old yellow soap 2 parts, silver sand 1 part, scent to taste. Melt the soap and mix in the sand, afterwards adding the scent, and make into balls.

G. B. asks: 1. What weight will a rope, 1½ inches in diameter, bear, supposing one end to be fastened to a girder, and the weight hung on the other end? A. Between 9,000 and 10,000 lbs. 2. If we have a pulley block suspended to a girder above, with three sheaves in the block, and the lower block with two sheaves, which of course would require five spans of rope to reeve the blocks, should we have the strength of five ropes, or three only? A. Disregarding friction and the rigidity of cordage, the relation of power to weight in such a system is as 1 to 5, so that the tension of the rope will be 1-5 of the weight.

W. D. B. asks: 1. How is a belt laced with two rows of holes? A. A good plan is to commence at each side simultaneously, first lacing through the inner rows of holes, either singly or doubly, and then through the outer. 2. What is the cause of kerosene coming out on the outside of lamps when they are not full, and what will remedy it? A. We did not know that this ever happened.

H. W. H. asks: 1. How is artificial blood for stage use prepared? A. By mixing rouge and water. 2. What is the enclosed? It is used, combined with bisulphuret of carbon, as shoemaker's glue, for patching without stitches. A. The substance enclosed consists of gutta percha. 3. Is there any book on practical pharmaceutical manipulation? A. Consult the catalogue of a publisher of medical works. 4. Can a competent person pass an examination and receive a diploma as graduate in pharmacy without attending lectures? A. We hardly believe it possible, if the institution is first class.

G. & G. ask: 1. Is there a steam crosscutting machine for crosscutting logs in the woods, light enough to draw from tree to tree? A. Yes. 2. What would be the necessary boiler room for a 4 inch cylinder with 12 inches stroke, ½ cut-off, working at 50 lbs. pressure, and 200 revolutions per minute. A. There is no settled rule, applicable to such small engines.

A. Y. M. asks: 1. What makes a good cement to stop water from running out between smoke stack and smoke arch? A. A strong hydraulic cement may answer. 2. What would be a good substitute for a safety plug in crown sheet? Could a wooden plug be used for a short time? A. It would not be very reliable. 3. Does the main pin on a locomotive wear round or flat? A. Generally the effect of wear is to give the pin an oval shape.

J. B. asks: Is there any way of finding the number of yards in a rolled piece of goods without unrolling it? A. It might be determined, approximately, by weighing a yard of the material used, and then the whole bundle.

J. C. S. asks: What is good to put in a boiler to keep the water from foaming? The water is hard. A. Tallow has been recommended.

J. C. asks: 1. What is required of a machine, to be a veritable perpetual motion? A. It must be one which works without the application of any external force. 2. I have a machine which runs constantly without stopping, has the power to drive a sewing machine, and is set in motion by cold (not running) water. What do you think of it? A. We cannot form any opinion from this description.

W. G. B. asks: 1. Is there any method by which lime can be burned with crude petroleum? A. We have not heard of any such process. 2. Would a barrel of petroleum equal a cord of wood if perfect combustion is kept up? Will it require a blower? A. The total heat of combustion of a pound of petroleum is equal to between two and three pounds of that of dry wood. We do not think that a blower would be necessary.

M. F. C. says: I have a fine pair of tweezers that by accident came in contact with a magnet and are unfit for use. What can I do to remove the magnetism from the tweezers? A. Apply to them a strong magnet in reverse of polarity.

H. J. M. replies to the many correspondents who ask for a paste that will fasten paper to bright tin: A. Take 2 lbs. flour, 1 quart water, 2 ozs. tartaric acid, 1 pint sirup molasses; boil together until stiff.

N. L. says, in reply to A. G. C., who asked how to temper taps: Polish the tap bright, and hold in the center of a red hot pinion or other piece of iron with a hole in it, without touching. By this means you can obtain any desired color.

L. B. says, in reply to A. McR.: The press for copying letters by pressure between moist sheets was first used by Murdoch, assistant to James Watt and the first user of coal gas for illumination.

W. says, in reply to H. N. who enquires about teaching parrots to talk: Perhaps H. N. would be glad to know that bird fanciers teach birds to repeat various words and phrases by waking them up in the middle of the night and repeating to them the words they wish them to learn, two or three times over, and then leaving them perfectly quiet. I have been informed that this method is practiced by many bird fanciers.

J. O. S. says, in reply to C. H. F., who asks why, in his base burning stove, a substance continually drips from the horizontal pipe, and asks what it is: I have had the same trouble, but always in stoves that had no feeders. I have found the same results with both wood and soft coal; I have had no experience with hard coal. In each case the stoves burnt with slow combustion, and but little heat passed up the pipe. In some cases I have found the cause to be a weak draft, occasioned by other stoves leading to the same flue. In others, by the cold air of the room coming in contact with the exterior surface of the pipe, thereby cooling it and causing the moisture in the smoke to condense and form a watery substance, referred to above. I have overcome the difficulty in two ways; first, by putting up the pipe in the reverse way, so that the drippings would continue to flow until they found their way on to the stove where the heated plates immediately dry the moisture. This I have done in churches and halls where long pipes were used. In other cases I have enclosed the smoke pipe with a tin jacket, thereby protecting it from cold air.

S. says, in answer to W. D., who asked: Which is the deepest artesian well in the world? We have an artesian well in St. Louis nearly or quite 2,600 feet deep, from which flows a clear stream of white sulphur water, at a temperature of 70° Fah.

C. L. F. says, in reply to W. P. S. P., who asked: If the foundation of the centennial tower should give way ¼ of an inch on one side, how much would the top of the tower move? It would swing 6 inches from its original position.

C. L. F. says, in reply to W. H. D., who asked how much of the earth's surface could a person have in view from the top of a tower 400 feet high: 2,039·248 square miles. The distance from the outer edge of the field of view to the top of the tower in a straight line would be 24·4987 miles.

C. A. N. asks: 1. What is the best mode of preparing and covering wooden wheels with emery? A. Cover them with glue. We think, however, that solid emery wheels will be quite as cheap, and far more satisfactory. 2. What kind or number of emery is best suited for grinding carving and similar knives, and for finishing the same? A. You can obtain full information from a dealer.

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

J. P. G.—The rock is bituminous shale.

F. C. S.—Your specimen is gypsum; on burning, it is converted into plaster of Paris.

E. D. L. asks: Is there any material that can be mixed with fire clay to prevent its cracking, when applied to an oven?—J. W. G. asks: What is the greatest depth below the earth's surface ever reached, and where is it?—H. C. R. asks: Can any one give me a plan for making an apron for a double-ended ferry boat?—R. J. asks: What are the ingredients and *modus operandi* of making candy of white sugar?—S. G. N. asks: Is there any plan, either by packing in dry sand or otherwise, by which lemons, oranges, and peaches may be kept for any length of time, especially in warm weather—J. H. P. says: Astronomers tell us that the earth for ages past has been gradually cooling, but the glacial theory necessitates the belief that the earth was once much colder than it is at present. Has any attempt been made to reconcile the two theories?—R. H. F. asks: How can I test squares with the dividers, to tell whether the angles are 90° or not?

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 Crotched Stick for Detecting Water and the Precious Metals. By J. H., and by H. B. M.

On Ventilation. By J. R. L.

On Oiling Safe Locks. By J. S. G.

On Kepler's Third Law. By G. B. G.

On Canada Thistles. By P. E.

On a Theoretical Perpetual Motion. By L. L.

On Ventilation. By C. G. V. P., and by J.

On the Vital Principle, and on a Mathematical Formula. By J. B.

On a Rat Trap. By J. H. P.

On Wheat Growing in Minnesota, etc. By ——.

On a Waterproof Dress. By J. P.

On an Improvement in Spectacles. By G. V.

On the Wear of Journal Boxes. By C. D. S.

On Nerve Force. By I. R.

On the Pons Asinorum. By F. S.

On the Beech Blight. By C. G. C.

Also enquiries and answers from the following:

C. W. P.—S.—B. D. L.—S. W.—O.—J. A. M.—X. Z.—D. B. W.—F. W. S.—J. H. P.—J. T.—R. E. G.—E. P. L.—E. W.—W. H. N.

Correspondents in different parts of the country ask: Who makes a mud digger, to be used in shallow water? Who makes garden seed sowers? Who makes pill box and match box machinery? Who sells small portable forges? Who furnishes feather renovators, and at what price? Who makes machines for cutting veneers from the round log? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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

[OFFICIAL.]

Index of Inventions

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Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

March 10, 1874,

AND EACH BEARING THAT DATE.

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Whiffletree, G. R. Edwards	148,423
Wood polishing machine, J. C. Fish	148,437
Yarn spool guide, Draper & Bancroft	148,287

APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

28,644.—Pump.—N. S. Bean. May 27.
28,670.—Railroad Brake.—N. Hodge. May 27.
28,537.—Fog Alarm.—C. L. Daboll. June 10.

EXTENSIONS GRANTED.

27,458.—Black Washing Molds.—W. Ferguson *et al.*
27,438.—Timber Bending Chain.—L. Heywood.
27,456.—Covering Skirt Springs.—J. T. Loft.
27,473.—Turning Lathe.—W. Sellers.
27,485.—Lantern.—A. Tufts.

DESIGNS PATENTED.

7,233.—Burial Case.—G. Albin *et al.*, Cincinnati, Ohio.
7,234.—Sleigh-Bell Strap.—W. E. Barton, East Hampton, Conn.
7,235.—Soap Cake.—J. Burns, New York city, *et al.*
7,236.—Shutter Fastener.—C. B. Clark, Buffalo, N. Y.
7,237.—Blind Hinge.—C. B. Clark, Buffalo, N. Y.
7,238.—Gate Hinge.—C. B. Clark, Buffalo, N.Y.
7,239 & 7,240.—Types.—H. Ilenburg, New York city.
7,241.—Tumbler.—S. McKee, Pittsburgh, Pa.
7,242.—Types.—E. C. Ruthven, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,661.—Tomatoes.—Anderson *et al.*, Camden, N. J.
1,662.—Fruits, etc.—Anderson *et al.*, Camden, N. J.
1,663.—Glassware.—R. Douglas & Co., New York city.
1,664.—Whiskies.—Friebery *et al.*, Cincinnati, Ohio.
1,665.—China, etc.—W. Grange & Co., Philadelphia, Pa.
1,666.—Shirts.—Marley & Co., Newark, N. J.
1,667 & 1,668.—Kid Gloves.—E. Ridley & Son, N. Y. city.
1,669.—Medicine.—M. A. Simmons, Iuka, Miss.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
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On application for Design (14 years)	$30

CANADIAN PATENTS.

List of Patents Granted in Canada, March 12, 1874.

3,187.—I. M. Rose, Brookhaven, Suffolk county, N. Y. U. S. Improvements on embroidering attachments for sewing machines, called "Rose's Improved Embroidering Attachment." March 12, 1874.

3,188.—William Beeman, Selby, Lennox and Addington county, Ont. Improvements on farm and garden fences, called "Beeman's Portable Fence." March 12, 1874.

3,189.—J. H. Livingston, New York city, U.S. Improvements in the process of making cheese, called "Livingston's Cream Cheese." March 12, 1874.

3,190.—V. H. Felt, Brantford, Brant county, Ont. Improvements on self rakes attachable to reaping machines, called "Felt's Self Rake." March 12, 1874.

3,191.—A. Soper, New York city, U.S. Improvements on a machine for drying grain, called "Soper's Grain Dryer." March 12, 1874.

3,192.—P. Brotherhood, No. 15 Elgin Road, Notting Hill, Middlesex county, England. Improvements on triple cylinder engines and pumps, called "Brotherhood's Triple Cylinder Engine and pump." March 12, 1874.

3,193.—G. Booth, Toronto, Ont. Improvements on fire extinguishers, called "Booth's Improved Fire Extinguisher." March 12, 1874.

3,194.—R. M. Wanzer, Hamilton, Ont., assignee of T. Hall, Northampton, Hampshire county, Mass., U. S. Improvements on sewing machines, called "Hall & Wanzer's Improved Sewing Machine." March 12, 1874.

3,195.—J. S. Tibbets, Jeffersonville, Clarke county, Indiana, U. S. Improvements on fire extinguishers, called "Peerless Fire Extinguishers." March 12, 1874.

3,196.—P. D. Roddey, New York city, U. S., assignee of W. F. J. Thiers, same place. Improvements on system and apparatus for ventilating and pumping vessels, and sounding fog and other alarms, called "Thier's Automatic Ship Ventilator, Fog Alarm, and Bilge Pump." March 12, 1874.

3,197.—E. Dégagné, Quebec, P. Q., and P. Brousseau, same place. Manière nouvelle et utile de faire les moppes au lavettes, nommée "Lavettes Prosper." March 12, 1874. New and useful mode of making mops.

3,198.—N. A. Beack, T. N. Rider, and H. M. Rider, Stanstead, Stanstead county, P. Q. Improvement on tyre iron for wheels, called "Beach & Rider's Improved Tyre Iron." March 12, 1874.

3,199.—G. Macfarland, Toronto, Ont. Improvements in step ladder locks, called "Macfarland's Step Ladder Lock." March 12, 1874.

3,200.—T. Northey, Hamilton, Ont. Improvement in coal cooking stoves, called "Northey's Improved Dampers for Cooking Stoves." March 12, 1874.

3,201.—I. J. Mervesp, Dobbs Ferry, Westchester county, N. Y., U. S. Improvements on horse shoes, called "Mervesp's Improvement in Horse Shoes." March 12, 1874.

3,202.—I. Arnold and J. C. Bates, Scott Township, Ontario county, Ont. Improvement in the ball and socket joint, called "Arnold & Bates's Ball and Socket Joint." March 12, 1874.

3,203.—I. Y. Smith, Pittsburgh, Alleghany county, Pa. U. S. Improvements on air ejectors, called "The Steam Condensing Air Ejector." March 18, 1874.

3,204.—D. Bourgeois, Montreal, P. Q. "Nouvelles et utiles améliorations aux attachements de pompe pour pomper le sable, les graviers, etc., nommées "Attachements de Pompe pour Puiser du Sable, de David Bourgeois." (New and useful improvements to pump attachments for pumping sand, gravel, etc. March 18, 1874.

3,205.—T. Ruston, Montreal, P. Q. Improvements on paint oils, called "Ruston's Paint Oil." March 18, 1874.

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