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Scientific American

AN ILLUSTRATED
JOURNAL OF ART, SCIENCE & MECHANICS

Vol. XXXII.

NEW-YORK
PUBLISHED BY MUNN & CO.

Центральна Наукова
БІБЛІОТЕКА при ХДУ
Інв. № 110624

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XXXII.—No. 1. [NEW SERIES.] NEW YORK, JANUARY 2, 1875. [$3.20 per Annum, Postage prepaid.

IMPROVED PLANING AND MATCHING MACHINE.

The invention herewith illustrated belongs to the large and varied class of planing and matching machines, of which almost every wood-working shop of medium and even of small size has a representative tool. It presents the advantages of strength, compactness in form and design, and economy in room, power, and cost. It is adapted to plane and match hard or soft lumber up to 14 inches in width, and will surface 24 inches wide and up to 5 inches in thickness, by dropping the matcher shafts below the bed. There is a strong, heavy, and substantial frame. The bearings are perfectly fitted by scraping, and made of the best anti-friction metal, the latter compounded for the purpose by the manufacturers. The bearings also have self-oiling boxes, and the steps of the spindles are also self-lubricating.

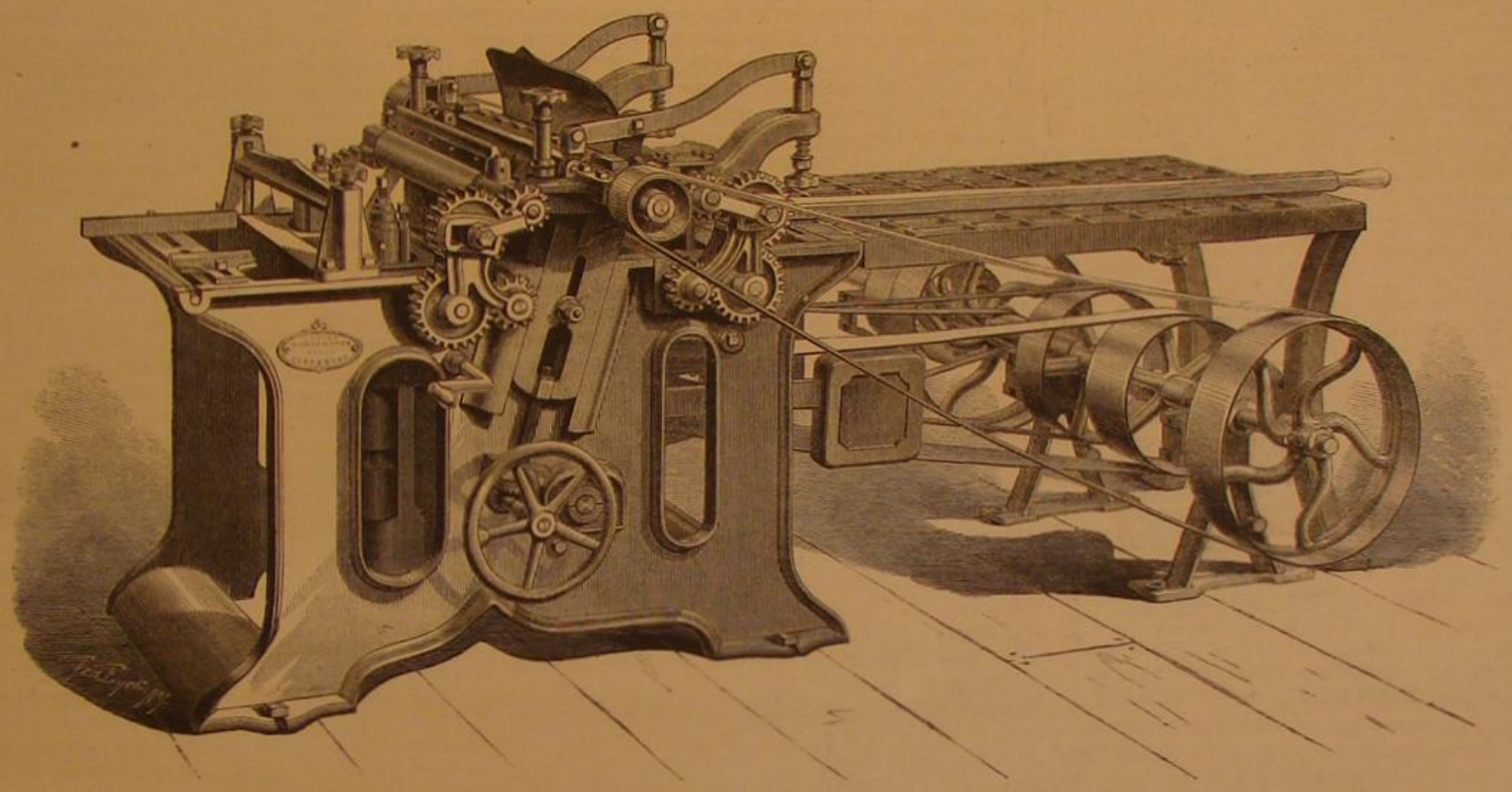
The cylinder cutter head is made triangular, of a peculiar form, and carries three knives. The last though straight, similar to those generally used, make a drawing cut, thereby insuring a very smooth surface even if the material be cross-grained or knotty. The cylinder has long steel journals, and on each end a driving pulley, and can be raised or lowered while in operation. Both cylinder and top rolls are raised and lowered together by one hand wheel, in planed ways at an angle, in order to keep the belt at the proper tension for any desired thickness of lumber.

The machine is furnished with a newly patented sectional chip breaker, and an adjustable pressure bar, which holds the lumber down so that, as nearly as possible, a uniform surface is presented to the revolving knives of the cutter. The one piece pressure bar, held by springs or weights, presses the material only along the whole line of cut or width, and rests upon salient points or elevations, without allowing for the warp or sinuosities of the timber. If it is required to press the material which is in wind in its whole width to the table, the driven roller in front of the chip breaker is brought down, but the chip breaker itself only sufficient to bring its parts in a perfect contact with the whole width of the material. Heretofore the pressure bar had to press very heavily on the work, which made it necessary to use much feeding power to overcome the resistance. The feed rolls are weighted and strongly geared.

The arrangement for changing from a matcher to a surfacer is very complete, and the adjustment can be made with facility. For surfacing wide lumber, the matcher spindle can be lowered out of the way by loosening the adjustable step and letting the top of the spindle slide below the table. One of the matcher spindles is adjustable by a crank wrench, while the other may be placed to suit the width and nature of the work.

A matcher clip is furnished for preventing splitting and tearing cross-grained lumber when matching, also a lever to hold the lumber to the guide when feeding the lumber in. The matcher heads are made of gun metal and provided with a full set of cutters. The feed of the machine can, on either side, be instantly started or stopped

The invention is covered by several patents secured through the Scientific American Patent Agency. For further particulars, address the manufacturers, Bentel, Margedant & Co., Hamilton, Ohio.



BENTEL, MARGEDANT & CO.'S PLANING AND MATCHING MACHINE.

Action of Magnets on Spectra.

M. Choquart, of the French Academy of Sciences, states that the effect of magnetic influence on the spectra of the flames of sulphur and selenium is to cause them to pale and finally to become quite extinguished. On the other hand, the same influence multiplies the rays and renders more brilliant the spectra of chlorine and bromine. The effect, says the investigator, is so rapid as to seem magical. The result of these discoveries is to render the deductions from the spectra of the heavenly bodies only to be accepted with great caution, as they virtually introduce a new element to be considered in drawing conclusions from the aspect of the same.

IMPROVED SHOT POUCH SLING.

Mr. William W. Kollock, of Augusta, Ga., has patented, through the Scientific American Patent Agency (November 17, 1874), a novel and simple shot pouch sling, by means of which the pouch may be conveniently carried in such a manner that it cannot become detached and lost, and so that it will always be in handy position for loading the gun.

The annexed engraving shows its arrangement. The strap which passes over the shoulders is made in two parts, buckled together so as to admit of adjusting. To the end is attached a ring strap of a size to fit around the smaller part of the pouch; and above, a larger ring strap is attached to encircle the corresponding portion of the flask. There are two straps more, one of which is secured to both ring straps at one side, terminating in a buckle at the upper strap; and the other is similarly attached, but passes up over the top of the pouch. The end is then fastened by the buckle just mentioned. The pouch thus held is prevented from being lost by the tearing off of the rings. The invention seems a useful one, and doubtless will meet with appreciation among sportsmen generally. For further particulars address Mr. E. M. Habershaw, or the inventor, as above.

The Stevens Battery.

A contemporary publishes the following list of offers for the Stevens battery, or for portions thereof, which was recently offered for sale on terms which we have already published:

T. F. Rowland, Brooklyn, N. Y. For the 15 lots, $80,000.

The Chief of Bureau of Construction and Repairs of United States Navy Department. For all the lots, $145,000. This bid was accompanied with a proviso that, if any foreign government offered more, with the intention of removing the ship from the United States, then the United States Navy Department would increase their bid so as to exceed any such offer, subject, however, to the approval of Congress, which would have to make an appropriation for that purpose.

John Roach, New York. For total lots, $105,000.

John Stewart, New York. For lots 14 and 15, $3,000.

H. McKay, No. 52 Broadway, New York. For total lots, $50,000.

J. H. Wiggins, New York. For total lots, $60,000.

John F. Feffenly, No. 533 Water street, New York. For lots 14 and 15, $4,500.

N. Lassar & Sons, Hoboken. For lots 14 and 15, $5,274, and for lot 1, which consists of the hull, $20 per tun for the scrap iron, and $2,600 for another lot.

A. Pervis & Son, Philadelphia. For lots 1 to 14, $52,000, and for lots 14 and 15, $52,000.

We have often read of the value of workmanship, and how raw material worth a few cents a pound may be, by skillful manipulation, changed into watch hair springs worth their weight in gold or microscope objectives more precious than diamonds; but here we see that, in the estimation of would-be purchasers, the value of a vessel that cost millions of dollars, expended with a vast amount of the highest engineering talent, is not over $145,000 in any case, unless some other government than our own wants it; and then the importance of the vast structure to our navy will be allowed to magnify the price indefinitely. Solomon said, ages ago: "It is nought, it is nought, saith the buyer; but when he hath gone his way, then he boasteth."

I. C. says: "A one-line advertisement in the SCIENTIFIC AMERICAN paid me fifty-three dollars and fifty cents."

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.....$3 20
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VOLUME XXXII., No. 1. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, JANUARY 2, 1875.

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THE VACUUM AN ABSOLUTE NON-CONDUCTOR OF ELECTRICITY.

The passage of electricity through rarefied air constitutes a well known experiment in the lecture room of physical science. The oldest style of performing it is to attach, by means of a stopcock connection, a long glass tube to the air pump, each end of the tube being provided with brass caps. The electricity may be made to flow through its interior as soon as the exhaustion of the air has proceeded to a certain extent; then a most beautiful exhibition is produced in the dark, resembling the aurora borealis; hence such a tube is called an aurora tube, and the aurora borealis has been ascribed to a discharge of electricity from the polar regions to the equator, through the stratum of rarefied air above the clouds. Another form of this experiment is the so-called electric egg, which differs from the preceding in nothing but that, in place of a long tube, an egg-shaped glass globe is employed, into which brass knobs or points project from both ends.

Lately this same experiment has been modified, so that the vessel filled with rarefied air is always ready for the experiment. Gassiot and Geissler first conceived the idea of manufacturing small and large glass tubes, melting pieces of platinum wire into their extremities, so as to introduce the electric current, exhausting the air in them to the proper degree, and then sealing them hermetically.

As it had been found that rarefied gases of different natures produce different colors of light in the dark when the electric current was passed through them, and later that different kinds of glass and liquids, when illuminated in this way, produced a great variety of effects (due to fluorescence), a very extensive assortment of these tubes was soon in the market; and they may now be bought, under the name of Geissler tubes, from the dealers of philosophical instruments in our large cities, at different prices, varying according to their size and the elaboration of their construction.

Experiments prove that electricity is retained on the surface of bodies by the presence of the atmosphere, which is an isolating substance; and that when its pressure decreases, the escape of electricity becomes easier; while, in a good vacuum, the resistance to escape becomes zero, and the electricity flows off and cannot be retained at all. This has for a long time been the accepted theory, and is still taught in most text books on physics, and is believed in by most electricians; but that it is an error was proved by Bécquérel, Hawksbee, Gray, and Snow Harris, as they showed that even the weakest electric discharges could be retained in vacuo. Bécquérel even went so far as to show that the charge was retained for fifteen days, provided that the vacuum was so perfect as to be equal to a mercurial pressure of one millimeter (the twenty-fifth part of an inch); and he concluded that, in a perfect vacuum, the body would retain the charge for ever: in other words, that electricity could not be transmitted through an absolute vacuum.

Du Moncel, in his lately published French work on the Ruhmkorff coil, gives an account of his experiments in passing a powerful electric current through a tube in which the air was being more and more rarefied, and states that, when the vacuum was made very nearly perfect by the continued operation of a good air pump, the passage of electricity through the tube continually diminished; so that at last, when the pressure had decreased to less than a half millimeter (one fiftieth of an inch), the light had almost disappeared, while tests proved that very little electricity passed; when, however, a little air was gradually admitted into the tube, the electric current was re-established, and the light appeared again.

Gassiot was the first who attempted to make an absolute vacuum, deprived of all traces of air or gas. He first made a barometer of the easily fusible alloy made of lead, tin, bismuth, and cadmium, which melts below 150° Fah., contains no mercury, and which would not contaminate the vacuum with mercurial vapors. He did not, however, succeed in this way, as the vacuum thus made always contained traces of air or gas. He tried then another method; he filled the vacuum with pure carbonic acid gas; and after exhausting by the air pump, he left the remnant to be absorbed by caustic potassa, which, by its well known great affinity for this gas, removed the last traces. He produced in this way a vacuum much more perfect than any one ever did before; while his manner of procedure allowed the experiment to be extended over several days, and even weeks. When the vacuum had been made with the air pump on carbonic acid, an electric discharge, which, in the air, would not pass over a distance of half an inch, traversed twenty inches with the greatest ease. In proportion as the vacuum became more perfect by the absorption of the carbonic acid, the discharge tended to fill the tube with a more and more pale luminous vapor. The vacuum becoming more perfect in the course of several days, the luminosity became confined to the sides, where the platinum wires, which conducted the electricity, entered into the vacuum; and a certain space, half way, became dark, and this darkness extended itself, so that, in a tube of twenty inches length, it occupied nearly ten inches. When a galvanometer was placed in the circuit, it indicated that there was no longer a constant discharge as before, but occasionally alternate discharges: when also the tube showed light flashes, and the so-called stratification of the light. When at last the absorption went on, and formed a perfect vacuum, perfect darkness was obtained in the tube, and no trace of light showed itself, even with strong electric charges, while neither the galvanometer nor an ordinary vacuum tube, when introduced into the circuit, would manifest a trace of any current, notwithstanding that this other ordinary vacuum tube showed luminosity with feeble currents. From all this, it is therefore evident that it is practically demonstrated that the absolute vacuum is not only a non-conductor, but that it is absolutely impenetrable by electric discharges.

De la Rive studied the phenomena observed. As soon as, during the attempts to pass the electric current, a small amount of gas is introduced, corresponding with a mercurial pressure of $\frac{1}{4}$ millimeter ($\frac{1}{100}$ inch), he found that the phenomena vary, according as the gas is admitted near the positive or the negative side; and he gives a very detailed description of the so-called stratification, the succession of colors, the rose-colored mist, etc., phenomena which are always repeated under the similar circumstances, depending, of course, upon certain laws governing the relation between the electric and luminous vibrations.

The writer of this article possesses a strong glass tube in which, after the method of Gassiot, the vacuum has been produced by the absorption of carbonic acid. The ends of the platinum wire intended to introduce the electric current are only one quarter inch distant from each other. But notwithstanding this short space, the strongest possible charge cannot be made to traverse this distance of vacuum, while the same charge will pass through a distance of six inches in common air, and of as many feet through a glass tube in which the air is rarefied. In the Stevens Institute, Hoboken, the experiment with a similar tube can be shown to any visitor, and excites the surprise of many who still persist in the faith in an electric fluid, notwithstanding they have abandoned the doctrine of a caloric fluid, being advanced enough in their ideas to be satisfied that heat is a mere mode of motion of ponderable matter.

Now the fact is that the whole science of thermotics cannot produce a single experiment upsetting the old doctrine of a caloric fluid, so conclusive as the experiment above described. Nobody has ever succeeded in producing an empty space or vacuum through which heat could not pass; but having done so for electricity, it proves conclusively that this subtle agent cannot be of the nature of a fluid, as a fluid would not be arrested by a vacuum. It proves that electricity must be a mode of motion (wave vibration or molecular rotation) of ponderable matter, which cannot be propagated except by such matter, and will be as effectively arrested in its propulsion, when ponderable matter is absent, in the same way as is the the case with the sound waves when the medium by which they can be transmitted is wanting.

DON'T KISS THE BABY!

The promiscuous kissing of children is a pestilent practice. We use the word advisedly, and it is mild for the occasion. Murderous would be the proper word, did the kissers know the mischief they do. Yes, madam, *murderous*; and we are speaking to you. Do you remember calling on your dear friend Mrs. Brown the other day, with a strip of flannel round your neck? And when little Flora came dancing into the room, didn't you pounce upon her demonstratively, call her a precious little pet, and kiss her? Then you serenely proceeded to describe the dreadful sore throat that kept you from prayer meeting the night before. You had no designs on the dear child's life, we know; nevertheless you killed her! Killed her as surely as if you had fed her with strychnin or arsenic. Your caresses were fatal.

Two or three days after, the little pet began to complain of a sore throat too. The symptoms grew rapidly alarming; and when the doctor came, the single word *diphtheria* sufficed to explain them all. To-day a little mound in Greenwood is the sole memento of your visit.

Of course the mother does not suspect, and would not dare to suspect, you of any instrumentality in her bereavement. She charges it to a mysterious Providence. The doctor says nothing to disturb the delusion; that would be impolitic, if not cruel: but to an outsider he is free to say that the child's death was due directly to your infernal stupidity. Those are precisely his words: more forcible than elegant, it is true; but who shall say, under the circumstances, that they are not justifiable? Remember

"Evil is wrought by want of thought
As well as by want of heart."

It would be hard to tell how much of the prevalent sickness and mortality from diphtheria is due to such want of thought. As a rule, adults have the disease in so mild a form that they mistake it for a simple cold; and as a cold is not contagious, they think nothing of exposing others to their breath or to the greater danger of labial contact. Taking into consideration the well established fact that diphtheria is usually if not always communicated by the direct transplanting of the malignant vegetation which causes the disease, the fact that there can be no more certain means of bringing the contagion to its favorite soil than the act of kissing, and the further fact that the custom of kissing children on all occasions is all but universal, it is not surprising that, when the disease is once imported into a community, it is very likely to become epidemic.

It would be absurd to charge the spread of diphtheria entirely to the practice of child-kissing. There are other modes of propagation, though it is hard to conceive of any more directly suited to the spread of the infection or more general in its operation. It stands to diphtheria about the same relation that promiscuous hand-shaking formerly did to the itch.

It were better to avoid the practice. The children will not suffer if they go unkissed; and their friends ought for their sake to forego the luxury for a season. A single kiss has been known to infect a family; and the most careful may be in condition to communicate the disease without knowing it. Beware, then, of playing Judas, and let the babies alone.

POSTAL DETECTIVE SERVICE.

It is rather more the custom to abuse the officials of the post office, for losses, irregularities, and other difficulties happening in the mails, than to give them credit for their skill in the detection of crime and recovery of missing property. We hasten, therefore, to put on record a recent instance of a prolonged search for lost money in which we have been directly interested, and which has resulted in a remarkable and praiseworthy success on the part of the post office detectives. On the first of May last, a correspondent in a village in Louisiana mailed a registered letter to this office, and enclosed therein the sum of sixteen dollars. The missive failed to reach us, and we notified both our correspondent and the post office authorities. The latter placed the case in the hands of special agents, and for the past seven months the detective officials have been actively at work tracing the lost missive. We, and doubtless the sender of the money, had given up hope of its recovery, and hence our astonishmnet was all the greater at the reception, a few days ago, of a terse communication, signed L. M. Terrell, Superintendent Railway Mail Service, Fourth Division, and dated from Chattanooga, Tenn., citing the above facts, and stating that the writer had arrested the guilty party, and recovered the funds, which we found enclosed. When the immense number of letters which pass through the mails is considered, this regaining of a single missive, the abstraction of which had probably been carefully concealed, exhibits a brilliant piece of detective ability, which redounds highly to the credit of our postal service.

TEMPERATURE OF IGNITION OF CHARCOAL.

Some months ago, as our readers will remember, an interesting discussion arose in our columns in reference to the possibility of igniting charcoal or over-seasoned wood, by the heat radiated from steam pipes. A well known engineer stated that he had collected conclusive evidence, proving the possibility of fires occurring in consequence of the ignition of wooden beams by contact with steam pipes, in cases where the wood had lain for a long time in contact with the pipe, and had thus been submitted to a process of charring at a very low temperature. We stated at the time that we were not convinced of the possibility of such action by any evidence which had then been given, and asked for more proof.

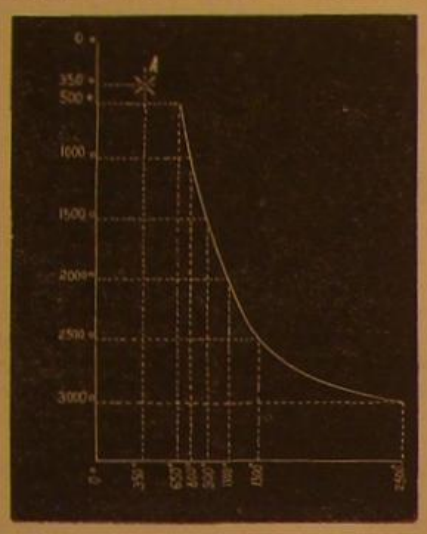
It is a well known fact that the lower the temperature at which charring occurs, the lower the temperature of ignition. The question is, however, whether the temperature of charring can ever become so low as to cause the temperature of ignition to become equally low, or nearly as low. In such cases as were above referred to, it was supposed that the wood lay in contact with the steam pipe for months, or even years, and that finally the wood, having become thoroughly charred, actually took fire at steam heat.

We have some evidence which has just been received, which may assist in settling the question, and in setting at rest the apprehensions of the authorities of our insurance companies, who are now acting upon the assumption that the possibility of this source of fire is so well supported by evi

dence that they are justified in imposing very severe restrictions upon the use of steam pipes.

Mr. Robert Harper, some time ago, contributed, to the collection of the Engineering Department of the Stevens Institute of Technology, a piece of wood, which, as he states, "stood during sixteen years and one month on top of and in contact with a one inch steam pipe, containing steam at fifty pounds in cold weather, used for warming the First United Presbyterian Church of Hoboken, N. J." The wood seems to be spruce. It is well seasoned, but no sign of injury or of charring is perceptible, and there is nothing to indicate that it might not have remained on the steam pipe an indefinite length of time without injury.

The accompanying diagram is interesting, and gives valu-



able evidence in this connection. We gave, at the time when this subject first came up, a table showing the temperatures of preparation and the corresponding temperatures of ignition of charcoal for a wide range on the scale.

Mr. Stahl, a student of the graduating class of the Stevens Institute of Technology, has prepared for us, at the request of Professor Thurston, this diagram, in which the vertical scale is one of temperatures of preparation and the horizontal scale is one of temperatures of ignition, and the curve shown contains the points of correspondence as given in our table.

It will be seen that the curve is apparently nearly hyperbolic. The lowest temperature of preparation was 500° Fah., but it is seen at a glance, even that at 350°, the temperature of steam under a pressure of over 125 lbs. per square inch, the temperature of preparation and of ignition cannot coincide unless some marked change of law should occur at so low a temperature, carrying the curve, which here represents that law, abruptly inward to reach the point A. We need hardly state that such a phenomenon would be quite improbable, and is probably impossible. Our readers will find this little diagram very interesting and instructive.

SCIENTIFIC FACTS AND SPECULATIONS.

Addressing a Glasgow society the other day—his subject being the relations of Science to religion—the Earl of Shaftesbury was pleased to be very patronizing to Science. No possible harm could come to his hearers' faith, he assured them, through the advancement of true Science. The speculations of scientific men might be misleading and mischievous, but facts never; and the function of true Science was simply the observation and registering of facts. Therefore, if he had the wealth of Glasgow, he would send fifty thousand pounds to Max Müller to help on his explorations at the fountain head of Aryan civilization. The learned professor's opinions on many things were far from sound; nevertheless, he was doing good work and ought to be encouraged. For like reasons, this champion of English orthodoxy would send another quarter of a million dollars to Professor Tyndall, and say to him: "Accumulate your facts; I don't care about your theories, but turn your powerful intellect to the pursuit of facts."

The evil that men do lives after them; and probably the worst legacy left by Francis Bacon—that pretender in Science, time-serving politician, insidious lawyer, corrupt judge, treacherous friend, and bad man, as Dr. Draper justly styles him—is this very theory of Science which Earl Shaftesbury echoes. According to this school of superficial thinking, the man who turns his powerful intellect to the recording of the temperature of the air, the direction of the wind, and the state of the sky three times a day is a meteorologist worthy of the name; but the man who leaves the recording of facts to other men, or to automatic machinery, and busies himself with suggesting and testing hypothetical interpretations of the recorded facts is a mere theorist, not to be acknowledged by "true Science." Similarly, the greatest astronomer is he who makes the greatest number of observations and discovers the most asteroids or comets; the greatest geologist, he who finds the most fossils. To seek the law within the law, by investigation guided by hypothesis, is to destroy one's right to the title of a true son of Science!

It is the fallacy of the French Academy, which rejected Darwin as an unscientific theorist because he turned from the blind accumulation of facts to the development of an hypothesis whereby to account for the facts. The very important truth that Darwin's hypothesis had given life to millions of otherwise fruitless facts, and still more had given purpose and direction to the observations of hundreds of naturalists, thus accomplishing more for the substantial enrichment of natural history than all their Academy had ever done, was entirely overlooked.

We are far from deprecating the accumulation of facts. No great truth was ever discovered without them, and the masters of Science have ever been zealous in their pursuit. But their service to Science did not end in barren observations, nor were they made at haphazard. In every case where great discoveries were the result, point and purpose were given to their investigations by hypothesis. Indeed, there can be no true inductive investigation without a marriage of hypothesis and experiment; and it is by such investigations only that Science has come to be what it is. The secret of the successful career of Faraday lies not less in his fertility in inventing hypotheses than in his patient observation and conscientious determination to prove all things. Without his genius for guessing, he would never have been able to add so much to our knowledge of electricity and magnetism. The first observer of the transit of Venus tells how he tried theory after theory, in order to discover one in accordance with the motions of Mars. So, too, Kepler submitted guess after guess, hypothesis after hypothesis, to computations of infinite labor, in determining the laws of planetary distance and motion. The writings of every great man in Science afford confirmation of the necessity of hypothesis in the pursuit of facts, as well as in the pursuit of scientific truths. But probably there cannot be found in the whole history of Science a more striking example of the worth of investigation guided by hypothesis, and the worthlessness of investigation without such guidance, than is afforded by the labors of Sir Isaac Newton. In his case we may see a great man studying chemistry, unaided by any theory: studying the phenomena of light under the influence of an utterly erroneous hypothesis: and again, incited by a bare suspicion that the attraction of the earth might extend as far as the moon, spending his ripest years mathematically testing hypotheses of the most stupendous reach, having for their object nothing less than the laws of the physical government of the solar system, if not of the Universe.

It is easy to imagine how a patronizing Earl of Shaftesbury, a brother alchemist, a Baconian philosopher, might have reproached him for wasting his precious time in theoretical investigations, advising him to stick to his laboratory and bend his powerful intellect to the accumulation of facts. But what says history of the days and nights which he spent in his laborious chemical experiments?

"While his hypothetical and deductive investigations have given us the true system of Nature, and opened the way in almost every one of the great branches of natural philosophy, the whole results of his tentative experiments are comprehended in a few happy guesses given in his celebrated 'Queries.'"

Aided by the insight into the principles of Nature which chemical theory affords, the student of to-day is able to discover more useful facts in a year than Newton could in a lifetime. So it is in every department of Science; and though weak men are apt to mistake hypothesis for final truth, resting on it instead of using it as a means of further progress, the hypotheses formed by powerful intellects are the stepping stones of true Science, without which there could be no advancement. If it were possible and necessary to confine our great men to one department of their work, we should therefore say, not "accumulate facts," but "give us theories. There are men enough, of smaller caliber, to observe and register: men enough to test your hypotheses and to follow their lead; do you give us theories. The guesses of genius are more valuable than the demonstrations of mediocrity."

Fortunately, however, there is no great need of such division of labor. Genius for sound hypothesis is very apt to be seconded by superior skill in devising means for subjecting hypotheses to the test of experiment.

SEEING THROUGH COLORED GLASSES.

A child, or an adult not accustomed to critical observation, looks through a bit of colored glass, and straightway declares that it makes everything green, or blue, or red, as the color of the glass may be. The first impression is that the glass somehow throws a flood of colored light upon the scene; and such, for many ages, was the universal belief.

The ancients explained the phenomena of sight by supposing that the eyes shot forth rays which passed through space to the objects seen: that they saw by means of these rays, much as one might explore by touch the bed of a pond by using material rods. From this standpoint there could be no apter explanation of the action of colored media than to say that they changed the character of the rays proceeding from the eye, and so changed the aspect of the objects looked upon through such media. Nearly eight hundred years ago this view was shown to be erroneous by the Mohammedan philosopher Alhazen, who taught the true theory, since adopted by the christian world, namely, that the light proceeds from the object to the eye. The old theory is practically forgotten; yet its influence is still seen in common speech. To most people a colored glass colors a landscape by adding color to it, though it is well enough known that it really takes more or less away from the color of the several objects, or at least the most of them. Even educated people will say that a green glass, for example, gives its color to objects seen through it. More than that, they will say, as Professor Clifford does in his able essay on the Philosophy of the Pure Sciences, printed in a late number of the *Contemporary Review*, that a colored medium will give its color to *everything*. Thus: "If a man had on green spectacles, he would see everything green. And if he found out the property of his spectacles, he might say with absolute certainty that everything he saw, without exception, would be green."

Surely Professor Clifford can never have looked through a pair of green spectacles! It is equally sure that he could have given no thought to the actual phenomena of color in writing the illustration we have quoted, else he would have stayed his hand. Even if it were possible to make a glass which would be transparent to all green rays and opaque to all others, the asserted result would not happen. All things would not look green through it, but only those which emitted or reflected green light. All objects colored red, orange, yellow, blue, violet, or showing any combination of these hues, would furnish no rays capable of passing through the supposed glass, and would consequently look black, not green.

But the transparency of colored glasses is marked by no such exact chromatic limits, so that the effect of them is still less likely to be as Professor Clifford assumes, as any one may readily see by looking through a pair of green spectacles. If the observer has paid but little attention to the matter before, he will be surprised to see how slightly the natural aspect of things is affected by the glasses. Still more will he be surprised to see how many objects show neither their natural tint nor the tint of the glasses, but a color bearing no apparent relation to either. We happen to have on our table samples of red, green, and blue glass. Probably the colors are as perfect as glass can be made to receive, yet neither specimen shows a pure color. For instance, all allow a little yellow light to pass through them; the green transmits blue rays quite freely, and the blue glass fails to arrest some of the red rays. Seen through the red and green together, the golden clouds above the setting sun show a pale canary-yellow tint, and so does a bright white cloud in another part of the sky. Through the blue glass, the golden clouds have a fainter hue, approaching orange, yet are distinctly visible. The clouds change to orange, then to red. No change can be observed through the green glass, save a gradual fading, the clouds becoming invisible when they have attained their brightest tint of red, the green glass being opaque to all rays below the yellow. Through the blue glass, however, the reddening sky grows purple, the final hue being exceedingly rich and beautiful. Through the red glass, the sky appears lurid, like the reflection of a great fire. The blue glass seems perfectly opaque only to green and yellow; the green is opaque to red rays alone, the red glass to green only.

These observations give a clue to the changing hues of colored objects when looked at through the several glasses in bright daylight, a few instances of which may be cited to show how widely Professor Clifford's assertion varies from fact. The salmon-colored cover of the *Contemporary* looks yellowish brown through green glass, and a dead brown through blue. Through the red it shows the palest possible orange tint. A yellow envelope shows a brighter yellow through the green glass, bright orange through red glass, and salmon color through blue. Some cherry colored silk appears a lustrous brown through green glass, pale pink through red, and an almost invisible purple through the blue. A piece of light blue silk appears a light drab through green glass, a pale brown through red, and bluish gray through the blue glass. A red spot in the carpet seems brown through green, pale red through red glass, and wine color through blue. A deep green band on a water pitcher shows lead color through the green, slate color through red, and brown through blue. Curiously, any color in the glass, instead of enhancing, as one would naturally suppose, the corresponding color in objects, invariably makes it less bright and clear. It is only as objects emit or reflect white light that their color approaches that of the medium through which they are seen.

Single Rail Steam Towage on the Belgian Canals.

We learn from the *Moniteur Industriel Belge* that a system of steam towage is about to be established on the Bourgogne canal, over a distance of about 150 miles. The tow path will be laid with a single rail weighing some 16 pounds to the yard, and fixed on traverses placed 3·2 feet apart. The locomotive has four wheels, two of which are placed directly along the axis of the vehicle, one in advance of the other, and two, one at either side. The former pair are directing, the latter driving, wheels. The directing wheels are grooved, and fit the rail: the others have rubber ties which give purchase on the macadamized road, and which press thereon only to the extent of 0·07 pounds per square inch. By means of simple mechanism, the weight of the machine may be thrown either upon the driving or directing wheels at will. In the first case the maximum and in the last the minimum of adherence is obtained, to suit the conditions of a loaded or an empty boat. A single road is to be used, with relay engines provided at suitable distances. Each locomotive tows one boat; and when a meeting takes place of two traveling in opposite directions, the engines change boats and retrace their paths.

This single rail system has already been satisfactorily tested for short distances on the Belgian Canals, and the projector, M. Larmangat, has obtained a government concession for its extended construction for forty years. The locomotives are to weigh 4 tuns each, and will travel at the rate of 3·1 miles per hour, with full boats carrying, a cargo of 150 tuns each.

Proposed Utilization of the Hudson River Sources.

The Legislature of New York, last year, ordered a survey in order to determine whether the immense accumulation of water on the great Adirondack plateau could be held in reserve and drawn upon as needed for State purposes. A report on the subject has recently appeared, from which we learn that this storage can be safely and economically effected. At the present time this water runs to waste, and is productive of much damage during the spring freshets. If confined, it could be obtained in sufficient quantities, when needed, to supply deficiencies in the river during the dry summer season for at least one hundred days.

THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER VII.

Continued from page 402.

The centering for the great 68 feet arch near 95th street, shown in the engraving in our last article, page 402, was put up and the arch turned while the trains were constantly passing and repassing beneath it. The centering was of itself a considerable work. In Fig. 17 we give an elevation thereof. It consists of a series of frames or ribs placed 5 feet 6 inches apart, from side to side. The back piece of the frame consists of two polygonal frames of boards 9 x 3 inches, so arranged that the boards of one frame break joints with those of the other, the joints, as usual, being in the direction of the radius of curvature, which, for the intrados of the 68 feet span, is 44 feet 5 inches. The back piece is strengthened and prevented from spreading laterally by a compound horizontal tie beam, composed of four beams 10 x 3 inches, placed in pairs and joined a little to one side of the center by a spliced joint, as shown in Fig. 17. This tie beam is placed a little above the springing line. Quite close to the crow is also placed a straining beam, 6 x 6 inches, single, supported by two inclined struts, 8 x 6 inches, single. The long horizontal tie beam is connected with the back piece by one vertical and four inclined ties, each composed of two pieces of timber which clamp the back piece and tie between them. The dimensions of the beams of the vertical tie, which is placed in the center of the span, are 9 x 2 inches, and those of two of the inclined ties, 9 x 3 inches. These ties are braced by single beams, 6 x 6 inches and 8 x 6 inches, placed in such wise as to convey the pressure on the back piece directly to the points of support of the frame. These supports are so arranged as to leave sufficient room for the passage of trains. They consist of three beams for each end of the rib, two vertical and one inclined. One of these, 6 x 6 inches, is placed upright against the abutment, a horizontal beam 3 x 5 inches, on which the end of the back piece rests. The other vertical support, 10 x 6 inches, single, is placed nearer the center of the tunnel, and rises to the back pieces. The inclined shore, 12 x 6 inches, starts from the foot of this latter shore, and rises to the under side of the horizontal tie, where it abuts against a straining beam 4 x 6 inches, placed underneath this latter. These shores are strengthened by string pieces, 2 x 9 inches, double, and rest upon a sill placed transversely to the axis of the tunnel. Under this sill, and resting upon longitudinal timbers, 8 x 6 inches, are the wedges (three sets for each end of the rib) by which the frame is keyed up. The laggings are 3 inch plank.

The frames are braced together by two beams, 8 x 12 inches, placed horizontally across the upper side of the horizontal tie beam, and also by six other beams (three for each end of the rib), placed, one along the backs of the vertical shores, and two along the backs of the inclined shores. On the outside of these latter supports are placed inclined beams, 8 x 6 inches, which bind the frames in sets of three, the beam passing from the foot of the shore of one rib across the middle of the shore of the second to the top of that of the third rib. From here another beam passes to the foot of the sixth rib, and so on. The ribs at the end of the tunnel, where the span is fifty feet and the radius of the intrados 31 feet, differ from the ribs just described in that they want the vertical shores and the ties joining it with the back piece. The inclined shore in this case rises from the foot of the abutment.

The rock tunnels commence at 92d street and extend to the north side of 94th street, a distance of some 550 feet. It will be remembered that at this point on the road was the old rock tunnel. This tunnel now forms the large central tunnel, and on each side of it was excavated a single tunnel. The three tunnels as they now exist are shown in cross section in Fig. 18. The two single tunnels are 18 feet high from the railroad grade to the top of the arched roof, and 18 feet 8 inches wide at the bottom: or, allowing 32 inches for the thickness of the two side linings, the span becomes 16 feet in the clear, and the hight 16 feet 8 inches. The arches are semi-circular. Their center is 36 feet east and west from the center of the central tunnel. This latter has a span in the clear of 27 feet; and as the side tunnels have each a span of 16 feet, we have, for the thickness of the rock walls separating the side and central tunnels, 14 feet 8 inches. The middle tunnel is unlined, but the face of the rock is trimmed off to a very fair degree of smoothness. The two side tunnels, however, are each of them lined with brick 16 inches thick, and the space between the rock and the brick filled in with concrete.

The ventilation is effected through circular shafts sunk over the summits of these tunnels, at the usual distance apart. These shafts are lined with brick 16 inches thick, and are 6 feet in diameter in the clear, and coped on top with pene-hammered granite coping 10 x 18 inches, surmounted by an iron railing. During the excavation of the tunnel, these ventilating shafts served also as working shafts, the headings being carried forward north and south from the bases of them, and the excavated rock raised to the surface by a small steam engine.

The blasting was done in the most careful manner, the charges in the neighborhood of the dividing wall being so regulated as not to injure them in any manner. The drilling was done partly by hand and partly by steam, and the amount of rock thus excavated was, in the tunnels, 25,406 cubic yards; in the open cut, 37,200 cubic yards.

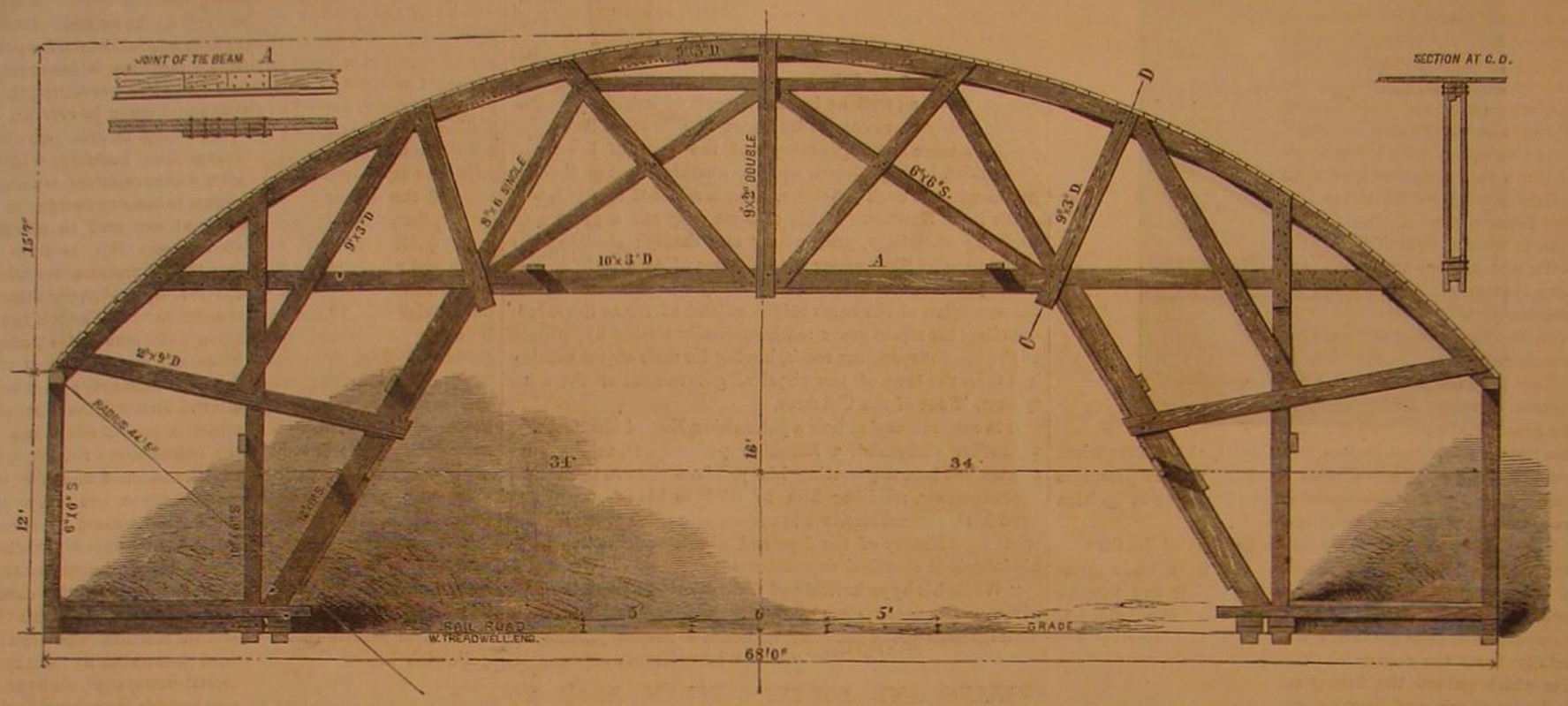


Fig. 17.—THE UNDERGROUND RAILWAY IN NEW YORK.—CENTERING OF THE GREAT ARCH, FOURTH AVENUE, NEAR 95th STREET.

Singular Cause of a Boiler Explosion.

The tube of a boiler recently exploded in a foundery at Liège, Belgium, caused, as shown on examination, by the corrosive action of ferrous sulphate and sulphuric acid, derived from the sulphur in the coal fuel. The discovery strongly points to the necessity of carefully and frequently cleaning the forward portions of the boiler tubes, and other parts which do not come in direct contact with the flame.

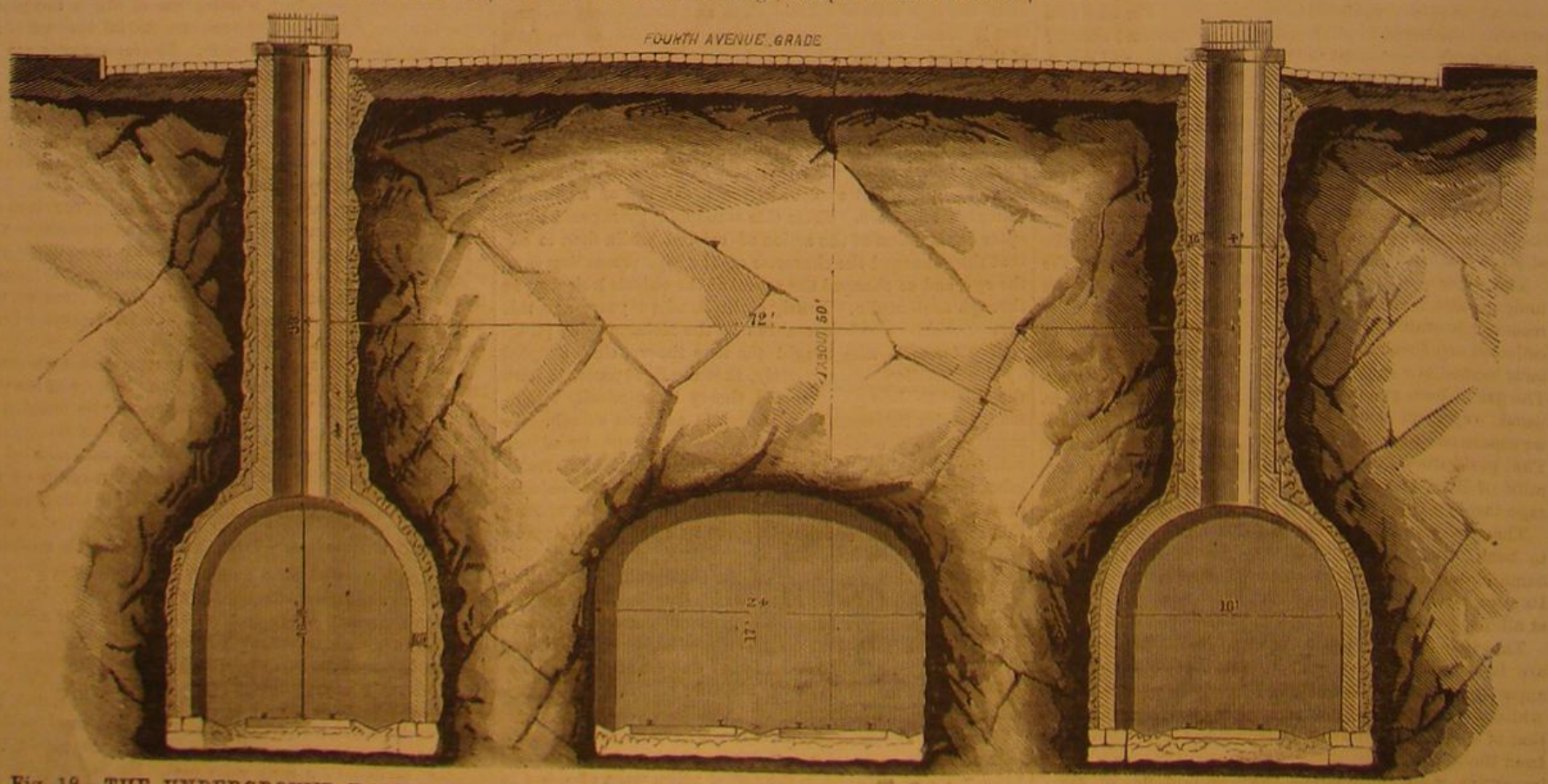


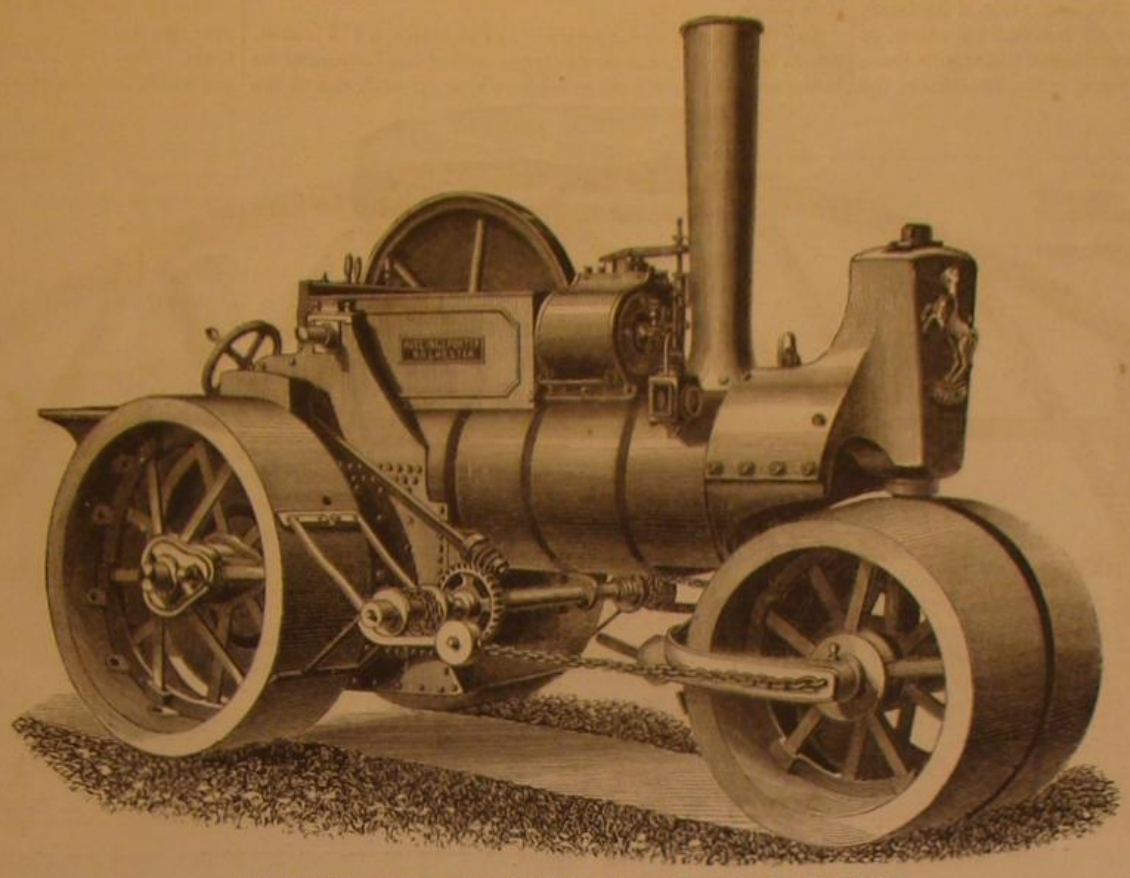
Fig. 18.—THE UNDERGROUND RAILWAY IN NEW YORK.—THE ROCK TUNNELS FOURTH AVENUE, BETWEEN 92d AND 94th STREETS

ROAD AND FARM LOCOMOTIVES AND STEAM ROAD ROLLERS.

The newest types of Messrs. Aveling and Porter's steam road roller and road and farm locomotives are illustrated on this page, the steam roller particularly presenting many improvements when contrasted with the well known roller of Messrs. Aveling and Porter's manufacture which has already been illustrated in the SCIENTIFIC AMERICAN. As nearly as practicable, the steam roller is now made to conform in design and construction to the successful and extremely simple road locomotive of this eminent firm. The heavy turntable and steering apparatus of the old pattern roller is avoided, and the weight thereof is added to the rolling wheels, the thickness of whose tyres is now 4½ inches, instead of 2½ inches, as heretofore. The durability of the wheels is thus increased twofold One man only is required for the entire control of the roller, in place of two, and the running expenses, including coal, oil, and wages, are by this arrangement reduced to six dollars per day for the 15 tun size. The consumption of fuel is less than in the old style of roller; the boiler and engine are larger and more powerful; the number of wearing parts is fewer; and moreover, the first cost of the machine is materially less.

Now that the steam roller has become a recognized necessity in the practice of good road making, this improvement and reduction in cost will be acceptable to the large number of corporations and contractors requiring such machines.

The engraving of the road and farm locomotive is taken from one of Messrs. Aveling and Porter's recent manufacture. In general construction it does not differ materially from the engine of this firm which gained the first prize at the latest trials of traction engines by the Royal Agricultural Society of England. In some of its minor details, alterations have been made which add to



AVELING AND PORTER'S STEAM ROAD ROLLER.

the success of the locomotive. Messrs. Aveling and Porter have built upwards of a thousand road and farm locomotives, and they have gained first prizes with them at the International Exhibitions of London, Paris, and Vienna.

The variety of uses to which these locomotives are applied, including plowing, thrashing, and the removal of heavy material, induces a large and extensive demand, which has never been so great as at the present time. Mr. A. T. Stewart, at his Garden City, Long Island, has adopted the Aveling and Porter road locomotive, and it's success has been remarkable in plowing, thrashing, hauling, and the uprooting of large trees. Mr. Hinsdale, Mr. Stewart's manager at Garden City speaks very highly in its praise.

Messrs. Aveling and Porter's agent in New York city is Mr. W. C. Oastler, 43 Exchange Place.

Gas from Sewer Refuse.

A novel and apparently important utilization of sewage has recently been successfully put in practice in Breslau, Germany. Mr. Alfred Sendermann announces that from this waste he has obtained an excellent illuminating gas, and this on a scale sufficiently great to warrant the belief that the plan might be extended to meet the requirements of large communities.

The apparatus, which is built underground, consists in a large reservoir in which the material is collected and thence run off to retorts located at a still lower level. The gas is here generated in the usual way, and conducted to a tar cistern and then to a condenser. The purification is effected by milk of lime, and finally by passage through clean water.

The gas thus obtained is said to burn with even a brighter flame than that made from coal. Its odor is slightly acid, but not at all disagreeable.

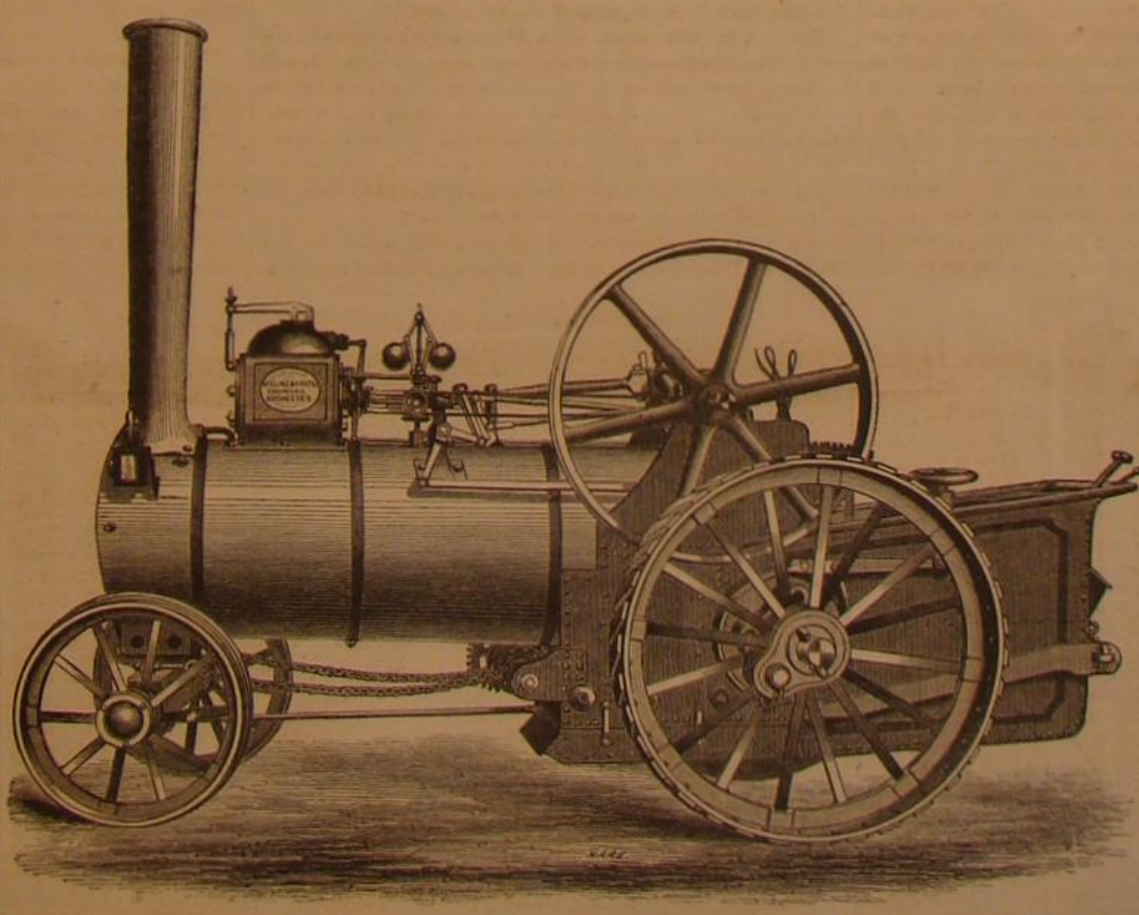
The common residues, such as coke, tar, and fatty matter, are inodorous and perfectly utilizable. The cost of the apparatus is no dearer than that of the ordinary description, while the expense of the product is necessarily less than that of coal gas. There is no disengagement of bad odor from the factory. If these claims are legitimate, several important sanitary problems will be solved by the invention.

Fish as Makers of Oxygen.

Dr. Moreau has recently investigated the facts indicated by Biot, from which it appears that the gas contained in the natatory vessels of fish is nearly pure oxygen. Dr. Moreau has verified this, and has also discovered that, when other gases are found in the vessel, such as nitrogen, their presence is due to accessory causes. In order to prove this view, he examines fishes which had existed for a long time in shallow water. These, after determining by many analyses the quantity of oxygen which they had secreted to be about 16 per cent of the vesical gas, he plunged into water of a depth of some 25 feet. Submitted under these new conditions to a much higher pressure than before, the fish, to counterbalance the same, augmented the quantity of gas contained in the natatory vessel. Analysis of the gas then showed an increase in oxygen to 25 per cent, showing that the cause of the augmentation was clearly a secretion of that gas in a pure state

A Noble Bequest.

Ex-Mayor T. M. Allen, of Hartford, has offered to give that city $100,000 for the establishment of a free industrial school for the instruction of boys and girls in the business



AVELING AND PORTER'S ROAD LOCOMOTIVE.

avocations of life—agriculture and the mechanic arts. He suggests that every boy, while he is acquiring a knowledge of the arts, sciences, and modern languages, should become a practical agriculturist and master of some useful trade, and that the girls should be instructed in all the practical duties of the household, understand and become familiar with the chemistry of the kitchen, and made to master the art of making every article of a lady's wardrobe, and also that they learn bookkeeping, banking, telegraphy, photography, or any other occupation that is within the measure of their strength and adapted to their tastes.

The Overworked Man of Business.

The London *Sanitary Record*, in an interesting article on "Overwork," gives the following graphic picture of the business man who is overtasking his powers:

"Sooner or later he finds that his day's work has become an effort, a toil rather than a delight; the last hour has become a strain only maintained by determination; a sense of exhaustion and fatigue envelopes his closure of the day's work, and the last columns of figures have presented difficulties hitherto unknown, and the last pile of letters has seemed more trying than of yore. Anything new, of an unwonted character, making special demands upon the higher faculties, becomes arduous and distasteful, revealing the fact that the higher powers are first commencing to give way, to announce their inability; while the more routine matters, which have almost become automatic, or even habitual, can still be effectively discharged. But in time even these lower processes are affected, and the last half hour at the office is a distinct trial, and is followed by a new sense of exhaustion. There is a certain amount of irritability combined with the sense of exhaustion, that irritability which is ever found along with the exhaustion of nerve matter; this irritation, sometimes almost amounting to exaltation, marks the commencement of nervous exhaustion and failure. While work seems to become more irksome, the usual sources of pleasure no longer afford their wonted solace and satisfaction. There is a heightened susceptibility to any little trivial annoyance, domestic matters are felt more keenly, the dinner is not so satisfactory, the children are noisy; the more necessity for rest, and the more distinct the craving for comfort and quiet, the less seems forthcoming. There is an emotional exaltation which reveals the irritability of the exhausted nerve centers; the newspaper is stupid and uninteresting, the piano wants tuning, servants are deteriorating, children are less obedient, and wives less sympathizing than of yore. The mind is as sensitive as is the skin after a blister; the slightest touch produces pain."

The Sandy Hook Ordnance Experiments.

The experiments with the ten-inch Rodman smooth bore gun, which has been altered into an eight-inch rifled piece by the insertion of a wrought iron core, are still in progress at Sandy Hook. It is intended to subject the weapon to the test of 500 rounds; and up to the time of writing, 400 rounds have been fired. The charge used is 35 lbs. hexagonal powder, with a Butler projectile weighing 170 lbs. At the 363rd round, the pressure in the bore was 25,500 lbs. per square inch. Careful examination with a star gage, an instrument capable of noting changes in diameter of the bore of $\frac{1}{1000}$ of an inch, fail to show the slightest variation, and the gun is apparently as strong as when first fired.

It is intended to continue using the piece after the 500th round, until bursting takes place, in order to determine the limit of strength. These results are of the highest importance, since, if the success thus far encountered is continued, some 4,000 smooth bore guns, now in government possession, will be fully trebled in value and efficiency.

Amalgam Fillings for Teeth

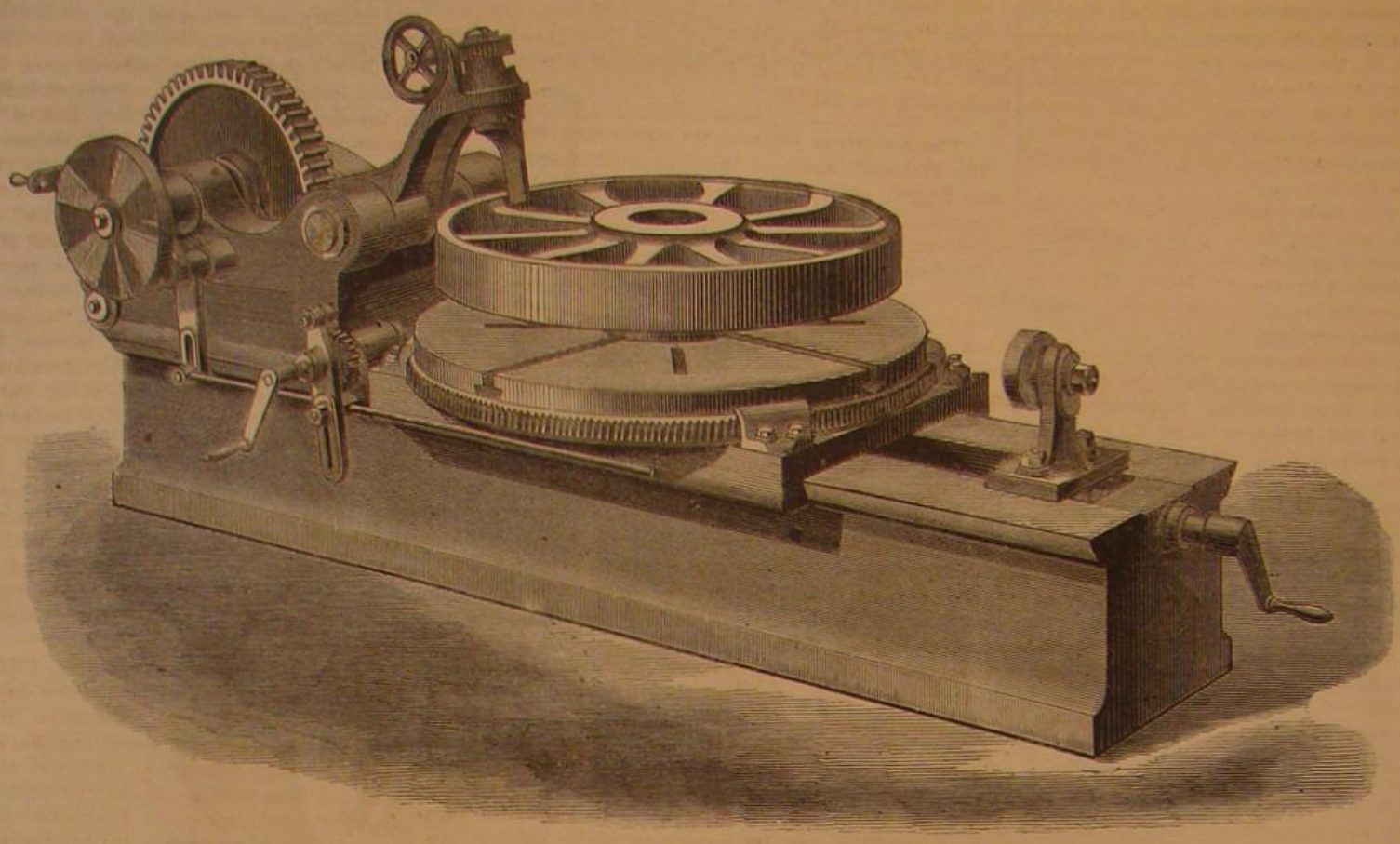
"As a durable filling, amalgam can be used," says Dr. A. C. Castle, "in cases where other metallic fillings cannot be applied. Their use has been on the increase for very many years; and where formerly only grains were sold, our most distinguished dental depots now monthly sell pounds of the best American prepared amalgams.

Opposition to their use is made by those only who seek to obtain fabulous fees for gold fillings, which cannot be obtained for these, and hence appropriate to themselves the title of "the best dentists." In the appropriate places I have used amalgams for forty years past. No injury, above electro galvanic action, has been done by their presence."

FINISHING LOCOMOTIVE WHEELS.

It has of late years become the custom—and a very good one too—to bestow much greater care upon the finish of locomotive engine wheels than was formerly the case, and, as a result, several special machine tools have been introduced for the purpose of trimming off wheels, which in Europe are universally f wrought iron, and thus saving hand labor.

We illustrate a machine for this purpose by Mr. F. W. Webb, locomotive engineer to the London and Northwestern Railway Company. It is a curvilinear slotting machine, and the tool is mounted in a holder provided at one end of a vibrating lever, the other end of this lever being slotted, and being fitted with a sliding block, into which the pin of a disk crank enters. As the crank disk revolves with its upper edge approaching the fulcrum of the lever, the effect of the arrangement is to give the tool holder a slow downward and a quick return stroke. The point of the tool, of course, describes an arc of a circle struck from the center of the vibration of the lever, thereby producing a convex form on the inside of the tyre, and so giving additional strength to the rim. The wheel bed plate is revolved by suitable automatic mechanism, as shown, somewhat similar to the devices ordinarily employed in planing machines. Provision is made for wheels of any diameter, by means of the crank and screw shown on the right of our engraving.



WEBB'S WHEEL FINISHING MACHINE.

WOOL WASHING MACHINERY.

In scouring wool, the operator has to insure that a constant supply of the washing fluid be continuously and intimately brought into contact with the material, and that a plentiful supply of rinsing water be at hand. To this end, the washing machines are constructed with several cylinders, that the wool may be repeatedly washed and rinsed. This system is known to the trade as "the leviathian," and the apparatus has been frequently improved in form and efficiency till last year, when Messrs. J. & W. McNaught, of Rochdale, England, exhibited at Vienna the machine of which we publish an engraving.

Fig. 1 represents the machine, used as a single self-acting wool washing apparatus for smaller quantities of wool, while Fig. 2 shows the transferring apparatus provided for carrying the wool from one washing reservoir to another in a series of machines. The arrangement of the working parts of this apparatus will be easily understood from the engravings. The washing reservoirs are provided with double bottoms, and are connected with each other by the tube, H, through which the washing fluid can pass from one reservoir to the other; this movement is effected in a peculiar manner, a steam injector being fixed in the tube, H, the steam jet of which, when acting, forces the fluid, through H, into the first reservoir, from whence it can pass back again into R as soon as it has reached the hight of the communicating pipe. The wool is put in motion in the reservoirs by means of swing rakes, which are moved in the manner shown in our engraving.

The transferring arrangement for the wool is as follows: The rod, *u*, is jointed to one end of the link, T, while the other end of this link works on an adjustable center carried by a slotted bracket, *b*. The lower end of the rod carries rakes, A, which pierce through the wool, while a bush connected with the crank, *r*, the axis of which is put in rotation by wheel gear, can slide along the rod, *u*, whence the rotation of *r* produces an elliptical motion of the points of the rakes, A; the larger axis of this ellipse is in the direction of the motion of the wool, and the points of the rakes are through one half the curve in connection with the wool, and travel forwards, while they rise above the wool and travel backwards through the second half of the curve. The rakes which carry the wool forward through the troughs are similarly arranged; and at the point of contact of each of the curves described by the four systems of rakes, as shown in Fig. 1, fixed rakes are provided, through which the wool is pressed on one side and caught on the other side by the descending rakes of the next system,

Fig. 1.

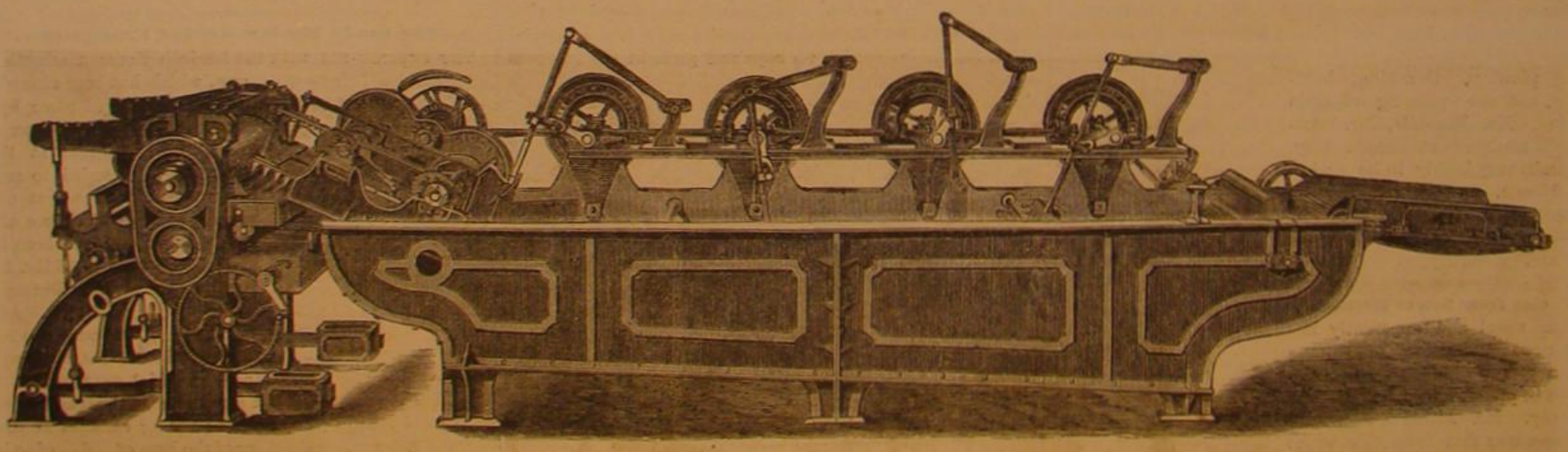
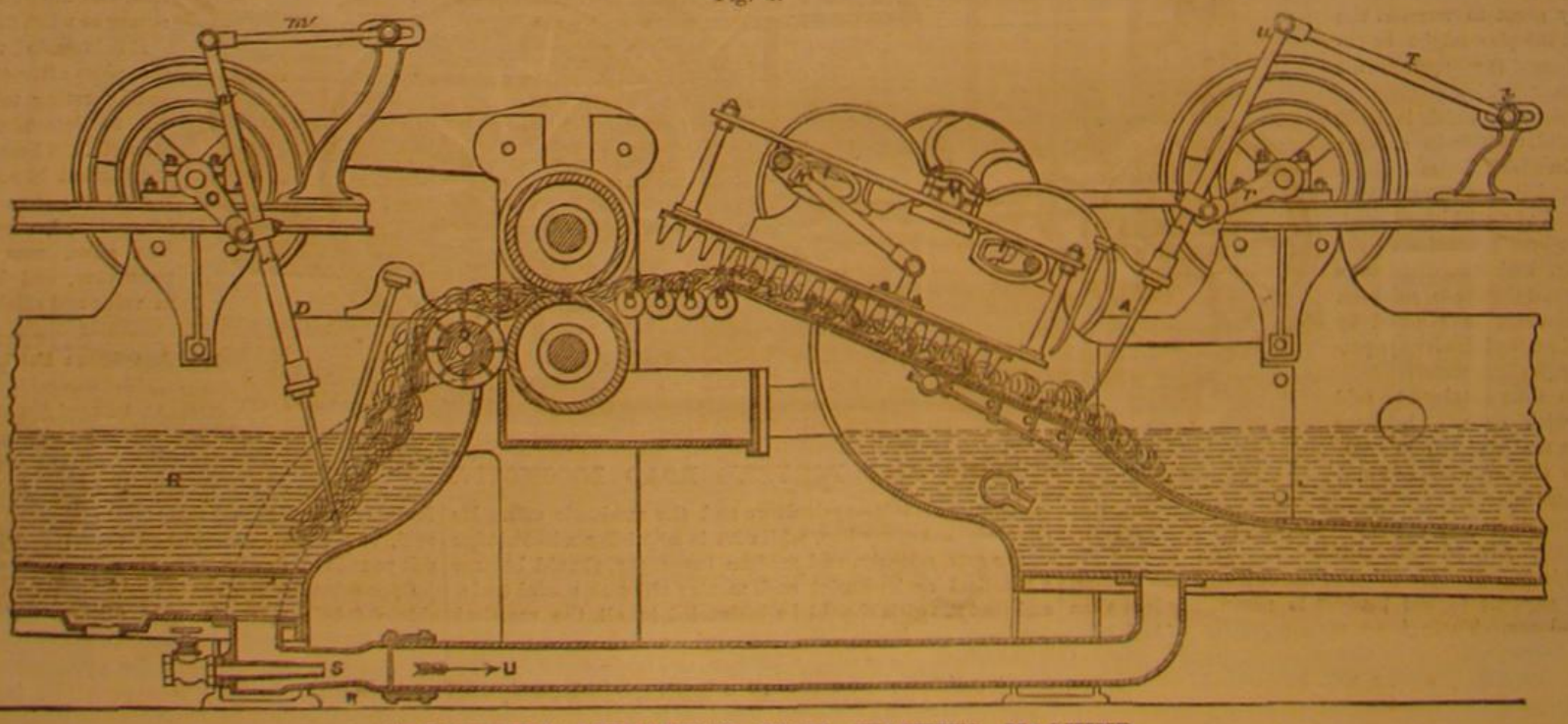


Fig. 2.



McNAUGHT'S LEVIATHAN WOOL WASHING MACHINE.

a continuous travel of the wool being thus effected. Returning to the arrangement for transferring the wool from one trough to the next, it will be seen from the sectional view of the transferring apparatus that the last system of rakes carries the wool on to an inclined plane, through which the small rakes, C,C,C, project; these latter hold the wool on the inclined plane, B, when the points of the rakes, A, have to travel backwards. From B, the wool is taken off and carried forwards by a separate apparatus, H, to which a curvilinear motion is also given by the cranks, I, and the rod, K. The rollers, M, M, M, M, carry the material between the squeezers, F, from which it passes either over another roller, as shown, into the following reservoir, where it is at once caught by the rakes, D, worked by the crank, O, and the rods, *n* and *m*, or over a second squeezer or pressing roller to the drying machine, as shown in Fig. 1.

This apparatus for getting the wool from one reservoir into the other, or from the last reservoir through the squeezers to the drying machine, is well designed, and fulfils its purpose perfectly, while the mode of forcing the washing fluid from one reservoir into the other by a jet of steam is very simple, and also gives most satisfactory results.

The inventors provide the self-acting machines (says *Engineering*, from whose pages we extract the engraving) with a feeding cloth and a brass revolving immerser. The squeezers have wrought iron shafts 4½ inches in diameter, and are covered with hemp or wool, and the fixed rakes are adjustable.

NEW SWIMMING BATH IN LONDON.

The public baths and washhouses are a feature in the life of English cities that is worth attention In many of them a bath, with clean towels, etc., can be obtained for two cents; and hot water, use of tubs, and all necessaries for washing linen can be had for two cents an hour. One of the largest of these establishments belongs to the parish of St. Marylebone, and is situated in Seymour Place. It possesses accommodation for some hundreds of bathers and washers, and is very largely patronized.

An important addition has recently been made to this establishment in the form of a large and handsome swimming bath, of which we present an engraving, extracted from the London *Builder*.

The length of the bath room is 85 feet, and the width 41 feet, the hight being 28 feet from the platform round the bath to the apex of the roof. The dressing boxes, averaging 4 feet 3 inches long and 3 feet 6 inches wide, are contained along the sides of the room in recessed arched openings. All the fittings of these boxes are of ebony, and the metal work is electro-plated. The arcading is continued along the end walls, but the recesses here are filled in with ornamental tile work. The piers of the arches have each three panels, filled in with blue hand-painted tiles, with variously designed representations of birds, fishes, and water fowl. The roof is supported by cast iron semi elliptic ribs, ornamented with gilded scroll work panels.

The size of the bath itself is 26 feet by 73 feet, and the depth of water 4 feet 6 inches, shelving down to 6 feet. The spring diving board is 4 feet above the water, but there is another diving board 5 feet higher than this one.

The bottom and sides of the bath are covered with glazed tiling, in variously designed patterns; and the hand-painted tile border above the water line, 21 inches wide, represents the appearance of an aquarium, with fishes and rockwork.

The whole of the interior of the building is decorated with Pompeian ornament. Mr. Raymond Smith is executing the marble fountain, which will be placed at the east end of the bath. The architect is Mr. H. Saxon Snell, and the cost of the building was $21,250.

The American Centennial Great Exhibition.

The Financial Agent of the Centennial Board, Ex-Governor Biglow, of Pennsylvania, recently made a speech at Norwich, Conn., upon the prospects of the Centennial, from which we take the following interesting particulars:

The Board accepted the refusal of Congress to grant money as an intimation that they must rely upon private capital or State aid to carry forward the project, and on this basis they have zealously devoted themselves to the work of raising funds, with much success. But they will make one more attempt in Congress to get money from the public treasury in the shape of payments for premiums, police guard, etc.

"I am confident that you must feel especial interest in the present status of this great enterprise, and I shall give it to you in as few words as practicable. The buildings are an art gallery, covering 2½ acres, a main exhibition building, covering 20 acres, a conservatory of 2½ acres, a machinery hall of 12 acres, and the agricultural department of 5 acres, making a total of 42 acres, which, with the space occupied by the zoölogical garden and the cattle pens and grounds for the agricultural tests, will make a vast show. Some months since, the art building and the main exhibition building were contracted for, and the inner walls of the art building are up to the square, and the granite will be all put up during the coming winter; and its completion in time is fully assured. The foundation of the twenty-acre building is nearly completed, and the glass and iron are being prepared with satisfactory expedition, and its completion within the time prescribed may be confidently relied on. The conservatory and the machinery hall will be contracted for within a few days; the agricultural department, which can be completed within a few months, will be commenced in the spring. I say, further, there is nothing in the financial condition of the Board of Finance to interfere with the progress of these buildings. The State of Pennsylvania and the city of Philadelphia have provided for the art gallery; the city for the machinery hall and the conservatory; and the subscriptions to the stock, already secured, amount to about $2,000,000, which sum, with what we expect to get from Connecticut and the other States, will be applied to the main exhibition building and the agricultural department. So you see that the great problem of the buildings is solved. The next inquiry that naturally arises is: Will there be anything to put into these great buildings? I answer, unhesitatingly, an abundance. The space already applied for decides that question affirmatively, and eighteen months still remain before the opening. I know that the Director General, A. T. Goshorn, is already impressed with the great difficulty of restraining the exhibition, that is, to restrain it in quantity so as to elevate it in kind. I have myself, within a brief period, visited all the great cities of the country, and witnessed the exhibitions at Cincinnati, Chicago, Indianapolis, St. Louis, Louisville, Philadelphia, and New York, and have gathered some knowledge of the public feeling; and I feel that I am warranted in saying that in the department of machinery and of the useful arts generally, and in that of manufactures and natural productions, the display will overshadow all its predecessors. The prospect of attendance and display from foreign countries is brighter by far than the Commission had anticipated. The following countries have formally and favorably accepted the invitation of the President to be represented and take part in the coming international exhibition, to wit: Germany, France, the Netherlands, Belgium, Sweden, Norway, Spain, Canada, Liberia, the Sandwich Islands, Japan, Honduras, Ecuador, Hayti, Argentine Confederation, Chili, Mexico, Brazil, Guatemala, Peru, Venezuela, Salvador, Colombia. While Great Britain, Austria, New Zealand, and the Australian islands have adopted no official steps as to ministers, commissions, or appropriations of money, the Director General is in possession of trustworthy information showing that each one of the governments of these countries intends that its subjects shall take part in the exhibition. In ten of the countries named, commissioners have been appointed to care for the articles to be exhibited, and in seven or eight it is known that handsome appropriations have been made to defray the necessary expenses.

I wish I had the precise utterances of Baron Schwarz-Senborn, delivered at Philadelphia a few days since, as to the value of the late Exposition in Austria. He said that manufacturing had received a strong impulse, and that new and special branches had sprung up in and about Vienna; that looked at from this standpoint, the exhibition had been a most judicious investment. I cannot doubt that the Exhibition of 1876 will prove so to our country, for while we may have lessons to impart, there are many more we should accept."

PROFESSOR WATSON, at present one of the members of the transit of Venus expedition for this country, has found a new asteroid. This makes his seventeenth discovery of the same kind.

THE Brooklyn tower of the East river bridge was completed on the 16th of December. Its total hight is 268 feet. It is very imposing in appearance; we hope it will not prove a tower of folly.

ST MARYLEBONE SWIMMING BATH, LONDON, ENGLAND.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

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

Positions of Planets for January, 1875.

Mercury.

On the 1st of January, Mercury rises at 7h. 4m. A.M., and sets at 3h. 53m. P.M. On the 31st, Mercury rises at 7h. 57m. A.M., and sets at 6h. 4m. P.M.

Mercury and Saturn will be in conjunction on the morning of the 27th, and must be nearly together in the evening; but they are so far south in declination, and set so early, that it will not be easy to see them.

Venus.

Venus should be looked for in the morning, being west of the sun after the transit.

It rises at 4h. 56m. A.M. on the 1st, and sets at 2h. 46m. P.M. On the 31st, Venus rises at 4h. 13m. A. M., and sets at 1h. 51m. P.M.

Venus attains its greatest brilliancy on the 12th, at which time it passes the meridian a little after 9 A.M., at the low altitude of 31°.

Mars.

On the 1st, Mars rises at 2h. 18m. A.M., and sets at 0h. 47m P.M. On the 31st, Mars rises at 1h. 50m. A.M., and sets at 11h. 38m. P.M.

The apparent diameter of Mars is now very small, and its southern declination is large; of course it is not a good time for making observations on the planet.

Jupiter.

Although Jupiter's relative position is becoming better, it is yet not very favorable to observers. Jupiter rises on the 1st at 1h. 41m. A.M., and sets at 0h. 29m. P.M. On the 31st, Jupiter rises at 11h. 53m. P.M., and sets at 10h. 35m. the next morning. It can be beautifully seen at early morning.

Saturn.

Saturn, also, is far south in declination, rises in the morning, and sets early in the evening. On the 1st, it rises at 9h. 24m. A M., and sets at 7h. 10m. P.M. On the 31st, it rises at 7h. 36m. A.M., and sets at 5h. 30m. P.M.

Saturn and Mercury are nearly in the same position near the last of January.

Uranus.

Uranus is in northern declination among the small stars of *Cancer*. On the 1st, it rises at 7h. 18m. P.M., comes to meridian at 2h. 22m. in the morning, and sets at 9h. 26m. On the 31st, its position is very good. It rises at 5h. 15m. P.M., comes to meridian about midnight, at an altitude of 66°, and sets at 7h. 25m. the next morning.

Neptune.

Neptune is too far off to be seen without the aid of good telescopes. It rises at 0h. 29m. P.M. on the 1st, and sets at 1h. 35m. the next morning. On the 31st, it rises at 10h. 31m. A.M., and sets at 11h. 37m. P.M.

Meteors.

Very bright meteors were seen on the evenings of December 11, 12, and 15. One which passed from the zenith to the southwest, at 8h. 27m. P.M. on the 11th, was so large as to attract the attention of persons who occupied a brilliantly lighted room.

Sun Spots.

The record is from November 16 to December 16 inclusive. The photographic picture of the 16th shows the group of spots seen on the 14th, consisting of several very small spots. The next picture was taken on the 19th, when one large spot appears near the place where we should look for the group. Clouds prevented photographing again until the 25th, when a large spot was seen near the center of the disk, preceded by a smaller one. On the 26th, no change took place, except that caused by the sun's axial motion. From this time until December 10, on account of clouds and wind, but three pictures were taken, and no spots were observed except a very small group on December 4. December 10, a group of good size appeared, of which five photographs have been taken, showing marked changes during its passage across the disk. The picture of the 10th shows three spots of moderate size just within the eastern limb. On the 12th, the most westerly of these was surrounded by small spots arranged so as to form nearly a complete circle. On the 15th, the group consisted of five distinct spots of good size. On the 16th, no change.

GLUE.

"During the progress of a recent investigation, I observed," says S. Dana Hayes, in the *American Chemist*, "some chemical characters of commercial glue, that I believe have not been previously described.

Analyses of two samples of white glue, of the best grade, yielded the following results:

	"No. 1 extra C." glue.	Frozen glue.
Moisture (loss of weight at 212° Fah)...	16·70	16·28
Gelatin, with a little animal fiber and fats.....	79·85	80·42
Carbonate of lime.....	1·42	1·33
Sulphate of lime.....	0·41	0·34
Phosphate of magnesia.....	0·35	0·31
Alkaline salts.....	0·17	0·12
Silica, oxide of iron, etc.....	0·09	0·08
Oxide of zinc.....	1·01	1·12
Total.....	100·00	100·00

Analyses of ten more samples of frozen and sheet glue, of common grades, and from different makers, showed the proportion of water contained in them to vary from fourteen to eighteen per cent, averaging seventeen per cent. And the proportion of ash or mineral matter varied from three to six per cent, averaging rather less than four per cent. Two of these samples contained about one per cent of white zinc, and two of them contained sulphate of lime.

"Analyses of two samples of commercial gelatin averaged sixteen and a half per cent of water, and 2·56 and 3·11 per cent of ash, respectively. There was no oxide of zinc or sulphate of lime in these gelatins.

The presence of so much water was quite unexpected; and as the quantity is nearly the same in fresh and in seasoned specimens, it is not a make-weight, although steam is very freely used in the rooms where glue is packed by the manufacturers. The carbonate of lime comes from the quick lime used for cleaning and preserving the animal matter, or glue stock, while the sulphate of lime is formed by the addition of small quantities of sulphuric acid during the process of manufacture, to neutralize the lime that is carried forward by the solutions of glue. The oxide of zinc is said to be added to prevent souring, or the acidity caused by decomposition, and it also improves the color of the glue; but it is not very generally used, as these analyses indicate. I have heard of the use of sulphate of zinc, alum, magnesia, etc., by glue-makers, but I did not find any other substance than those named above in these specimens, which represented the article commonly sold and used.

The impure glues, or those containing the most mineral matter, became almost insoluble after they had been broken into small pieces and heated in a hot air bath (copper oven) at 212° Fah., for two or three hours, until they ceased to lose weight; they then soften and become dough-like, but do not dissolve when boiled in water for some time. The purer gelatins were not so much injured, and one specimen, containing only 2·56 per cent of ash, was not materially affected by this thorough drying. The solid sheet glue, while drying in this way, tumefied, and became very porous: the frozen glue did not alter in structure.

The conclusions drawn from these experiments was that the excess of lime combines with the gelatin and, perhaps, with the extraneous animal matters of the glue, at the high temperature, forming a compound like lime soap, as the whole quantity of lime is retained in the insoluble portion left after boiling the dried glue in water. Such an explanation accounts for the difference noticed in the effect of drying upon gelatin and common glue."

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From November 2 to November 26, 1874, inclusive.

ATTACHING TEAPOT HANDLES, ETC.—Tiffany & Co., New York city.
BALE TIE.—W. Cooper, Tyler, Texas.
BARREL.—A. Mason, New York city.
BOOTS AND BOOT MAKING MACHINERY.—F. D. Ballou *et al.*, Boston, Mass.
CARBURETTING AIR.—T. B. Fogarty, Warren, Mass.
CARTRIDGE SHELL.—W. F. Parker, Meriden, Conn.
CHEMICAL TELEGRAPH, ETC.—W. E. Sawyer, Washington, D. C.
DISTILLED WATER.—W. A. Lighthall, Brooklyn, N. Y.
DRAIN-PIPES, ETC.—H. Hirsch, New York city.
DRESS PROTECTOR.—C. Murphy, Camden, Me.
FASTENING BUTTONS, ETC.—Z. K. Young, Philadelphia, Pa.
FILE CUTTING MACHINE.—C. Vogel, Fort Lee, N. J.
FISH JOINT.—J. Hampson, Newburgh, N. Y.
GRINDING AND POLISHING MACHINERY.—J. H. Volk, Chicago, Ill.
IRONING MACHINE.—T. S. Wiles, New York city.
LIGHTING GAS.—H. B. Stockwell *et al.*, Brooklyn, N. Y.
LOOM WEFT STOP.—J. J. Switzer, Boston, Mass.
MECHANICAL TOY.—W. A. P. La Grove (of N. Y. city), London, England.
NOSING DEVICE FOR ANIMALS.—W. Crighton, Fall River, Mass.
PIANOFORTE.—A. Steinway, New York city.
PREPARING TEXTILE FIBERS.—H. B. Meech (of N. Y. city), London, Eng.
RATCHET BRACE.—J. W. Evans, New York city.
REAPING AND BUNDLING GRAIN.—E. Horton, Hartford, Conn.
REFRIGERATOR.—J. J. Bate, Brooklyn, N. Y.
ROTARY MOTOR AND PUMP.—J. H. Field, Edgefield, Tenn.
SEWING MACHINE.—Singer Manufacturing Company, New York city.
SHIELD FOR STOVES, ETC.—W. M. Conger, Newark, N. J.
SPINNING MACHINERY.—G. Chatterton, Providence, R. I.
STEAM ENGINE.—T. L. Jones, Natchez, Miss.
STOCKING DARNER.—O. S. Hosmer, Boston, Mass.
STOPPER.—N. Thompson (of Brooklyn, N. Y.), London, England.
STREET LAMP.—E. Parkman (of Madison county, Tenn.), London, England.
TELEGRAPH.—W. E. Sawyer, Washington, D. C.
TRIMMING WALL PAPERS.—H. L. Todd, Corning, N. Y., *et al.*
TYRES ON WHEELS.—E. Mellon, Scranton, Pa.
WATER METER.—F. W. Brooks, New York city.

NEW BOOKS AND PUBLICATIONS.

JOURNAL OF THE CHEMICAL SOCIETY OF LONDON. Price £1. 1s. ($5, gold) a year. London: J. Van Voorst, 1 Paternoster Row.

During the past three or four years, the Chemical Society of London has been engaged in an undertaking which deserves the support and recognition of all who are interested in the progress of physical, and especially chemical, science. For the past few years of its existence, the society published quarterly a report of its proceedings, including the papers on chemical subjects which had been read at the meetings. Afterwards it was found desirable to issue the Journal monthly; and this form it retained till the year 1871, when, with the aid of funds, partly derived from voluntary subscriptions by the Fellows of the Society, partly from a subsidy received from the British Association for the Advancement of Science, the society undertook the task of printing, not only papers read at the meetings in London, but abstracts giving the results of every memoir on chemical or allied physical subjects published either at home or abroad. The monthly Journal of the Chemical Society thus becomes a complete chronicle of the progress of chemistry all over the world. Taking the last number of the journal, we find that the 100 pages of which it consists contain about 150 abstracts of papers taken from seventeen different journals, including the *Annales de Chimie et de Physique*, the *Comptes Rendus* of the French Academy, the *Berichte* of the Berlin Chemical Society, Poggendorff's *Annalen*, and the *Journal fur praktische Chemie*. The student of theoretical chemistry or the manufacturer, the mineralogist, the physiologist, or the scientific agriculturist, may here find a complete and yet concise record of all that has been lately done in the department in which he is specially interested. We trust that such an important undertaking will not be allowed to fall to the ground for want of support.

THE POLARIZATION OF LIGHT. By William Spottiswoode, F.R.S., etc. Price $1. New York: Macmillan & Co., 21 Astor Place.

Mr. William Spottiswoode is the Vice-President of the Royal Society; and, although an amateur, is widely known as a profound and accomplished scientist. The book before us (No. 6 of Messrs. Macmillan's excellent NATURE SERIES) contains the substance of lectures delivered to the work people in the employ of Messrs. Spottiswoode & Co., printers, etc. The branch of optical science herein treated is clearly elucidated, and its great importance in technology and its beauty as a study of natural phenomena demonstrated in forcible and pleasing language.

TABLES FOR THE DETERMINATION OF MINERALS BY THEIR PHYSICAL PROPERTIES, ETC., for the Use of Students in the Field. Translated from the German of Alban Weisbach, by Persifor Frazer, Jr., A.M., etc.

We have here an exceedingly useful and compendious guide for explorers, who frequently have to pronounce on substances *in situ*, where no laboratory is at hand. The eminent author gives many new lights on classification, and his aim has been throughout to render the science of mineralogy as clear and accessible as its complicated nature will permit. The translator's work has been done faithfully and intelligently.

INSECTS OF THE GARDEN, THEIR HABITS, ETC. By A. S. Packard, Jr., Editor of "The American Naturalist," etc. Also (by the same Author) INSECTS OF THE POND AND STREAM. Price 25 cents each. Boston, Mass.: Estes and Lauriat, 143 Washington street.

Two numbers (of twelve) of a most interesting series of handbooks of natural history. We commend them especially to the notice of our young readers, as popular expositions of a most fascinating study.

THE STONE AGE, PAST AND PRESENT. By E. B. Tyler, Author of "Primitive Culture," etc. And "Theory of a Nervous Ether," by Dr. Richardson, F.R.S. Price 25 cents. Boston, Mass.: Estes and Lauriat, 143 Washington street.

The first of these essays is an interesting treatise on the use of stone implements in all ages, and it points out some forcible instances of the survival of the use of such tools to this day. The second paper is a *resume* of the theories on a subject which has been widely and discursively treated, with some original speculation on the supposition, which has long engaged the attention of the eminent author.

REGISTER OF RURAL AFFAIRS. Price 30 cents. Albany, N. Y.: Luther Tucker & Son.

Messrs. Luther Tucker & Son, Publishers of the Albany, N. Y., CULTIVATOR, have issued their illustrated Annual for 1875 in a very attractive form. It contains a large number of engravings of interest and use to agriculturists, and is full of practical suggestions and directions of importance to horticulturists and fancy gardeners.

THE INTERNATIONAL REVIEW. $5. Six times a year. New York: A. S. Barnes & Co.

The number for January and February contains several valuable articles. Dr. McCosh, President of Princeton College, reviews the late utterances of Professor Tyndall, about the potency of matter, and shows the weak points of his reasoning. Professor Vogel gives an article on Baron Liebig. Professor Hart discusses the proposed Centennial Exhibition and that of Vienna.

THE CHEMIST'S AND DRUGGIST'S DIARY FOR 1875.

A useful and convenient form of diary, published by the proprietors of our esteemed contemporary, the CHEMIST AND DRUGGIST, London, England.

ANNUAL REPORT OF THE TREASURER OF THE UNITED STATES TO THE SECRETARY OF THE TREASURY, for the Fiscal Year ended June 30, 1874. Washington, D. C.: Government Printing Office.

MR. JAMES VICK, one of the largest seed dealers of Rochester, N. Y. has just published the first number of his FLORAL GUIDE for 1875. This is a good sized magazine, beautifully illustrated, and containing descriptions of the best flowers and vegetables, with valuable directions for culture. It is issued quarterly in English and German, and sent to any person for the nominal price of twenty-five cents a year.

THE DOUBLE CENTURY CALENDAR AND SILICATE NOTE BOOK is the title of a pocket volume forwarded to us by Mr. C. W. Youngren of Amboy, Ill. The silicate part is useful—the balance obscures an advertisement of a well known watch concern.

DECISIONS OF THE COURTS.

United States Circuit Court.—District of Massachusetts.

PATENT EGG BEATER.—EDWIN P. MONROE *vs.* THE DOVER STAMPING COMPANY.

[In equity—September 3, 1874.]

Shepley, J.:

Complainant alleges that defendants infringe the invention secured to him by letters patent, reissue No. 1,062, dated October 16, 1860, for a new and improved egg beater. Defendants, under license from the patentees, were making and selling egg beaters under and in conformity to letters patent of the United States granted to Turner Williams and E. D. Goodrich, assignees of Turner Williams, dated May 31, 1870, and numbered 103,811.

The beater described in complainant's patent consists of a frame, to be clamped to a table or other support, with two concentric beaters, which are, by suitable gearing, revolved in opposite directions. The vessel containing the eggs to be beaten is held up to the beaters, which project downward from the frame, so that the beaters will be immersed in the matters to be beaten. By turning the crank the beaters are revolved concentrically in opposite directions. In the Monroe patent the first claim is for, "in combination with a rotary egg beater, an arm having at one end bearings for the journals to rotate in, and at the other a clamping device for the purpose of securing the beater to the table with its shaft or bearing in a vertical line, as set forth." It is not contended that defendants infringe this claim. The second claim is for "the beaters revolved in opposite directions by suitable mechanism, substantially as set forth." The Monroe beaters revolve in opposite directions, and the beaters in the Turner Williams patent also revolve in opposite directions. Here their resemblance begins and ends. The Monroe beaters revolve concentrically. The axes of the beaters in the Williams machine are at some distance apart, and the orbits described by the revolution of the blades of the beaters intersect each other. The currents produced in the matter to be beaten are entirely different. In the Monroe beater the fluid material tends to arrange itself mainly in two concentric layers, which are carried around in opposite directions by the beaters, the centrifugal force tending to accumulate the material around the circumference of the vessel. In defendant's beater this action does not take place, for the reason that the orbits of the blades intersect at two points in their circumference. After the blade of one beater has passed through the material, another beater, moving in an opposite direction, passes through the same material, obliterating the track made by the other, and so on alternately. There are other obvious and important differences in the mode of operation of the beaters, which render it too clear to admit of any doubt that the invention described in the Turner Williams patent is not an infringement of the patent to Monroe.

Bill dismissed.

Held by the court;

Making and selling egg beaters having two beaters rotating on axles separate and apart from each other, is no infringement of a patent for such an implement having two beaters rotating on the same axis, although in both cases the beaters revolve in opposite directions.

[James B. Robb, counsel for complainant.
Thomas W. Clarke, counsel for defendants.]

United States Circuit Court.—District of New Jersey.

PATENT MITER MACHINE.—GEORGE W. LA BAW *et al.*, COMPLAINANTS, AND WILLIAM HAWKINS *et al.*, DEFENDANTS.

[In equity.—Before Nixon, Judge.]

This is a suit for alleged infringement of letters patent No. 3,445, for "Improvement in miter machines," reissued to George W. La Baw, May 18, 1869, and extended by the Commissioner of Patents for seven years from May 29, 1869.

The defendants filed a joint and several answer, alleging, among other things, that the surrender made by the complainant of his original patent was not for a good and sufficient cause, and that the reissue was for a different invention, denying the infringement and setting up prior public use. They admit that they have constructed and sold miter machines containing knives or cutters in combination with mechanism for operating the same for cutting miters, under the authority of letters patent granted to one Stephen W. Hall, August 17, 1858, but deny that the said Hall machine infringes upon the invention described in the bill of complaint.

It is the judgment of the court that the defendants have infringed the second claim of complainant's reissue, and there must be a decree for an injunction and an account.

Held that:

Whenever a patent is reissued or extended, the presumption is that it is for the same invention, and the action of the Commissioner is conclusive against a charge of fraud in obtaining the extension or the reissue, as well as on other objections, unless it appears upon the face of the papers that the new patent is not for the same invention as the original.

The testimony of witnesses of whose names no notice was given to the complainants is admissible to show the state of the art; but will receive no consideration upon the question whether there had been a prior knowledge and use of the invention.

It will require strong evidence to overcome the presumption that a patented machine is substantially different from one patented before, which arises from the Commissioner's having not only issued the second patent with the knowledge of the other, but having afterward reissued it and extended it.

The experts produced by the parties having disagreed whether the machine covered by the patent in suit was anticipated by one previously patented, the court examined the question itself, and held that it was not.

A patent will not be set aside upon the mere testimony of a single witness that many years ago he saw a machine like the one described; it must be regarded at most as an abandoned experiment, no second machine having been known.

Although a man may make valuable improvements upon a patented machine and obtain patents for them, he cannot use the elements of the original machine without infringing on the first patent.

[C. A. Durgin and J. Marshall, for complainants.
Runyon & Leonard, for defendants.]

LOOKING GLASS PATENT.—THE FLORENCE MANUFACTURING COMPANY *vs.* THE BOSTON DIATITE COMPANY.

[In equity.—May Term, 1874, to wit: September 3, 1874.]

Shepley, J.:

This suit is founded on the letters patent granted to Dudley & Clark, assignees of W. N. Dudley, July 29, 1869, for an improved hand mirror. The mirror was constructed by first using a base piece of wood or other suitable material, preferably of similar contour to the glass designed to be mounted on it, and elongated at one end, with a strip of metal or other stout material at its back to form a stiffener for the handle of the mirror. The base piece, with its handle extension or stiffener, is laid, face downward, on a mold, and a composition of any suitable plastic material, in sufficient quantity to cover the back and extend beyond the edges of the base piece and surround the handle stiffener, is applied, when an upper mold of suitable configuration, and with its interior embellished with any ornamental devices, is pressed down on the plastic composition, thus making a smooth finished ornamental outer back and handle. The advantages claimed for his new manufacture by the patentee are that the handle and back of the mirror are "smooth finished, and may be highly ornamental, impervious to damp, exempt from warping, with its consequent liability of fracturing the glass, and preservative of the wooden or other base piece, which may be of a cheap and rough construction; and that by its end extension, with strengthening strip at the back, gives not only a general stability to the whole article, but especially stiffens the handle at its junction with the back or body, where it is naturally weakest or most liable to break."

The claim is: As a new article of manufacture, a hand or portable toilet mirror, constructed, substantially as described, of a base piece B, with its handle extension piece or stiffener C, glass A, and outer back or handle D, made of any suitable composition or cement, substantially as specified.

Respondent made hand mirrors, in other respects like those described in the Dudley patent, but having no "wooden or other base piece of suitable material" behind the "glass designed to be mounted on it," and having no extension from such base piece into the handle. In the smallest and weakest part of the handle two nails of iron were embedded in the plastic compositions, which formed the entire frame and handle of the mirror, but they did not extend behind the mirror, or form any base or support for the glass or the frame behind or around it.

This is clearly no infringement of the Dudley patent. The practice of molding a plastic material around a skeleton, or partial skeleton, of a material of greater rigidity is as old as anything known in the arts, was practised by the Assyrians in molding bronze, and has been in common use to the present day. Hand mirrors date back to an equally remote antiquity. Hand mirror frames, molded from a plastic composition of *papier maché* and other plastic compounds, were well known before the date of Dudley's invention. Frames for pictures and photographs of a plastic composition of shellac and other substances, molded and ornamented, were well known and described in Merrick's patent of December 16, 1868, for his new composition of matter. The patentable matter in Dudley's patent must, therefore, be found, if found anywhere, in his new composition of a base piece, with its extension or handle stiffener, with the other elements in his combination. Without such combination there would have been no new article of manufacture. It is not every new article put upon sale in the market which is a new article of manufacture. If one were to substitute a Claude Lorraine glass for the plate with its stiffened back in the Dudley hand mirror, it would be a new article of commerce, but not a new manufacture.

In the case of Clark *vs.* Scott (2 *Official Gazette*, 4), Judge Blatchford held that hand mirrors made of cement, applied in a plastic state and afterward hardened, and having embedded in the cement, and concealed from view, two flat wires or strengtheners, made of metal, which run from the body of the mirror part through the neck and into the handle, and which serve to strengthen and stiffen the article, particularly at the junction of the handle with the body, were infringements of the Dudley patent. But this was upon the ground that he found in those mirrors the base piece, the handle extension piece or stiffener, the glass and outer back and handle of cement. He says "the defendant's wires act as a base piece or support for the glass, and the wires extend through the neck and in the handle as stiffeners." But in defendant's mirrors there is no base piece or support for the glass, and no substitute or equivalent therefor. He makes a hand mirror with a molded frame of plastic compound, and he reënforces or strengthens the handle with metallic rods. There was nothing new in this before the date of the Dudley patent.

Held that:

In a hand mirror containing a wooden back with an extension for a handle strengthened by metal rods, the whole being covered with a composition, to which form is given while plastic in a mold, the novelty consists in the introduction of the wooden back and strengthened handle.

A patent for such a mirror is not infringed by one in which the back and handle are formed entirely of composition, though the handle is strengthened at its weakest part by nails embedded in it.

Clark *vs.* Scott (2 *Official Gazette*, 4), commented on and explained.

Bill dismissed.

[E. W. Bond, for complainant.
T. W. Clarke, for defendant].

REPEAL OF PATENTS.---OPINION OF THE ATTORNEY GENERAL.

The following letter of the Attorney General is of great interest to patentees and the legal profession, as it contains an announcement of the principles which will control the Government in the matter of its joinder in suits to repeal patents:

DEPARTMENT OF JUSTICE,
Washington, D. C., November 19, 1874.

SIR: On the 6th instant an application was made to me by Messrs. Curtis and Corwine for leave to use my name in a suit upon the relation of George B. Fearing, Esq., to vacate a patent issued to B. F. Sturdevant, for a coil or ribbon of blank wood for the use of pegging machines. It was alleged as a ground for this application that there was a want of novelty in the said ribbon or coil. Accompanying this application were several affidavits to the effect that Sturdevant had recently raised the price of said blanks from twelve and a half to twenty cents each, and that a similar article was offered in the market for eight cents.

I was induced to think, upon the showing then made, that the leave asked for should be granted, and you were accordingly instructed to take the necessary steps for the commencement of the suit. Since then, application has been made to me by Messrs. Curtis & Corwine to amend the bill, and at the same time Mr. Sturdevant, with his counsel, Mr. Roberts, and others, claiming to represent the manufacturers of boots and shoes, asked to have the order made for the use of my name in said suit rescinded.

It is somewhat difficult to determine in what cases the Attorney General should allow his name to be used to set aside a patent as contemplated by the Supreme Court in the case of Mowry *vs.* Whitney, 14 Wall, 434. "The ancient mode," says the court in that case, "of doing this in the English courts was by *scire facias*, and three classes of cases are laid down in which this may be done.

1. When the king, by his letters patent, has, by different patents, granted the same thing to several persons, the first patentee shall have a *scire facias* to repeal the second.

2. When the king has granted a thing by false suggestion he may, by *scire facias*, repeal his own grant.

3. When he has granted that which by law he cannot grant, he, *jure regis* and for the advancement of justice and right, may have a *scire facias* to repeal his own letters patent."

And the court further remarks that "If an individual finds himself injured, either specially or as a part of the general public, it is no hardship to require him to satisfy the Attorney General that the case is one in which the Government ought to interfere, either directly by instituting the suit, or indirectly by authorizing the use of its name, by which the Attorney General would retain such control of the matter as would enable him to prevent oppression and abuse in the exercise of the right to prosecute such a suit."

When Sturdevant's patent was issued, the question as to the novelty of the invention claimed by him was expressly decided by the Commissioner of Patents, and upon the reissue of the patent another decision of the same kind was made. I am now called upon by the relators, upon the allegation that there was no novelty in said invention, to proceed in the courts for the purpose of reversing these decisions.

To allow this would be practically to give an unsuccessful party objecting to a patent the right to appeal to the courts, and would seem also to put one department in the attitude of attacking the acts of another department of the Government. Whenever it appears that the Commissioner of Patents has become satisfied that, through fraud or mistake, a patent has been improperly or illegally issued, the Attorney General, as a general rule, in my opinion, ought, upon the relation of "an individual who finds himself injured thereby," to allow a suit to be brought on behalf of the Government to set aside such a patent. I do not mean to say, however, that the views or wishes of the Commissioner should be conclusive upon the Attorney General, but his action in such cases ought to look as well to the rights of the patentee as to the interests of those who seek its cancellation.

Taking a case like the one before me, in which the question is as to the novelty of the alleged invention, I have determined that where the Commissioner withholds his consent to a suit in the name of the Attorney General, to vacate a patent issued by him, such suit ought not to be brought until the validity of the patent in question has been denied or at least gravely doubted in a judicial proceeding between private parties, as where the patentee sues some infringer of his alleged patent. Exceptions to this rule may be admitted where persons, alleging a want of novelty in a patent, infringe it, and the patentee delays suit with a view of allowing a large claim for damages to accrue, or where, with doubts as to the validity of his patent, there are special circumstances of injustice or oppression on the part of the patentee. But to preserve something like consistency in the action of the different branches of the executive department of the Government, and to afford adequate protection to the discoveries and labors of inventors, it is necessary, in general, that the rule above stated should be observed. If the invalidity of a patent appears in a litigation about it between private parties, the Attorney General, upon a proper application, ought to interfere to prevent the patentee from harassing other persons with suits for the use of his pretended invention.

When fraud is alleged as a ground of suit in the name of the Attorney General, to repeal a patent, nothing more than to satisfy him of the existence of the fraud is necessary to the application, as such a case cannot go upon the ground that the facts disclosed to the Attorney General were not presented to or passed upon by the Commissioner of Patents.

Mr. Sturdevant has given satisfactory reasons for advancing the price of his peg wood blanks, and that it was by an arrangement with the manufacturers of boots and shoes, and for their benefit; and I am further satisfied that the public interests do not require me to take any steps to vacate his patent. You will, therefore, withdraw the bill filed, and decline any further use of my name in this matter.

Very respectfully,
(Signed) GEORGE H. WILLIAMS,
Attorney General.

George P. Sanger, Esq., U. S. Attorney, Boston, Mass.

Recent American and Foreign Patents.

Machine for Rolling Blanks for Nut Bars.

George Johnson, Haverstraw, New York.—This invention consists of a revolving clearer having notches in its periphery, in combination with a pair of rolls for rolling notched bars. The notches of the clearer correspond to the notches in the rolls for forming the hexagonal nuts, so as to mesh with the notches in the soft, hot iron as it is received and discharged by the clearer.

Improved Water Elevator.

Henry M. Sweet, East Haddam, Conn.—The shaft passes through a box flange which is attached to the brake lever. This box flange is made to slide in a slot of a curb sufficiently to throw a pinion out of gear with a wheel. The pinion is thrown out of gear, at the same time that the brake is applied, by manipulating a lever, by means of which the bucket may be stopped, when full of water, at any desired point.

Improved Garter.

Samuel Chard, Mianus, Conn.—This consists of an outside spring band and an inside adjusting band, severed at one point, and connected together. The inner band will be made a little less in circumference than the limb which it is designed to clasp. It is placed over the top of the stocking, and exerts, through the spring band, a gentle pressure sufficient to hold the stocking securely to the leg.

Securing Handles to Burial Caskets.

William S. Wood, Newtown, N. Y.—An ear plate extends from one end to the other of the handle, and is of some ornamental design. A stay plate is placed on the inside of the casket and is secured by screws and nut rivets having square shanks, which pass through square holes in the stay plate, and through the side of the case, and are riveted thereto to keep them in place before the handles are attached. The stay plate extends down through the case to near the bottom with a rib on its outer side, and has a tendency to stiffen the side of the case and keep it in shape when lifting upon the handles.

Imporved Voltaic Battery.

Dr. Robert Arthur, Baltimore, Md.—This invention relates particularly to an improvement in the mechanical construction of the batteries kuown as the Bunsen or carbon and the Grove, although it is applicable to other forms. The invention is the result of difficulties encountered in the employment of these and other well known batteries for running a small electro-magnetic engine, and for operating an electro-magnetic mallet for condensing gold in the operation of filling teeth. The battery is composed of the following elements, namely: An outer jaw or cylinder with lower end closed, having a groove or depression in its bottom containing mercury; an inner perforated cylinder having one or more tubes attached; and a carbon plate provided at the upper end with a platinum tube, and fragments of zinc in suitable quantity, the latter being placed in the annular space between the outer jar and inner perforated cylinder.

Improved Mooring Attachment for Buoys.

Henry Brown, Charleston, N. C.—The object of this invention is to provide a means of replacing the worn out loops of buoy bottoms and ballast balls, without the expense, time, and trouble usually involved in the repair of the same. It consists in making the bottom plate of the buoy with a pocket, which receives a detachable mooring link, to be fastened therein by a keyed bolt. It also consists in casting the ballast ball with two holes, which intersect each other at right angles at the center, one of which said holes receives the tapering shanks of two loops, and the other a bolt which passes through the said shanks and locks them.

Improved Water Piston for Hydraulic Presses.

John F. Taylor, Charleston, S. C.—This invention consists in a hydraulic piston formed of the usual packing rings, so united with a cut and an elastic ring that a very durable and efficient piston is obtained, while the cost thereof is comparatively small.

Improved Car Coupling.

Ezra N. Gifford, Cleveland, O.—This invention relates to certain improvements in car couplings, and it consists in the peculiar construction of a slot or recess in the side of the coupling catch, in which rests the end of a cross bolt, by means of the peculiar conformation of which said recess the said catch is controlled in its motion and position, and the danger of its loss obviated. It consists also in the inclined shape of the shoulder upon the front of the coupling catch; and the mode of locking the short cross bolt by embedding its bent end in a recess in the drawbar, whereby the said bolt is protected from incidental knocks, is always kept in place, and is easily detachable. The invention further consists in the peculiar construction of the drawbar in combination with the coupling catch and bolt.

Improved Velocipede for Picking Cotton.

Charles and George E. Hess, Huntsville, Ala.—This invention relates to means whereby a person may be enabled conveniently and with the least possible labor to pick cotton from the pod or stalk, and place the same within a bag, the said picker and his bag being supported relatively to each other during the whole operation, while the bag is readily conveyed along from point to point without manipulation.

Improved Gas Cooking Apparatus.

Thomas Peacock, Wood Green, Eng., and John C. Peacock, Finsbury Park Road, Eng.—This invention consists in economizing the heat derived from a combustion of gas by preventing the walls, top, and bottom of stove from radiating the heat generated within the oven, and it also consists in ventilating the oven by an exact supply of air, while the products of combustion are drawn off at the lowest possible level.

Improved Bracket for Dentist's Chair.

George W. Gray, Albany, Oregon.—A slotted plate is attached to a metal plate which is attached to the chair by means of a pivot joint, so that it can be inclined in any position, carrying with it a sleeve in which slides an upright tube. The last is held as desired by a set screw. A T joint is attached to the top of the upright through which passes a sleeve which slides on a feather. On the end of the arm which slides through the sleeve is an upright tube, on the upper end of which is a ball and socket joint. The ball is clamped in the socket by a set screw. A table of any form is arranged on the arms, which extend from the stem of the ball. On this table are arranged any instruments or materials used in filling and excavating teeth. Water cups are attached by means of sliding rings. When the patient is seated, the table is adjusted by means of the various mechanisms described, to bring the instruments and materials into convenient position for use.

Improved Button Boot.

Edward F. Wells, New York city.—The lower portion of the overlapping flap of a button shoe is made in one piece with the quarter. A flap piece constitutes the upper part, which is sewn to the main portion, the slit extending about half way down the latter. The seam, at the place where it bears inside against the leg, is not so liable to be hurtful as an inside seam along the instep.

Improved Rotary Harrow.

William J. Murphy and William H. Cock, Murfreesborough, Tenn.—There are two rollers, a foot in diameter, into which are screwed knives. To a cross bar is bolted another set of knives, so arranged that their paths may be midway between the paths of the knives of the rollers. There is besides a roller which is designed to roll and smooth the ground in the rear of the harrow.

Improved Wheel Plow.

John B. Herman, Blair, Neb.—The plow beam is connected to the bar by a universal joint, which gives it a free vertical and lateral movement, so as to allow the plow to be laterally adjusted to cut a deeper or a shallower furrow, or a wider or narrower furrow, as may be desired. There are besides novel devices which enable the plow to be readily adjusted to run deeper or shallower in the ground, and others by which the caster wheel may be readily adjusted to take the downward pressure of the plow, and thus decrease the friction and enable it to be drawn by less power, and mechanism which permits the plow to be readily lowered to and raised from the ground when desired, and holds it securely in place when suspended.

Improved Sheaf Dropper for Harvesters.

Perry G. Nichols and William O. Nichols, Cresco, Iowa.—The table is pivoted to the frame for tilting. It has an arm extending below the pivot at one end, to which a cord is fastened, which is suitably connected with a bell crank. The last communicates with a foot treadle in front of the driver's seat, so that by a downward movement of the foot treadle a catch will be pulled back to unfasten the table, and the table will be tilted to dump the sheaves. The table will then be turned back by gravity, the weight of the next sheaf put on by the binders, and it will be fastened by a catch and spring. The catch is so arranged relatively to the binder's table that the binder next to it can reach it readily to unfasten it by hand.

Improved Peg Box for Pegging Machine.

George H. Davis, Oxford, Mass.—This invention consists of a peg box with two feed channels for stock, to make pegs of two sizes, and feed mechanism and shifting apparatus, adapted for use in connection with the pegging machine patented by C. Varney, and so arranged that the operator can shift the feed mechanism at will without interrupting the operation of the machine, to use pegs of different sizes in different parts of the work. The invention also consists of certain improvements in connection with the cutter, and an improved form of the peg driver.

Improved Compound Metal Working Machine.

George L. Jones, Vanville, Wis.—This invention relates to improvements in the compound metal working machine patented by the same inventor, under date of September 2, 1873. The punching mechanism, substantially such as previously employed, operates a supplementary punch, so that bands, tyres, etc., may be punched at certain points with large holes, and at others with small ones at the same time.

Improved Whiffletree Tug Fastener.

James L. Graff, Petrolia, Pa.—Instead of boring the whiffletrees longitudinally to receive rods, cylindrical metal caps are applied to each end of the whiffletree. A sliding rod, having a knob at one end and a plate at the other, is formed at a right angle to each cap. A short pin projects from the center of the disk in a plane parallel with the sliding rod. A bar slides in a socket formed on the rear side of the cap, while the plate projects interiorly of the socket and a pin projects through the loop formed on the end of the socket. A coiled spring is placed in the cap between the end of the whiffletree and the plate. The ends of the traces are inserted in the loops on the cap, the pins having been first drawn back into the sockets by pressure applied to the knobs, and there secured. To release the traces, the bars are drawn toward each other by cords, which are joined to a ring between centrally arranged pulleys.

Improved Soap Bubble Toy.

William A. Harwood, Brooklyn, N. Y.—This is a little tin cup with another small cup attachment on the bottom, forming an inclosed chamber, in which is a hollow cone with a hole in the top. A small tube like a pipe stem enters the chamber at the top, and there is a passage from the cup into the chamber. There is also a small hole through the bottom of the chamber containing the cone, and around the outer edge of the bottom of this chamber is a flange projecting downward a short distance. The pipe blows along the surface of the water, and carries small quantities along with it down through the exit passage to form the bubble.

Improved Saw Gummer and Sharpener.

Henry Baughman, Dorn's Gold Mine, S. C.—This invention has for its object to improve the construction of the saw gummer for which letters patent were granted to the same inventor, February 18, 1873, and December 9, 1873. To an upright frame is bolted a block, and a support for the block, against which the straight saw is clamped to be operated upon. The inner end of this block may be inclined to one side and the other, to give a bevel to the saw teeth. The clamp, by which the saw is held, has a rabbet on its inner side for the back edge of the saw to rest upon, and is so constructed that, when one tooth is gummed and the clamp allowed to drop down, the inclination of its slots will carry forward the clamp, and with it the saw. As the clamp is again raised by a lever, a tooth of the saw will catch upon a stop attached to the block, by which the saw will be held, so that it cannot be carried back by the backward movement of the clamp, thus bringing the next tooth into position to be operated upon by the gumming wheel. Another new feature is the provision of an orifice in the block for the escape of filings.

Improved Heat Radiator.

Owin Marrin, Brooklyn, N. Y.—This invention consists in providing the inner cone of the radiator with flexible plates projecting from its base, and arranged at suitable distances apart to regulate the size of the openings, through which the heated air, gases, and other products of combustion ascend in the flue.

Improved Saw Tooth Swage.

Alonzo G. Rouse, Jacksonville, Fla.—In using this swage, the tooth of the saw is first inserted between projections, its edge projecting into a recess. Blows with a hammer upon the stock will cause the said projections to form small transverse grooves in the upper and lower sides of the tooth. The swage is then removed and adjusted to bring the edge of the tooth between another projection and the inclined end of a die. Hammering upon the end of the stock will thus bring the edge of the tooth to the proper form, obliterating the grooves and finishing the edge or point of the tooth.

Improved Polishing Machine.

William S. Wood, Newtown, N. Y.—In this device motion is effected by a rotary spindle with a chuck plate, to which is attached a spring pivot carrying a box or holder for the grinding substance, in such a manner that the pressure and stroke or motion are entirely at the command of the operator.

Improved Brick Mold.

John Treadway, Haverstraw, N. Y.—This invention consists of a removable key or wedge block placed beneath the reciprocating plunger of the machine and above the platform, whereby the amount of pressure on the brick is raised according to the quantity or condition of clay in the mold.

Improved Soap Frame.

John H. Keller, New Orleans, La.—This is a soap frame for forming soap blocks, constructed of iron side walls strengthened by longitudinal re-enforcing wooden bars, and of wooden end walls bound by the vertical flanges of the side walls, the whole being firmly clamped together and to the bottom part.

Business and Personal.

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

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Wanted—2d hand Engine and Boiler, ready for use. Address, with price and maker's name, *until Dec. 31, 1874*, to J. F. Sanders, Elizabeth City, N. C.

A Small Boat Engine, Boiler and Pump, for Sale cheap. W. H. Brown, 87 Center St., New York.

Treatise on the Steam Engine Indicator—Price $1. Address E. Lyman, C. E., New Haven, Conn.

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

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J. E. S. will find a description of mica on p. 88, vol. 25.—J. J.'s proposition as to an astronomical problem is utterly unintelligible.—W. P. will find directions for black enamel leather on p. 122, vol. 27.—E. S. can bleach moss by using a preparation described on p. 91, vol. 28.—H. W. M. and W. J. will find a description of the art of molding or modeling on p. 58, vol. 24.—C. C. will find a recipe for solder for gun barrels and other iron and steel work on p. 353, vol. 27.—J. V. will find directions for japanning iron work on p. 208, vol. 26. Bronzing is described on p. 283, vol. 31.—J. J. McG. will find directions for cleaning brass and nickel plating on p. 370, vol. 26.—F. E. W. will find a recipe for indelible ink on p. 112, vol. 27. Japanning on iron is described on p. 122, vol. 27.—W. L. A. will find an account of the canal boat award on p. 81, vol. 30.—W. C. R. can keep the rust from his plowshares by following the directions on p. 283, vol. 31.—J. W. P. will find a rule for proportioning cone pulleys on p. 180, vol. 26.—J. H. D. will find explicit directions for constructing a cheap telescope on p. 186, vol. 30.—W. P. M. will find full directions for treating sumac on p. 363, vol. 31.—B. B. B. will find a formula for silver plating without a battery on p. 299, vol. 31. Galvanizing wrought iron is described on p. 346, vol. 31.—W. J. can temper his brace bits to a straw color by the method given on p. 21, vol. 31.—W. H. H. will find directions for making a good soft solder on p. 185, vol. 27.—E. E. H. should apply to the master mechanic of a railroad.—B. F. G. will find directions for nickel plating steel on p. 43, vol. 31. Polishing brass is described on p. 102, vol. 25.—A. S. G. will find full directions for etching on glass on p. 409, vol. 31.—J. E. will find rules for calculating the proportions of gear wheels on p. 330, vol. 24.—E. B. W. will find directions for mending rubber boots on p. 268, vol. 30.—J. C. H. will find full directions for stuffing and mounting animals on p. 250, vol. 30.—H. D. P. will find a recipe for scarlet ink on p. 200, vol. 30.—C. T. will find full directions for washing flannel and other woolen fabrics on p. 267, vol. 30.—H. P. H. will find instructions for gilding on walnut on p. 90, vol. 30.—E. B. M. will find directions for turning iron on pp. 76, 122, vol. 30.—M. B. can galvanize iron wares by the process described on p. 346, vol. 31.—D. H. M. will find a description of a simple and excellent filter on p. 251, vol. 31.—J. H. B. will find instructions for gilding on china and glass on p. 41, vol. 27.—J. J. and many others will find that the anti-snoring device is illustrated on p. 34, vol. 24.—F. W. will find a recipe for the logwood and copperas dye on p. 331, vol. 31.—A. G. S. and D. M. will find a formula for harness blacking on p. 218, vol. 28.—H. C. will find ample information on measurement of engine power on p. 16, vol. 29, and on indicating engines on p. 64, vol. 30.

(1) G. W. says: 1. I have thought of making a cistern of brick inside of a series of grate and stove flues, running from the cellar to the top of a dwelling. Can I make it with iron hoops, strong enough to be safe when filled with water to a hight of 25 feet, using water lime in laying the brick and plastering inside? My object is to prevent freezing and to economize in room and brick by combining the cistern wall with the inside walls of the flues, thus making a reservoir for water by letting it run from the roof and thence to any part of the house, through pipes, properly arranged in the walls and secure against frost. A. By making the interior wall of the cistern of sufficient thickness to resist the pressure, such a construction is possible. But it is objectionable in two respects: First, the water at the bottom will be so low as to be capable of being supplied only to the lower part of the house; and secondly, the column of water will be so extended when full as to cause an undue pressure at the bottom. Both of these objections will be overcome by adopting the usual tank at the upper part of the house, and the danger of freezing in such case is less than is generally supposed. 2. Can a four inch wall of brick be built around the outside of a wooden frame building, instead of siding the house with wood, anchoring the word to the frame occasionally? The object is to save painting; it would also be safer from outside exposure to fire. A. We consider such a construction very impracticable, as the unequal settlement of the diverse materials would cause them to separate, and thus in a very short time cause the house to have the appearance of a ruin. The expense of making the wall entirely of brick, moreover, would not be much greater.

(2) W. L. says: In order to ventilate and carry off a portion of surplus heat in a small conservatory or greenhouse, I put a round ventilator in the ceiling, 18 inches in diameter, carrying a sheet iron tube of the same size through and about four feet above the roof, with a cap. The room is heated by a double tier of hot water pipes. Contrary to my expectations, instead of having an upward draft, the cold air blows down the shaft during a windy day, and on still days is sluggish and inert, affording no satisfactory ventilation. How can I obviate the difficulty? A. You do not say whether you have an opening to the outside air near the floor. If you have no such opening, we should suggest one as a remedy.

(3) A. C. R. says: No. 1 asserts that houses with cellars are healthier than those built without them; but No. 2 says the contrary, and that a house built on solid foundation without cellar is not likely to be affected by disease arising from impure air as easily as the house built on a cellar. Which is right? A. There have been so very few houses built without cellars that this question cannot be answered experimentally. If you fill a vessel with sand and then pour water into it so as to allow the latter to rise to within a short distance of the surface, you have a good representation of the way the water lies in the earth; but sometimes it is at one hight and sometimes at another. In some localities it lies deeper than in others. It this city, at one section, water can always be found within 6 feet of the surface; on the other hand, at Passaic Bridge, a well had to be sunk 60 feet before water could be obtained. *It can, therefore, easily be inferred* that the healthfulness of a house, having a cellar, will depend upon the nature of the soil in this respect, for it would make very little difference as to dampness, to a house at Passaic Bridge, whether it had a cellar or not. But answering generally as to cellars, if the first floor is set high up from the ground and is well ventilated beneath, the probabilities of health are in favor of the house that has no cellar.

(4) J. G. R. says: 1. In consequence of a too severe strain on our engine, the foundation wall is shaken. Can we remedy it by passing Rosendale cement (sufficiently diluted) into the cracks, or would it be better to bind it with bolts and plates? A. We think it would be well both to bind the foundation, and to fill up the cracks. 2. We have another foundation in which mine water has eaten the keys from the lower bolt ends, thereby causing the bolts to turn when the nuts are turned. Can I tighten the bolts in the masonry by pouring in a solution of sal ammoniac mixed with fine iron filings? A. We scarcely think you can use the sal ammoniac and iron filings, unless there is a good chance to make a driven joint. Melted sulphur will answer very well, if you can prevent it from running out of the bottom of the openings as it is poured in.

(5) E. M. asks: 1. What part of a horse power will it take to run a sewing machine? A. From 1-30 to 1-20. 2. What bore of cylinder would be the most economical to run 10 family machines? A. From 2 to 2½ inches will answer very well. 3. Will a ¾ supply pipe supply steam enough for a 2½ inches cylinder? A. In general, yes.

(6) R. L. H. says: What is the difference in temperature, or relative heat, of the oxyhydrogen blowpipe and the common blowpipe? A. The temperature of the common mouth blowpipe at its hottest point is about 2,000° Fah. That of the oxyhydrogen blowpipe has never, we believe, been accurately determined.

(7) F. W. asks: 1. How can I cover muslin with a thin coat of gum? A. You do not state what kind of gum. 2. How can I color it black inside and a light yellow outside? A. We know of no better method than that of coating it with size, and then applying the desired pigment with a brush.

How can I clean dogskin gloves? A. We can recommend benzine for this purpose.

(8) J. G. C. says: 1. What is the relation of the magnifying lenses to the condensing lenses with regard to focus in the magic lantern? A. The relation depends upon the amount to which it is desired to magnify the objects placed before the condensers. To give the relation in any particular case, it is necessary to know the character of the lenses employed. 2. What is the use of the Lieberkuhn? A. The Lieberkuhn consists in placing the small lens in the center of a highly polished concave speculum of silver, by which means a strong light is reflected upon the upper surface of an object, which is thus examined with great ease.

(9) A. D. P. asks: What is the best method of separating gold and lead? A. By means of the cupel. There is no means easier or cheaper.

There is a rock in North Carolina called the cotton stone. What is it? A. Send us a specimen.

(10) C. A. asks: What kind of furnace or retort is used in making lampblack? A. The burning of the tarry and pitchy combustibles is carried on in any suitable furnace. The smoke is conducted through long horizontal flues terminating in chambers hung with sacking, upon which the lampblack is deposited.

(11) S. P. B. asks: What kind of steel are files made of? A. Generally from cemented steel, rolled or hammered. 2. What is the difference between cast and spring steel? A. The first is cemented steel, melted, cast into ingots, and rolled into bars. Spring steel is produced, according to Bauerman, by heating blistered steel to an orange red heat, and drawing down in size by hammering or rolling.

(12) T. A. C. says, in reference to lining shafting (p. 340, vol. 31): Suppose T. F.'s shafting is already up, and has got out of true: do not put him to the trouble of removing it from the bearings, but tell him to stretch a line parallel with the shafting, that is, equidistant from the ends, as close to the shafting and as near level with its center as the surroundings will permit. True it laterally by the line and then level it up. A. This is a good method for an experienced workman, but the other is best adapted for general use.

(13) I. G. H. says: *To run a saw mill*, we have an engine 14×36 inches stroke, with an 8 feet driving wheel, belting to a pulley on the main countershaft only, 3½ feet diameter, surface 15 inches. This pulley is so small (in order to give the necessary speed) that the belt will slip. Can we, by putting in another countershaft, improve the mill by belting from the engine, and then to the present shaft, thereby giving an opportunity to increase the pulleys to a size that will prevent slip? The engine is said to be 60 horse power. It is argued that this extra shaft would take so much more power that the engine would not drive the mill. Can you tell us about how much power it would consume to drive this extra countershaft, it being about 8 feet long? A. The change suggested would be a decided improvement; and instead of a loss, more of the power of the engine would be utilized than at present.

(14) E. C. D. Jr. asks: How can I test soda ash? A. The test is to find how many measures of diluted acid are required to destroy the alkaline reaction of and to neutralize 100 grains of a specimen of soda salt. *The acid is measured in the alkalimeter*, which is a straight glass tube, or very narrow jar, with a lip, about ⅝ of an inch in width and 14 or 15 inches in hight, generally mounted upon a foot, and capable of containing at least 1,000 grains of water. It is graduated into 100 parts, each of which holds 10 grains of water. To form the test acid, 4 ozs. oil of vitriol are diluted with 20 ozs. of water, or larger quantities of acid and water are mixed in these proportions. About ¾ oz. bicarbonate of soda is heated strongly by a lamp for an hour, to obtain pure carbonate of soda, of which 171 grains are immediately weighed, that quantity containing 100 grains soda. This portion of carbonate of soda is dissolved in 4 or 5 ozs. hot water, contained in a basin and kept in a state of gentle ebullition, and the alkalimeter is filled up to 0 with the dilute acid. The measured acid is to be gradually poured into the soda solution, till the action of the latter on test paper ceases to be alkaline, and becomes distinctly acid, and the measures of acid necessary to produce that change accurately observed. The last portions of the acid must be carefully added by a single drop at a time. It may probably require about 90 measures. In applying the test acid, it is poured from the alkalimeter, as before, upon 100 grains of the soda salt to be tested, dissolved in two or three ounces of hot water, the liquid being stirred with a glass rod after each addition of acid. The salt contains as many grains of soda as it requires measures of acid to neutralize it, and, therefore, so much alkali per cent. The first trial, however, should only be considered an approximation, as much greater accuracy will be obtained on a repetition of it. The experiment is often made in the cold; but it is very advantageous to have the alkaline solution in a basin, in which it is heated and evaporated during the addition of the test acid. The indications then become greatly more clear and decisive, both from the expulsion of the carbonic acid and the concentration of the solution. With such precautions the proportion of soda may be determined to 0·1 grain in 100 grains salt; and an alkalimetrical determination, made in a few minutes, is not inferior in precision to an ordinary analysis.

(15) B. L. H. asks: Is the pressure in a boiler greater at the mud valve than it is at the safety valve or other part of the boiler above the water? A. The pressure is greatest at the lowest point in the boiler, and least at the highest point.

(16) W. F. McK., H. B., and many others say: We are about to build small engines to drive lathes, etc. Please give the proper dimensions for a cylinder, say, 4 inches long. We want the dimensions of all the working parts. A. Make a drawing of a large engine of good design on a reduced scale. This will give you a fair idea of the proportions.

(17) H. B. asks: What sized boiler should I use, with how many flues, to furnish steam to two cylinders 2¼×1½ inches? A. Make the boiler with from 18 to 20 square feet of efficient heating surface per horse power.

(18) A. B. C. says: We are sinking a shaft in very hard rock, below the 700 feet level. The shaft at the 700 feet and about 15 feet below is running at an angle of 59°, and is 8 feet long by 4½ feet wide in the clear. At the 700 feet, a tunnel was run in the hanging wall or side about 12 feet, when we cut soft ground. We want to get the shaft into this soft ground in order to sink it faster. How far shall we have to sink before we strike it, as we are now running at an angle of 54°? A. About 118 feet.

(19) E. W. M. asks: If a pipe from a large tank has a check valve placed at the end, and a pipe of the same diameter has a check valve on the same level as that in the pipe from the tank, the water in the tank and pipe being of the same head, on which check valve is the pressure the greatest? A. The pressure will be the same on each, and water will flow with the same velocity from each, if the heads are equal.

Is steam used for heating buildings ordinarily hotter than that which is used for working steam engines? A. No.

How can I whiten ivory after it has turned yellow? A. Rub it with pumicestone and water, and expose it to the rays of the sun in an airtight glass case. Repeat the operation several times, if necessary.

You gave a recipe for bluing glass chimneys; will not the heat cause the color to peal off? A. No.

What causes blistering on paint, when heat is applied? A. The moisture in the paint is vaporized.

You give a recipe for plating small articles without a battery, taken from Watt's "Metallurgy." Will that plating stand for 6 months with moderate handling? A. Yes.

(20) F. O. asks: How can I dye feathers to a red color, to be waterproof, for fishing flies? A. Take 1 oz. Brazil wood in powder, ½ oz. alum, ¼ oz. vermilion, and 1 pint of vinegar; boil them to a moderate thickness, and dip the feathers (they first having been soaked in hot water) into the mixture.

(21) C. D. asks: Can aluminum be worked? A. Yes, readily. In small quantities it costs as much as silver.

1. Will an engine of 2 inches stroke run a 6 inch turning lathe? A. Yes. 2. Should the engine be connected by a belt to the flywheel shaft of the lathe? A. You can use a belt from 1 to 2 inches wide, with a wheel on engine 8 inches in diameter, and another on lathe shaft of 6 inches.

Speaking of a 6 inch gear wheel, does it mean 6 inches in diameter over all, or from base of tooth to base of opposite tooth? A. It is the diameter of the pitch circle.

In what book can I find practical instruction for building model engines? A. We do not know of any that distinguishes a model steam engine from an ordinary one.

(22) N. J. J. asks: How many fish can be raised in a pond containing an acre of ground supplied with 100 gallons of water per minute? A. Try to raise as many as possible, and the principle of the survival of the fittest will regulate the matter.

(23) H. B. asks: 1. Will a cast iron shell turned down to the proper thickness do for a small boiler? A. It would be better, in most cases, not to turn it down at all. 2. What is used for packing the joints of a boiler three feet long? A. Rivet and caulk the joints. Ordinarily, no packing is used. 3. To what degree must iron be heated to melt common solder, and could soldering be used on boiler joints? A. To about 400° Fah. It could be used as suggested.

1. Is it possible to obtain good small sized castings of iron? A. Yes. You must have seen plenty, such as stove castings and the like. 2. Is copper cast? A. Yes. It is ordinarily sold in cast ingots.

(24) F. H. and others: It is always best to place the tightener on the slack side of the belt; and to get the greatest driving power, it should be placed close to the small pulley.

(25) J. B. P. asks: Does any harm arise from using, in the cylinder of a steam engine, a mixture of black lead, sulphur, and tallow, or black lead and tallow? A. With a surface condenser, the collection of the lubricant in the tubes sometimes causes trouble. Impure tallow frequently eats away the tallow. It is better to use good oil.

1. What is the best material for an idle pulley, used in a sawmill for transmitting motion to reverse the carriage? A. Cast iron. 2. What material is best for use in making a friction feed pulley in a sawmill? A. Cast iron. 3. Why do saws which have been worn down from 60 to 54 inches require hammering to make them run stiff enough to work? A. A saw is generally strained somewhat in the rim, and when run down it must be strained again.

I have a boiler, 14 feet long by 51 inches diameter, with 39 three inch tubes; outside diameter of tubes is 3 inches. The tubes are contained in that portion of the boiler below a line drawn 30 inches from bottom of boiler. How much water will it take to fill the boiler to a line drawn 2 inches above top row of tubes? A. You can readily calculate the volume of that part of the boiler diminished by volume of tubes.

(26) E. H. S. says: We have a schoolroom 30x23x about 14 feet. The acoustic properties of this room are very poor; at times it is hard for the teacher to make herself understood. What can we do to improve them? A. The echo has been destroyed or materially reduced in rooms of this kind by breaking up the reflex of sound, from the wall opposite the speaker, by wires. As has been explained in our previous issues, the manner of doing this, lately adopted in England, is to stretch the wires from floor to ceiling at about 6 inches apart, and, say, 6 inches out from the face of the wall. This may be tried at first for a space of about ⅓ the width of the room, at the center of the wall, and if found beneficial, afterwards extended.

(27) H. L. H. asks: How can I plate with nickel? A. Use the chloride of nickel for a solution with a nickel positive pole, and proceed in the same way as with silver plating.

(28) T. D. M. asks: Where is meerschaum found? A friend says that it is a clay in the ocean, and is washed by the waves to shore and collected in dust-like form. I think it is dug out of the earth. Which is right? A. The word meerschaum is German for froth of the sea, in allusion to its lightness and whitish color. It is a hydrated silicate of magnesia, and occurs in Asia Minor, in stratified earthy or alluvial deposits at the plains of Eskihisher, where, according to Dr. J. Lawrence Smith, it it has proceeded from the decomposition of carbonate of magnesia, which is imbedded in serpentine in the surrounding mountains. It is also found in Greece, at Hrubschitz in Moravia, in Morocco, and elsewhere.

(29) O. asks: 1. Is there any known process by which cotton seed oil can be thoroughly and economically refined? A. In the strictest sense, what is called by the trade refined oil is more or less pure oleic acid. This so-called refining of the oil is the abstraction of the dark color, accompanied by improvement in flavor, and may be accomplished by washing the oil in a solution of caustic potash or soda: but in nearly every case it will be previously necessary to submit the oil to a thorough steaming and washing with hot water, so as to remove from the oil as much as possible of the mucilaginous and albuminous matters, met with in the crude oil sometimes to a very large amount; if this precaution is neglected, there will be more waste, that is to say, a larger amount of alkali will e necessary, and in consequence thereof a larger proportion of the more solid fatty matter of the oil is abstracted. The mixed liquids—alkaline lye and oil—after having been beaten up together, separate in three distinct layers on being left to repose: the upper one is nearly colorless, so-called refined oil; the middle layer is the still yet dark colored, saponified solid fat of the oil, while at the bottom is found the dark, almost black colored alkaline lye. Owing to the great discrepancy of impurity of the crude oil (some being evidently pressed from the damaged seed) it is impossible to state exactly what yield of purified oil may be obtained. It has been found that under the most favorable circumstances 100 parts of the previously steamed oil yielded from 85 to 88 parts of refined oil. It has been found, in practice, that potash for some reason or other answers the purpose of cutting down the oil much better than soda. 2. What are the uses to which thoroughly refined cotton seed oil could be put? A. The refined oil is notoriously exported for the adulteration of olive oil.

(30) I. J. S. asks: Is there anything which will effectually destroy magnetism in steel parts of watches, except passing them through the fire? A. No.

(31) C. A. asks: How can I smooth the surface of a glass eye, it having become rough by reason of the wear of the eyelid? A. Try rubbing with a little putty powder.

(32) J. S. asks: What is a good book on astronomy, in which I could find the names and positions of the principal stars, and also the focus and power of lenses for telescopes? A. Try the "Handbook of the Stars," in the Cambridge series.

What is an argand burner? A. This is an arrangement for increasing both the supply of air and the burning surface of the flame. In the candle flame and gas jet, combustion takes place only on the outside. The argand burner has a circular wick by which a second current of air is admitted to the interior of the flame, thus burning with a double surface. The effect is increased by a glass chimney contracted so as to deflect the ascending outer current of air strongly upon the flame. Your other question should be referred to a physician.

(33) E. T. C. asks: How can I make ordinary dry Venetian red into a cake or ball suitable for use on a striking line, as a carpenter uses chalk? A. Make it into a thick paste with water, and dry.

How can I stain and polish a violin? What kind of varnish is used? A. Boil together Brazil wood and alum, and before applying it to the wood add to it a little potash. A suitable varnish for wood thus tinged may be made by dissolving amber in oil of turpentine, mixed with a small portion of linseed oil.

I have heard that split timber, such as spokes, would season much faster if set up on end to season. Is it a fact? A. Probably, from the larger surface exposed to the air.

(34) A. M. asks: How can I color gelatin? A. The gelatin is either melted or dissolved in a limited quantity of water, and the tint desired is obtained by adding one of the aniline colors. It is then poured on to a smooth warm iron plate and immediately poured off again, leaving a thin film still adhering to the plate. This is allowed to dry. It may then be cut into the required shape.

(35) S. F. B. asks: How shall I arrange to burn brimstone so as to whiten a hat by the fumes? A. Put a chafing dish with some lighted charcoal into a close room or large box, then strew one or two ounces of powdered brimstone on the hot coals, hang the articles in the room or box, make the door fast, and let them hang for some hours.

Is it not a good plan to hang the watch at night with the stem downwards, so that the bearings will wear on opposite side from where they do in the daytime while in the pocket? A. Possibly.

(36) S. S. W. asks: 1. Can neatsfoot oil be extracted from leather so as to be used again? A. Try boiling with water for a long time. The oil will be found on the surface of the water. 2. Can soap be made from the oil? A. Yes, with an alkali. 3. What is the mode of bleaching oil, and purifying it from foreign particles? A. By straining or filtering, and heating several times with equal quantities of rose water, with constant agitation.

(37) M. K. W. asks: We cannot make a portable gas machine work, as we do not know what proportions of sulphuric acid to use to a gallon of water. A. One part of acid is diluted with four or five parts of water. 2. What is carbon oil (used in the bottom as a purifier)? A. We do not know of any oil by this name. Benzine, naphtha, or gasoline will answer the purpose. See answer on p. 379, vol. 30.

(38) G. D. asks: If I place a lighted alcohol lamp under a glass receiver, it will burn a moment or two until the oxygen is exhausted; what is the difference in pressure per square inch of the air outside, and the air, *minus* oxygen, inside? A. The difference is proportional to the difference in volume; but what that difference is will depend upon the temperature, barometric pressure, etc. Alcohol is $C_2H_6O_2$, the carbon burning to form its volume of CO_2, equal to the volume of the 8 atoms of oxygen with which the carbon combines. The hydrogen in excess of $2H_2O$ forms vapor of water, which when condensed produces the diminution of volume noticed.

(39) J. S. P.—See the books on water colors and water color painting by Rowbotham, Findley, and Barnard.

(40) J. C. & Co. ask: Do you know of any method of keeping scales from the bottom of a boiler? A. We can recommend nothing better than a good feed water heater.

1. How much lower should the tail end of a 20 feet bolting reel be than the head for wheat flour? There is considerable difference of practice among millers, but one foot fall will answer very well. 2. Why do some millers steam the wheat before grinding? A. We would be glad to hear something about this from millers who practise it. Your question as to power of engine is too indefinite.

(41) J. B. asks: How do worms get into apples? A. They eat their way in.

(42) O. P. asks: 1. What power is required to raise 100 lbs. 40 feet high in 4 minutes? A. ⅓ of a horse power. 2. What power is required to raise 100 lbs. 40 feet high in one minute? A. ⅓ of a horse power. 3. A balance (or any heavy wheel) starts slowly. What laws govern this force? A. The same laws as govern the raising of a weight equal to the resistance of the wheel.

(43) W. H. asks: How can I melt sandarac for making the polish for black walnut wood described by you on p. 315, vol. 30? A. Gum sandarac melts readily on the application of a moderate heat.

(44) M. T. asks: How is gun cotton made? A. Pour equal parts of strong concentrated sulphuric acid, of specific gravity 1·84, and fuming nitric acid into a porcelain basin; as much cotton wool is steeped in the fluid as the acid is capable of thoroughly moistening, and the vessel covered with a glass plate, and left for a few minutes. The cotton wool is then removed from the acid, immediately transferred to a vessel containing a large quantity of water, and washed with care, the water being renewed until no more acid adheres to the gun cotton, which is next dried in a current of warm air, and finally combed to remove all lumps. The cotton should not be left too long in the acid, as it becomes entirely dissolved.

(45) M. E. P. asks: Will it add to the power of an engine to increase the length of cylinder and of course proportion all other parts to the increased length of cylinder, the number of revolutions and the pressure of steam remaining the same? A. Yes.

(46) C. E. S. asks: 1. Can a young man of 3 years' experience in the engineering and draftsman's business, not a graduate of any college, enter the navy to work under some engineer in that business? A. We think it quite likely. Address a letter of inquiry to the Chief of the Bureau of Steam Engineering, at Washington. 2. How can he become a member of the Mechanical Engineers' Association? A. We do not know of any such association in this country.

(47) S. M. W. says: I am very desirous of having an electric light for use in illuminating a magic lantern and illustrating other objects in a schoolroom. What apparatus shall I require? Will a battery or an electro-magnet be best? How long will the battery run without being renewed, and what form of battery would be best? A. You require two pencils of charcoal or baked carbon, and a battery of 50 carbon cells. The battery will cost about $150. The length of time that the battery would last and cost of running it would depend upon its use. If you used it every evening for several hours, the battery would require to be renewed every day, at an expense of about $3.

(48) O. H. asks: 1. The weight of a pile driver is 100 lbs., falling 20 feet; what is the force of the blow? A. We do not know of any rules by which it could be calculated. 2. Would a weight of 500 lbs. increase the force to five times? A. Yes.

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

A. B. C.—Quartz rock.—R. M. K.—It is black oxine of iron.—W. F. B.—It is iron pyrites.—J. B. T.—It is called iron pyrites, and is composed of iron 46·7 per cent, and sulphur 53·5 per cent.—R. W. T.—No. 1 is datholite or borate of lime with native copper. No. 2, 3, and 7 are calamine or silicate of zinc. No. 4 is micaceous schist. No. 5 is siderite or carbonate of iron with red oxide of iron. No. 6 is conglomerate rock.—D. W. D.—No. 1 is clay mixed with scales of mica and impregnated with oxide of iron. No 2 is sulphide of lead or lead ore. No. 3 is striped jasper. No. 4 is black marble.—A. H. C.—It is not, as you suggest, either tourmaline, sphene, or zircon. It is pyroxene.—J. K.—The sample contained very few entire specimens of *pinnularia*, and it was much more difficult to obtain perfect specimens of *navicula*, which were also present. The amount of fine sand and grit present requires that the earth be treated with extreme delicacy and caution, for which reason we consider the deposit of little value.—A. W. H.—Chemical analysis of your specimen of soil shows the presence of common salt or chloride of sodium and traces of other chlorides. Along with these are the sulphates of soda and lime, also a small amount of alumina and oxide of iron. Particles of quartz, both white and colored, are mixed up with the powder, and shreds formerly belonging to plants and probably marine animals also.—The large beetle received some time ago without name or address is the *scarabæus tityris*, and the curious spider belongs to the genus *galeodes*.

H. P. asks: How can I imitate twist on the barrel of a gun?—G. F. C. asks: Can rosin be removed from varnish after it has settled and hardened upon it without injuring the varnish, for instance, from a violin that is varnished?—W. S. H. asks: 1. Has it ever been discovered whether there is an open polar sea at the south pole? 2. Did Captain Ross ever make any northern explorations?—L. McB. asks: What kind of varnish is the best for a violin? Should the violin be oiled before applying the varnish?—J. H. F. asks: Who was the discoverer of the method of manufacturing tinfoil used in America?—J. D. H. asks: 1. What can I put in aniline dye for coloring wood, so as to enable it to take a bright polish after being dried? 2. How can I stripe wooden balls in different colors, so that the colors will not run ogether, and will dry quickly?—H. P. L. asks: How can I make paper pulp from old scraps of paper?—F. W. D. asks: How are violins stained?—W. H. A. asks: 1. I want to make some piano wires. How is it done, and how are they tempered? 2. How can I plate steel wire?—F. N. D. asks: What is the rule by which paper can be cut so as to cover a globe?

COMMUNICATIONS RECEIVED.

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

On Shoddy. By J. L. N.
On Blast Furnaces. By E. J. H.
On Drawing in Education. By G. R. D.
On a Magneto-Electric Machine. By E. G. W.
On Cable Telegraphy. By G. L.
On Double Entry Bookkeeping. By S. G.
On a Wonderful Mechanism. By G. R. K.
On a Flying Machine. By T. H. C.
On Cast Iron in Boilers. By J. W. H.
On Curious Apples. By E. L. E., and by C. L. S.
On Zinc in Boilers. By J. W. C., and by L. T. W.
On Machine Belts. By J. R. P.
On Removing Snow. By ——.
On Boiler Explosions. By R. D. W.
On Modern Spiritualism. By S.

Also enquiries and answers from the following: W. W.—M. C. G.—J. B.—J. K.—E. L. E.—A. H. M—S. L. G.—P. H. B.—V. W.—F. B. M.—F. W. P.—J. M.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells books on watch and clock making? Whose is the best work on oil painting as a fine art? Who sells double-barreled breech-loading hunting rifles? Where can chrome steel be obtained? Who makes the best lime kiln? Why do not manufacturers of explosives advertise in the SCIENTIFIC AMERICAN? Whose is the best rock drill?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending

December 1, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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EXTENSION GRANTED.

10,882.—CLOTHES WRINGER.—G. J. Colby.

DISCLAIMER FILED.

10,882.—CLOTHES WRINGER.—G. J. Colby.

DESIGNS PATENTED.

905.—MULEY SAW FRAME.—T. E. Chandler, Indianapolis, Ind.
906.—PIPE STEM.—W. Demuth, New York city.
7,907.—PIPE STEM.—W. Harvey, New York city.
7,908.—STAIR RODS.—M. Krickl, New York city.
7,909.—FORK HANDLES.—C. Osborne, North Attleborough, Mass.
7,910.—TYPE.—A. Little, New York city.
7,911 & 7,912.—SODA WATER APPARATUS.—G. F. Meacham, Newton, Mass.
913.—SODA WATER APPARATUS.—F. H. Shepherd *et al.*

TRADE MARKS REGISTERED.

,909.—WORM MEDICINES.—A. W. Allen, New York city.
2,910.—FLOUR.—F. Bertschy, Milwaukee, Wis.
2,911.—SHEET IRON.—British & Co., San Francisco, Cal.
2,912.—CLOCKS.—B. J. Davies, New York city.
2,913.—DRESS GOODS, ETC.—Everett Mills, Lawrence, Ms.
2,914.—BLUING.—G. A. Moss, New York city
915.—CIGARS.—Sartorius & Retzig, Memphis, Tenn.

SCHEDULE OF PATENT FEES.

On each Caveat $10
On each Trade mark $25
On filing each application for a Patent (17 years) $15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
On appeal to Commissioner of Patents $20
On application for Reissue $30
On filing a Disclaimer $10
On an application for Design (3½ years) $10
On application for Design (7 years) $15
On application for Design (14 years) $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, NOVEMBER 25 to DECEMBER 3, 1874.

4,087.—S. J. Wright, Madrid, St. Lawrence county, N. Y., U. S. A combined carriage wrench and bit brace, called "Wright's Combined Carriage Wrench and Bit Brace." Nov. 25, 1874.

4,088.—W. S. Taylor, Toronto, Ont. Improved ticket system, called "Eureka Street Car Ticket System." Nov. 25, 1874.

4,089.—E. A. Yerkes, Philadelphia, Pa., U. S. Improvement on the manufacture of shovels and spades, called "Yerkes' Improvement in the Manufacture of Shovels and Spades." Nov. 25, 1874.

4,090.—D. Renshaw, Boston, Mass., U. S. Improvements on sectional steam generators, called "The Renshaw Boiler." Nov. 25, 1874.

4,091.—T. R. Crampton, No. 11 Victoria street, Westminster, England. Improvement in the manufacture of iron and steel, and on the construction and lining of revolving furnaces, and on apparatus connected therewith, called "Crampton's Improvements on the Manufacture of Iron and Steel, and in the Construction and Lining of Revolving Furnaces, and on Apparatus connected therewith." Nov. 26, 1874.

4,092.—J. F. Cass, L'Original, Prescott county, Ont. Improvements on folding stands, called "The Improved Folding Stand." Nov. 26, 1874.

4,093.—C. M. Nes, York, York county, Pa., U. S. Improvement on the manufacture of steel, called "Silicon Steel." Nov. 26, 1874.

4,094.—S. Keyes, Bennington, Bennington county, Vt., U. S. Improvement on steam boiler furnaces, called "Keyes' Improved Steam Boiler Furnace." Nov. 26, 1874.

4,095.—E. M. Slayton, Port Byron, Cayuga county, N. Y., Improvement on seamless paper vessels, and the machinery for manufacturing the same, called "The Slayton Seamless Paper Vessel." Nov. 26, 1874.

4,096.—M. E. Zeller, Ivesdale, Champaign, Ill., U. S. Improvements on harness findings, called "Zeller's Harness Finding." Nov. 26, 1874.

4,097.—W. J. Kent, Buffalo, Erie county, N. Y., U. S. Improvements on reed organs, called "Kent's Improved Reed Organs." Nov. 26, 1874.

4,098.—C. A. Blomquist, La Porte, La Porte county, Ind., U. S. Improvements in railway rail joints, called "Blomquist's Improved T Rail Joint." Nov. 26, 1874.

4,099.—W. F. Patterson, Boston, Mass., U. S. Improvements on screw drivers, called "Patterson's Reversible Screw Driver." Nov. 26, 1874.

4,100.—R. Freeland, Montreal, P. Q. Improvements on the manufacture of soap, called "Freeland's Automaton Soap Maker." Nov. 26, 1874.

4,101.—G. W. Brown, Buffalo, N. Y., U. S. Improvements on spring beds, called "Brown's Improvement in Spring Bed Bottoms." Nov. 26, 1874.

4,102.—S. W. Reese and J. F. Wright, Chicago, Ill., U. S. Improvement on stencil plates, called "Reese's Adjustable Stencil Letters." Nov. 26, 1874.

4,103.—G. Curtis, Ogdensburgh, St. Lawrence county, N. Y., U. S. Improvements on water wheels, called "Curtis' Turbine Water Wheel." Nov. 26, 1874.

4,104.—R. J. Took, Montreal, P. Q. Improvements on shirts, called "Took's Shirt." Nov. 26, 1874.

4,105.—R. Ross, Vergennes, Addison county, Vt., U. S. Improvements on machines for finishing horse shoe nails, called "Ross' Machine for Finishing Horse Shoe Nails." Nov. 26, 1874.

4,106.—J. Leith, Ridgway, Elk county, Pa., U. S. Improvements in car couplings, called "Leith's Automatic Car Couplings." Nov. 26, 1874.

4,107.—B. A. Whitaker, Wellington Square, Wentworth county, Ont. Improvements in rollers for curtains, called "The Acme Curtain Roller." Nov. 27, 1874.

4,108.—W. T. Root and W. G. Wood, Ingersoll, Oxford county, Ont. Improvement on boilers, called "Root & Wood's Improved Boiler for Steam Power and Heating Buildings." Nov. 27, 1874.

4,109.—W. H. Fulton, Foxcroft, Piscataquis county, Me., U. S. Improvements on machine for raising or extracting stumps, rocks, etc., called "The Iron Giant." Nov. 27, 1874.

4,110.—F. A. Lockwood, Fall River, Bristol county, Mass., U. S. Improvements on machine for scouring, glossing or setting leather or beaming hides, called "Lockwood's Hide and Leather Working Machine." Nov. 27, 1874.

4,111.—F. W. Ofeldt, Newark, Essex county, N. J., U. S. Improvements on gas machines for the vaporization of gasoline or other volatile hydrocarbons, called "Star Gas Machine." Nov. 30, 1874.

4,112.—J. B. Camyré, Montreal, P. Q. Improvement in boilers for washing clothes, called "The Nonpareil Steam Washing Machine." Dec. 1, 1874.

4,113.—T. Wallace, Chicago, Cook county, Ill., U. S. Improvement in emery stone pearling machines, called "Wallace's Emery Stone Pearling Machine." Dec. 1, 1874.

4,114.—C. Mee & J. George, Kingston, Ont. Improvement on melodeons and organs, called "Mee's Improvement on Organs and Melodeons." Dec. 1, 1874.

4,115.—Wm. Inglis, Bolton, Lancaster county, Eng., and J. Inglis, Montreal, P. Q. Improvement on elevator vessels, called "Improved Grain Elevator Boats." Dec. 1, 1874.

4,116.—N. Nilson, Minneapolis, Hennepin county, Minn., U. S. Improvement on steam brakes for railway cars, called "Nilson's Steam Brake for Railway Cars." Dec. 1, 1874.

4,117.—G. Ott, Warwick township, Lambton county, Ont. Extension of No. 247, called "Ott's Beehive." Dec. 1, 1874.

4,118.—C. P. Holmes, New York city, U. S.—1st Extension of 1,704, called "The United Canada Churn." Dec. 2, 1874.

4,119.—C. P. Holmes, New York city, U. S.—Second Extension of 1,704, called "The United Canada Churn." Dec. 3, 1874.

4,120.—R. Dudley, Erie, Erie county, Pa., U. S. Improvements on torsion springs for cars, wagons, etc., called "Dudley's Improved Torsion Spring." Dec. 3, 1874.

4,121.—E. Chesterman, Philadelphia, Pa., U. S. Improvements on apparatus for registering and classifying the fares of passengers, called "Passenger Fare Enumerator and Classifier." Dec. 3, 1874.

PUBLISHED WEEKLY.

THE SCIENTIFIC AMERICAN FOR 1875.

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A year's numbers contain 832 pages and SEVERAL HUNDRED ENGRAVINGS. Thousands of volumes are preserved for binding and reference. The practical receipts are well worth ten times the subscription price. As an Instructor and Educator the SCIENTIFIC AMERICAN has no equal. It is promotive of knowledge and progress in every community where it circulates.

TERMS.

☞ By the new law which goes into operation January 1, 1875, publishers are required to pay postage in advance. The subscriber then receives his paper through the Post-office free. ☜

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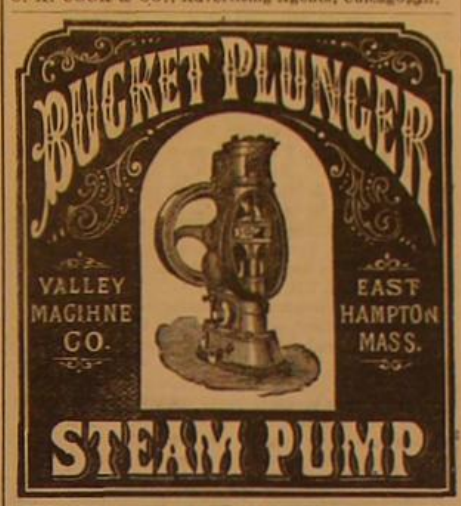

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XXXII.—No. 2. [NEW SERIES.] NEW YORK, JANUARY 9, 1875. [$3.20 per Annum, Postage prepaid.

THE BUCKEYE AUTOMATIC ENGINE.

The accompanying engravings represent an improved automatic cut-off engine, built by the Buckeye Engine Company, Salem, Columbiana county, Ohio. The manufacturers claim for this machine that it satisfies the conditions necessary for the highest attainable economy in the use of steam, and, at the same time, that it is so simple in construction as to be but a trifle more expensive than an equally well designed throttling engine.

The slide valve, shown in section in Fig. 3, is in one sense a small moving steam chest; the live steam enters its interior through circular openings in its back or cover, and thence passes into the cylinder, whose ports near its ends are alternately brought to coincide with the cylinder ports.

The exhaust takes place at the ends of the valve into the ends of the chest, thence through ample passages into the exhaust pipe. The tortuous exhaust passage, involved in the use of the common slide valve, is thus avoided. As a result, the indicator cards show a remarkable freedom from back pressure, even at high piston speed, as will be seen from the diagram, Fig. 4. The data forwarded to us in connection with this card are Cylinder 12x20, speed 160 revolutions; scale of indicator 48 lbs. per inch; steam pressure, per gage, 80 lbs.; clearance 2½ per cent; atmosphere 14 lbs.; mean calculated effective pressure, 30¼ lbs.; horse power, 55·23; and water per horse power per hour, 18·32. The reader, from this can make his own deductions as to the operation of the valves

Fig. 1

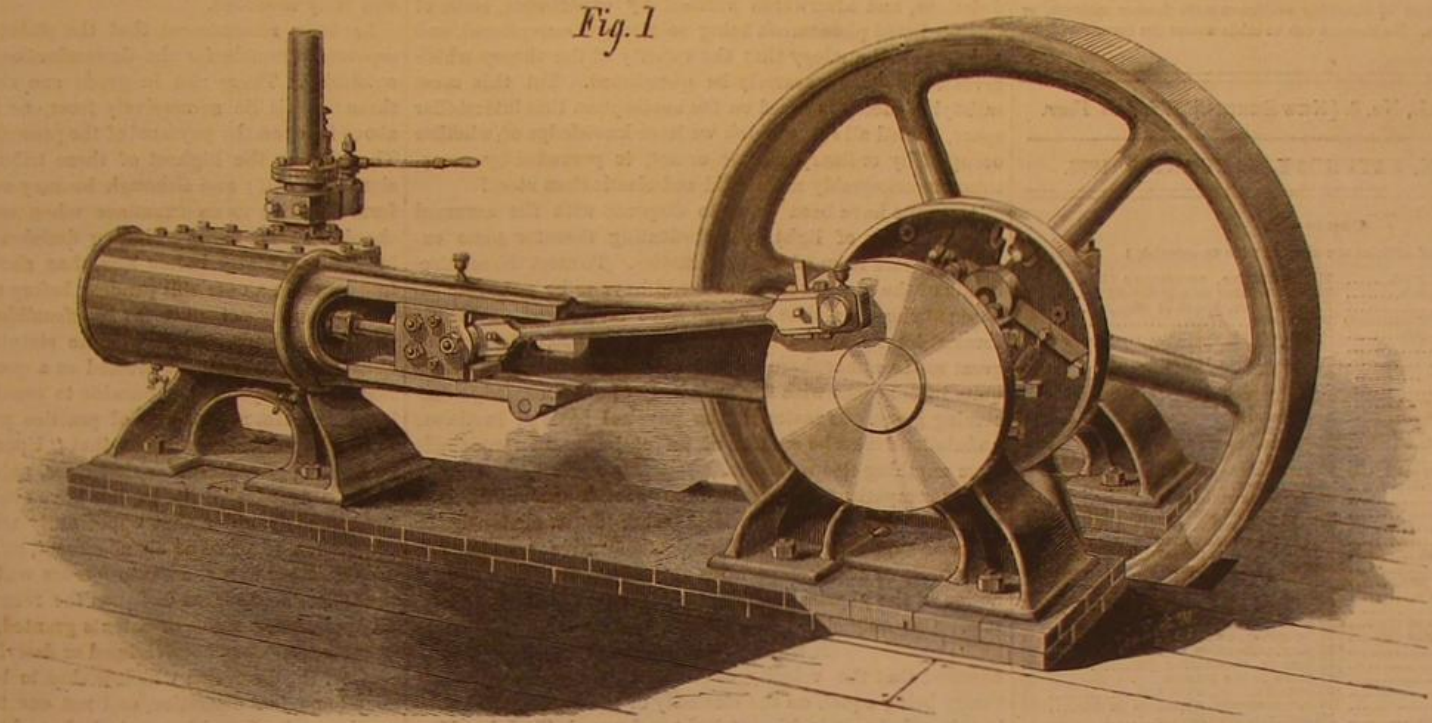
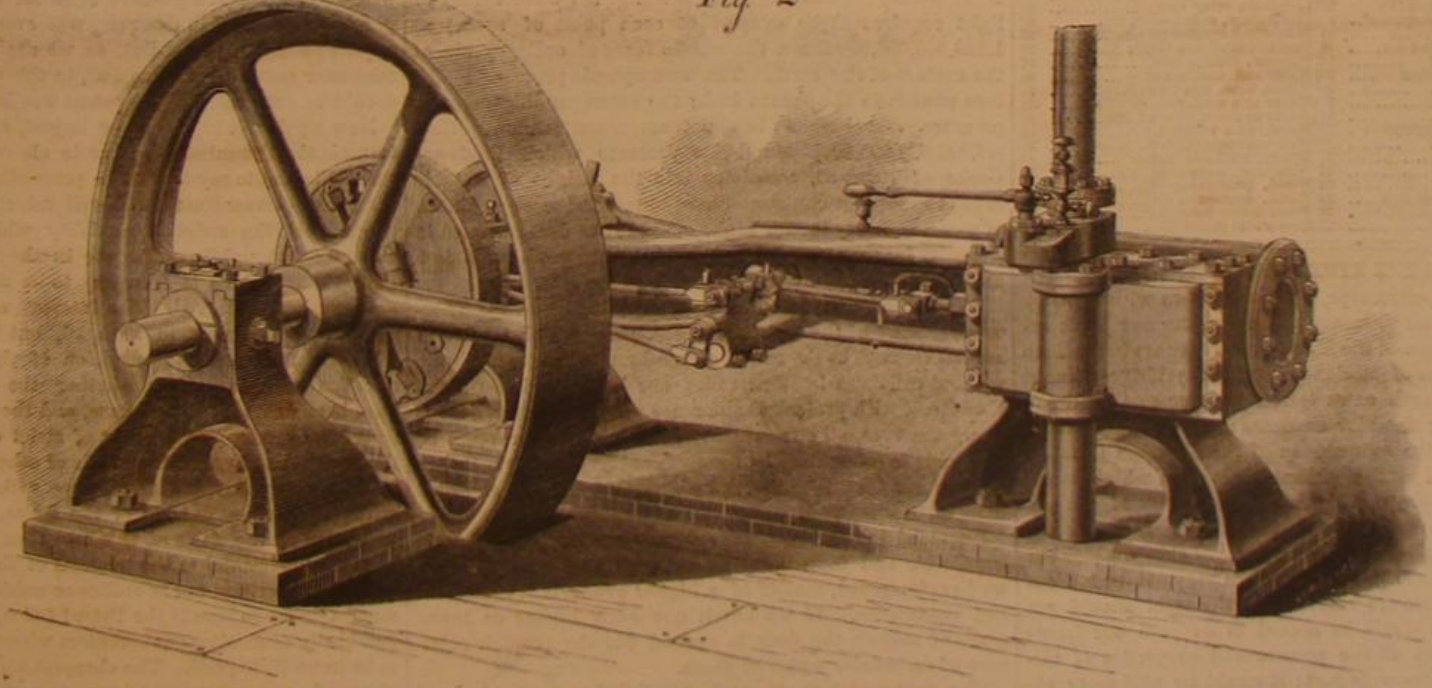
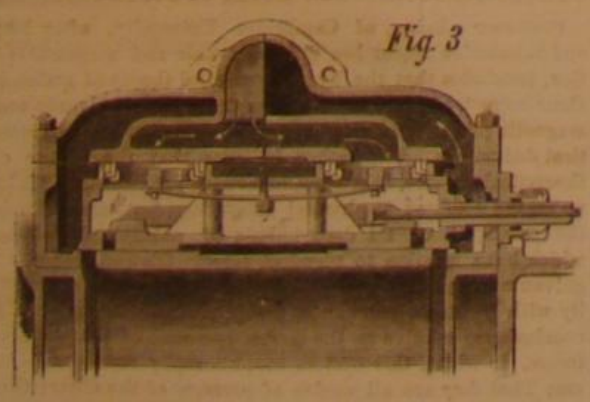


Fig 2



THE BUCKEYE ENGINE COMPANY'S AUTOMATIC ENGINE.

Fig. 3



The absence of exhaust passages in the cylinder and valve gives the additional advantage that the face of the valves may be as close to the bore of the cylinder as is consistent with proper strength of material, thus considerably reducing the clearance or waste room.

To the openings in the back of the valve are fitted steam metal self-packing rings, which serve the purpose of insuring a steamtight connection between the interior of the valve and the live steam chamber in the back of the chest. The area of these openings is made just sufficient to hold the valve to its seat, hence it is as nearly balanced as is practicable or desirable. As the valve chest contains only exhaust steam, the engines may be run with the chest lid removed, and any leakage readily detected. The cut-off valve works inside of the main valve, and alternately closes the ports leading to the cylinder. The fixed eccentric operates the main valve, and an adjustable one operates the cut-off valve through the medium of gearing. A small rock shaft, which forms a part of the latter, works in a bearing in the rock arm belonging to the main valve gear and moving with it. The movement of the cut-off valve, relatively to its seat in the main valve, is thus, both as to time and extent, just what its eccentric would produce if the valve worked in a stationary seat, and was attached directly to said eccentric. This arrangement will be clearly seen in Fig. 2, and the general aspect of the engine is shown in the front view, Fig. 1. The eccentric rod of the main valve gear works horizontally, while the cut-off eccentric rod inclines downward, so that its attachment to its rocker arm may be on a level, or nearly so, with the center line of the main rock shaft.

The stem of the cut-off valve passes through the hollow stem of the main valve, and is connected to an upright arm on the cut-off rock shaft, on the end opposite to that to which the eccentric rod is attached. The automatic adjustment of the cut-off eccentric is effected by means of its connection with two weighted levers contained in a circular case on the engine shaft. The outward movements of these levers advance the eccentric forward on the shaft, and two well tempered cast steel wire coil springs furnish the centripetal force which returns them when the speed slackens. It is claimed that the effect of this arrangement is to place the sensitiveness of the governor so far under the control of the engineer that he may, by varying the tension of the springs, adapt it to the most widely varying characters of resistance. For instance, in flouring mills, factories, etc., which are not subjected to any very sudden variations of load, so great a uniformity of speed can be obtained that the variation due to ordinary changes of load and pressure of steam almost defies detection.

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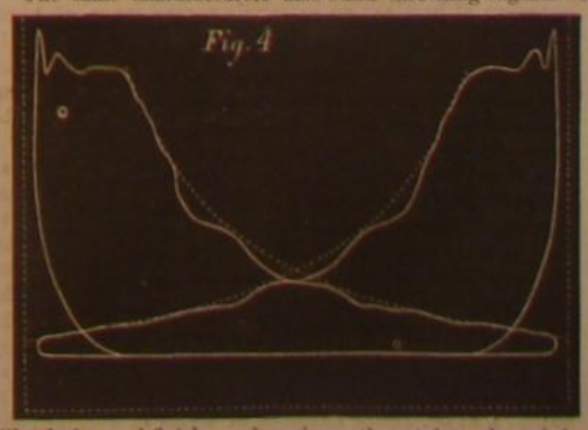
Fig. 4



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VOLUME XXXII., No. 2. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, JANUARY 9, 1875.

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IS THE ETHER MATTER?

Thanks to the spectroscope, it is now known with reasonable certainty that the elements which compose our earth exist also in other parts of the Universe. There are indications also of the existence of substances unlike anything we know; but the fact, that such extra terrestrial elements appear to act on light as our familiar elements do, has given rise to the inference that the composition of the Universe is fairly represented in kind by that of the cosmic atom which we inhabit, in other words, that the substantial unity of the material Universe is practically demonstrated. Limiting the term "material Universe" to the system of things which our senses make known to us, the inference may not be far out of the way; but there are reasons why the term should not be so limited. It would be absurd to suppose our feeble senses able to detect all the powers and properties of elements such as we know in part: it would be still more absurd to assume that our knowledge of the possible range of matter, even in the earth, is anything like exhaustive. To pronounce upon the composition of the Universe from our meager knowledge of it is consequently somewhat presumptuous.

It is easy to perceive that our range of knowledge is exceedingly limited. Relatively few aerial vibrations affect our sense of hearing; an extremely narrow range of luminous undulations are visible to us: and equally limited is our capacity to measure temperature, density, or any other accident of matter. The earth might easily contain numberless kinds and grades of matter so rare or so dense as to be entirely beyond our power of recognition.

For illustration, hydrogen passes through cast iron as water does through loose sand. The resistance which a cast iron ball would meet in its flight through an atmosphere of hydrogen would, on the other hand, be scarcely appreciable. The difference in density between cast iron and hydrogen, though very great, is far from infinite: were it infinite, the resistance which either would offer to the passage of the other would be infinitely slight: to *us*, *nil*. So with every other sort of matter in a medium infinitely more dense or infinitely more rare than itself. It is possible, therefore, to conceive, as Dr. Young suggests, of series of worlds of different orders, pervading each other, mutually unknown and unknowable, in the same space.

There is in this line of thought something more than purposeless speculation; and if there were not, one could hardly escape it in contemplating the theory of light now generally accepted by the scientific world, a theory involving conditions so astounding that nothing short of a new order of matter seems adequate to meet its requirements. Practically there could not be an hypothesis which would answer the requirements of a perfect hypothesis more completely than that which attributes the phenomena of light to undulations of a highly elastic medium pervading all space. It affords a reasonable explanation of every phenomenon in optics. More than that, it enables the investigator to anticipate effects which no eye has seen. As Fresnel observes: "There are certain laws so complicated and so singular that observation alone, aided by analogy, could never lead to their discovery. To divine these enigmas, we must be guided by theoretical ideas founded on a *true* hypothesis. The theory of luminous vibrations presents this character and these precious advantages; for to it we owe the discovery of optical laws, the most complicated and the most difficult to divine."

It would exceed the limits set for this article even to enumerate the wonderful discoveries made by the theory of undulations, and afterwards verified by experiment, some of the predicted phenomena being so strange, exceptional, and opposed to all analogy that the validity of the theory which revealed them can scarcely be questioned. Yet this most satisfying theory is based on the assumption that interstellar space, indeed all space which we have knowledge of, whether occupied by ordinary matter or not, is pervaded by something inconceivably more solid and elastic than steel!

Attempts have been made to dispense with the assumed ethereal basis of light by substituting therefor some excessively rare form of ordinary matter. To meet the requirements of the case, such a gas would have to be very rare indeed; at the same time it would have to possess an elastic force at least a million million (1,000,000,000,000) times as great as the atmosphere at the earth's surface, conditions quite inconsistent with the main body of our knowledge concerning gases. If material, the physical basis of luminous undulations must be matter of an entirely different grade from anything else we know.

Any comparison between ordinary matter and anything so unlike it as the hypothetical ether must obviously be taken as suggestive rather than demonstrative; nevertheless the results of such comparisons give us perhaps as correct a notion of the physical basis of light as we are able to entertain. Our only clue to its possible qualities lies in the extreme rapidity with which light rays traverse it. It is understood that the velocity of wave motion depends, other things being equal, on the elasticity of the medium. Knowing the relative velocities of light and sound, Sir John Herschel calculated the necessary elasticity of the ether (in other words, the amount of force which the wave theory of light requires to be exerted at each point of space) as 1,148,000,000,000 times the elastic force of ordinary air at the surface of the earth. The atmospheric pressure is fifteen pounds to the square inch; the corresponding ethereal pressure must therefore be about seventeen million million (17,000,000,000,000) pounds, a pressure which Professor Cooke, of Harvard, translates into the weight of a cubic mile of granite. The atmosphere counterbalances a column of mercury thirty inches high. Could it be demonstrated in a similar manner, the pressure of the ether would sustain a column of mercury six times as high as the sun!

These numbers give but an approximate idea of the enormous solidity of the adamantine something which the earth sweeps through at the rate of eleven hundred miles a minute without resistance! It pervades our bodies and we move about in it with perfect indifference. As Professor Jevons justly observes, all our ordinary notions of matter must be laid aside in contemplating conclusions like these; yet "they are no more than the observed phenomena of light and heat force us to accept."

Regarded in the light of ordinary matter, the ether is impossible and incredible; as extraordinary matter, or, as we have imagined, matter of a higher grade, it is consistent and reasonable. If we admit one such higher or lower grade of matter, the door is opened for the possible existence of an infinite series of them.

The contemplation of such possibilities may at least teach us not to be hasty in limiting the scope of the Universe to elements such as we know.

THE WOODBURY PATENT.

The great interest involved in this patent, and the corresponding efforts which have been put forth, both to sustain and to defeat it, have induced inquiry on our part, some of the results of which we shall now lay before our readers. We do not propose to discuss the validity of the patent, but only to refer to some of the extraordinary circumstances connected with its history.

The application—which was for an improvement in planing machines—was filed, June 3, 1848; was rejected, February 28, 1849; was withdrawn and $20 returned to the applicant, October 4, 1852. It then lay as dead as an antediluvian fossil for more than eighteen years, when, on December 5, 1870, a new application was filed by Woodbury for the same subject matter. This was unsuccessfully pressed by different attorneys for more than two years, the applicant in one case at least having offered an attorney $5,000 as a conditional fee, which was declined on account of the hopelessness of the undertaking.

On March 27, 1873, Fisher and Duncan, late Commissioners of Patents, became Woodbury's attorneys, and on April 26 following the patent was allowed. It was issued three days later, which was just two weeks earlier than it would have gone out in the regular course of business in the Patent Office. Such an advance was, it is true, not wholly without precedent; but as it always creates inconvenience and confusion, it is only allowed in very extraordinary cases. We know of nothing in this case that should have given it such a preference.

The main decision allowing the patent to Woodbury was claimed to be justified by the ruling of Judge Fisher in the Gray case. But there, the time which had elapsed between the withdrawal of the old application and the filing of the new one was less than two thirds as great as in the Woodbury case. And as abandonment—which was the vital question in this case—is specially declared by statute to be a question of fact, to be determined by the circumstances of each particular case, this increased length of time was a proper element to be taken into the account in forming a correct conclusion here. But the Commissioner, without taking this circumstance into consideration, and without waiting till the case was legitimately before him, made a written order that it should be decided on its merits, without taking the matter of abandonment into the account at all, which order or decision was fully observed.

Let it be remembered that the statute has provided four separate tribunals for the determination of questions of patentability. These rise in grade one above another, so that three appeals lie successively from one to that which is next above it, upon the payment of the prescribed fee in each case. The next to the highest of these tribunals is the Commissioner himself; and although he may very properly give informal advice to an examiner when consulted by him, he should no more make a binding decision until the matter is brought regularly before him than should any other appellate court, in a case still pending before an inferior tribunal.

But another act, quite as indefensible, remains to be noticed. We have stated that the statute has provided that abandonment should be treated as a question of fact. That rule is made specially applicable to cases like this. Accordingly, the 41st rule of official practice provides, in these old rejected or withdrawn cases, that "Upon the hearing of such renewed applications of either class, patents will be refused if it be found that the parties have abandoned their inventions; and in order that opportunity may be given for the production of proof of abandonment, or of two years' public use, if either exists, an interference will, at the discretion of the Office, be declared between the renewed application and all applications made, or patents granted, in which the device in controversy has been claimed or described."

Now, the discretion which is thus to be exercised means a sound and just discretion, and not one that is controlled by caprice or by favoritism. And there has never been a case since the act of 1870 was passed, and probably there never will be one hereafter, where such an interference, for the purpose mentioned in the rule, was ever more imperatively required than in this. But, as we are informed, the Commissioner gave instructions that, in this case, no interference should be declared, and the patent was issued accordingly.

Now we do not intend to be unjust, or even uncharitable, towards the Commissioner; but in all candor and sincerity, we feel bound to say that these proceedings have altogether been most extraordinary, and well calculated to create a suspicion that the strict impartiality which is so necessary to secure that public confidence in the management of the Patent Office which is necessary to its ultimate success, has not been here observed. The interests of the Office require, not only uprightness in its head, but also the absence of whatever may create a suspicion of the want of it. The question naturally arises whether the same favor would have been extended to this case, and the same alacrity manifested in overstepping the line of strict official propriety, if the matter had been in the hands of other attorneys. Rightfully or wrongfully, the idea of rings within the Office, co-operating with rings outside of the Office, is not unnaturally suggested by the facts of this case than which nothing can be more detrimental to the interests of the Office.

We have written not in malice or unkindness, but with an earnest desire to benefit the Patent Office, and through it, the great body of meritorious inventors whose welfare we believe to be in no little peril. The cheapest and most effectual way of securing uprightness and propriety of action in any public officer is, in a candid and just way, to spread his acts or those of others in like predicament fully before the public. This is well calculated to prevent those mistakes which arise through carelessness or inadvertence, as well as to correct those which may have had a different origin.

THE PHYSICAL FORCES ARE MODES OF ETHER PRESSURE

Professor Challis, of Cambridge University, after long and exhaustive researches upon galvanic and magnetic action, concludes that the hydro-dynamical theory of action is alone correct. The theoretical explanation of galvanic and magnetic phenomena is to be sought by means of mathematical deductions. The author believes that the science of theoretical physics, laid down in Newton's "Principia," is by no means confined to physical astronomy, but comprehends the principles of all departments of natural philosophy which have relation to physical force. His conclusions on galvanic and magnetic action have been reached in conformity with Newton's rules and principles. The author's main conclusions, relative to the *modus operandi* of the physical forces, to which this system of philosophy seems to point, are: That they are all modes of *pressure* of the ether; that the forces concerned in light, heat, molecular attraction and repulsion, and gravity are dynamical results of *vibrations* of the ether; and that electricity and galvanic, and magnetic forces are due to its pressure in *steady motions*.

THE CULTIVATION OF OYSTERS.

The usual method of studying oysters and the oyster trade is to swallow a dozen raw at a market stand., interview the wholesale dealer in regard to the number he handles and where he gets them, chat for half an hour, perhaps, with the master of an oyster sloop then clinch the whole with such information as may be gleaned from the nearest encyclopedia. This is the reporter's method. Much interesting knowledge is gained thereby; but, as we have already seen, more is missed. The most important feature of the business, the cultivation of oysters, is invariably overlooked.

Having seen that, so far from being unknown in this country, as commonly reported, oyster breeding is an industry at once extensive and very important, let us visit the oyster farmer at home, and study the methods of his business, their object, and the effect they have on the development of our much prized and most delicious product of Neptune's kingdom.

First, to the breeding ground.

To the casual visitor, sailing over an oyster plantation, it is the blankest of all cultivated areas. He sees but a waste of water, with here and there a protruding pole, and is but vaguely impressed when assured that as far as his eye can reach the ground is covered with crops in various stages of maturity. Strange farming, under twenty feet of brine! In the middle of a broad bay, perhaps a mile from shore, our tidy craft is put about, and our skipper says we are over a "patch" of twenty acres devoted to this year's spawn. For miles around the Sound is staked off for oyster beds, and hundreds, perhaps thousands, of acres, belonging to other oyster farmers, are in use as breeding grounds. As we drift across our twenty-acre field, a dredge is thrown over, and a moment after the quivering rope tells that the dredge is at work on the bottom. We drift a boat's length, and the catch is hauled in—a bushel or so of empty shells, half a dozen crabs, any quantity of amber-colored "gingles," and perhaps two or three oysters.

OYSTER SPAT.

"Nothing here!" you are tempted to say; but look closer. Every one of those empty shells, every object that has not escaped through the meshes of the net, is covered with rough brown creatures the size of one's finger nail. They are oyster spat, that is, young oysters of this year's spawning, now three months old. They first become visible to the naked eye when about a week old. A gingle the size of a nickel coin carries half a dozen; a nodule of coral as large as a walnut bears twenty; on half an oyster shell you count fifty or sixty, perhaps a hundred or more, if you have patience to distinguish the little ones. Who can number the thousand on a square yard, the millions on an acre, every inch of which is sown with promises of future stews and fries?

As we pass to other grounds, the dredge is cast on the gravelly shell-strewn bottom of a swift channel, in a quiet cove, in deep water and in shallow; each time the dredge is filled with rubbish interspersed with old oysters, clams, scallops, and other denizens of salt water. Here and there a bright shell, a pebble, or a bit of coal will show an oyster spat; but a whole dredge full of stuff will carry fewer than a single oyster shell from the breeding ground. It is the old story of Nature *versus* cultivation.

At spawning time last summer, the waters over the several areas were equally filled with microscopic oysters, millions of which were sent adrift by each prolific parent. They swarm free and independent, like other young people, for awhile; but the time soon came when they had to settle for life. At this critical stage of their existence, those on the breeding ground were plentifully provided with enticing resting places, in the shape of clean shells, gravel, and the like, and they settled in myriads. Those which had Nature for nurse had to take their chances, and on the uncultivated grounds the chances were relatively few, notwithstanding the season was an uncommonly favorable one for natural beds. The furnishing of clean stools for the young spat is thus a matter of

SEED OYSTERS—1, 2, AND 3 YEARS OLD.

prime importance in oyster culture, and it is of equal importance that the stools are provided at the right time. The period of spawning varies with the position of the bed, the depth of the water, and other conditions, from June to August. The precise time for each bed must be discovered "with the knife," that is to say, by dissecting the oysters. By this, which is purely an American method of breeding, it matters little how deep the water may be; shells and gravel will sink through a hundred feet as certainly as through ten. The shallow breeding places employed by the French would not answer at all in our climate, no more would their costly and clumsy contrivances for fixing the spawn. There the securing of a few hundred thousand spat is accounted a great achievement. Here it is the least of the oyster breeder's labors to obtain boat loads of them. The trouble is to defend them during the five years of their development.

Examine one of the spat-laden stools. It is obvious that such a crowd of oysters cannot come to any size in so small a space. If left to themselves, few could survive the struggle for existence, and they would be pinched and meager. The oyster farmer does not permit such a waste of seed. Yonder sloop, which has been beating back and forth across our breeding ground, is nearly laden with a worthless-looking cargo, in reality a wealth of seed that would be a small fortune to a foreign breeder. The business of her crew is, primarily, to keep watch against invasion by starfish and other foes of the young oysters. Their coarse-meshed dredges bring up quantities of spat-covered shells which are kept for distribution on other grounds, quite as many spat as can thrive on the ground being attached to stools small enough to slip through the dredges. Next summer the year-old seed will be similarly thinned, the clusters broken up, and the surplus transplanted. The same process will be repeated the year after; the next year the entire crop will be lifted, it happening that the oysters thrive exceedingly well on this particular ground up to their third year, after which their growth is too slow for profit. Transplanted to more favorable ground they increase in size and thickness very rapidly.

PINCHED.

By thus choosing grounds specially suited to the several stages of the oyster's development, the breeder is able to hasten the maturity of his crop, besides securing a higher average of size and quality in the product. On a firm gravelly bottom, for example, where a free circulation of water is maintained under and around the oysters, a crop will accom-

THE EFFECT OF TRANSPLANTING.

plish as much in four years as in five on mud, and the quality will be much superior. Our time is too short, however, to enter upon anything like a thorough study of oyster grounds and their effects upon the growing oysters. They vary as farm lands do on shore, the oystermen of any locality being able to recognize, at sight, the oysters of different beds within gunshot of each other, often those of different parts of the same bed. A novice can tell by its plumpness the cultivated from the natural oyster. Even when the latter has had the best of advantages, and has attained the rounded outline of the perfect oyster it invariably lacks the depth of body, the thickness of meat, which the cultivator strives to attain. It will be very apt to lack, also, firmness of flesh and delicacy of flavor.

NATURAL AND CULTIVATED

We shall return to this subject in our next issue.

THE COMMISSIONER OF PATENTS ON THE PATENT OFFICE TEA SET.

UNITED STATES PATENT OFFICE,
Washington, December 19, 1874.

MESSRS. MUNN & CO.:

Gentlemen:—I do not intend to take any notice of mere criticisms of myself or my official actions, which may appear in various newspapers. In the SCIENTIFIC AMERICAN, bearing date December 26th, 1874, however, there appears under the head of correspondence, on the 404th page, a charge so direct, that it passes beyond the domain of criticism, and becomes libelous. This charge in relation to my connection with the presentation of a tea set, to my predecessor, is an unmitigated falsehood. The facts are that the affair was originated and prosecuted without my knowledge, and during my absence from this city. I never signed the subscription paper for this set, and in fact never have seen it. If my name appears thereon, it has been put there by some one without my knowledge, and without authority from me.

Furthermore, I have not paid, or agreed to pay one single cent for this tea set for General Leggett, and I do not intend to make any payment for this purpose in the future.

I now demand that, in your next issue, you make a distinct and definite retraction of the libelous charge against me, in accordance with the facts in the case. I also demand that you will either compel your correspondent to make such retraction in a letter to be published in your paper, or furnish me the name of such correspondent, that I may make such demand upon him as the circumstances require.

I am prepared and determined to protect my good name and reputation from all libelous charges.

I am, Gentlemen, very respectfully yours,

J. M. THACHER, Commissioner of Patents.

Referring to the letter of our correspondent, page 404, last volume, we find it there stated that "the present Commissioner headed the list with $50."

To any one acquainted with the exalted and honorable character of Commissioner Thacher, his mere assurance that this statement was an error would have been quite sufficient; but in compliance with his desire that we should make the correction very distinct and explicit, we have chosen to use his own vigorous language. No candid person, we think, can read his letter without exonerating him entirely from all connection with the affair to which it refers. By reference to another column, it will be seen that our correspondent also makes the *amende honorable*. Heretofore his information has always proved reliable; how he could have fallen into so palpable an error is to us unaccountable. We regret that the publication of our correspondent's letter should have done the Commissioner an injustice.

Having thus discharged a simple duty in the prompt correction of a matter personal to the Commissioner, it may not be out of place for us to add a few comments, naturally suggested by his letter.

In these degenerate days, when many of our public men are so forgetful of personal honor and integrity as to engage in violations of the law, winking at or concealing its infractions, or neglecting to execute its provisions: at such a time, it is refreshing to find one public officer at Washington, in the person of Commissioner Thacher, who appears to entertain a high and proper sense of his obligations. It is greatly to his credit that he resents with indignation, regarding it as a libel upon his character, the suggestion that he has been, either directly or indirectly, connected with the Patent Office Tea Set presentation. He recognizes the binding force of the statute provided for such cases, so far as he is personally concerned, and evidently desires that the law shall be respected

The statute in question, is as follows:—

"Be it enacted, etc.: That no officer or clerk in the United States Government employ shall at any time solicit contributions of other officials or employees in the Government service for a gift or present to those in a superior official position, nor shall any such officials or clerical superiors receive any gift or present offered or presented to them as the contribution of those in the Government employ receiving a less salary than themselves; nor shall any officer or clerk make any donation as a gift or present to any official superior. Any officer or clerk violating any of the provisions of this bill shall be summarily discharged from the Government employ."

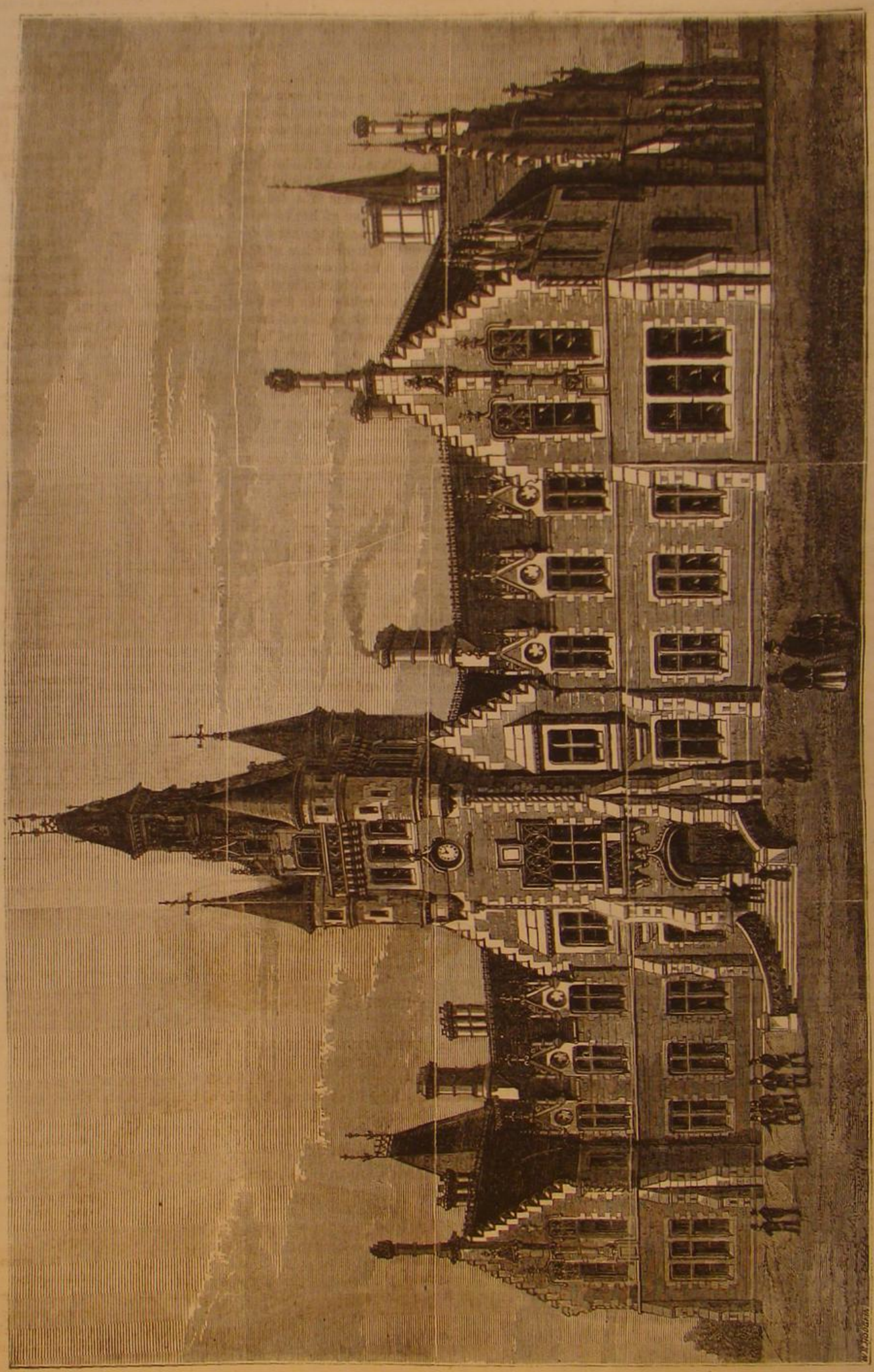
If the erroneous charge of a misinformed correspondent, of infraction of this law, is considered by the Commissioner as a libelous reflection upon his character, as stated in his letter, we may readily imagine with what keen abhorence he must regard those members of the Patent Office company, who were actually guilty of doing the forbidden thing: with whom he is not only compelled to associate day after day, but even to witness and assist their official actions. Nothing could be more galling than this to a highly sensitive and honorable nature like that of the Commissioner.

All appointments in the Patent Office, except five, are, under the law, made by the Commissioner and the Secretary of the Interior; hence it is the duty of one or both of these officers to see that the law above cited is carried out. But between them they have managed, somehow, up to the present time, to shirk the responsibility. There is a gross violation of duty somewhere. The Commissioner of Patents has at last spoken on the subject, and the legitimate inference from what he tells us is that he would be only too glad to execute the law if he had the power; but considers it not his business, but that of the Secretary of the Interior. We hope the Secretary will now give us his views of the matter. Congress may then be able to determine where the delinquency exists, and apply a suitable remedy.

THE MORGAN HOSPITAL SCHOOL, DUNDEE, SCOTLAND.

We publish herewith an excellent view, selected from the London *Builder*, of an hospital recently erected at Dundee, Scotland. The circumstances attending its establishment are curious, and involve considerations of some importance.

Mr. John Morgan, whose name it bears, died in 1850. On the death of his last surviving sister, on the 15th of January, 1848, certain writings were found in her repositories, executed by her brother, containing some personal bequests of small amount, and declaring it to be his wish that the bulk of his fortune should be employed to establish in Dundee, the place of his nativity, an institution for the education of boys, on the model of Heriot's Hospital in Edinburgh. Previously to the death of his sister, Mr. Morgan had fallen into a state of mental imbecility, and a *curator bonis* was appointed to take the management of his affairs. The writings alluded to passed into the hands of the curator, and formed the groundwork of litigation which subsisted for some years, and ended in their being declared, by a judgment of the House of Lords, to constitute a good and valid bequest of the fortune of John Morgan, or so much thereof as should be sufficient for the purpose of endowing a hospital for the education and maintenance of 100 boys in the town of Dundee. After the appointment of trustees and governors, measures were taken for the construction of the hospital. A site was acquired, and a design, prepared by Messrs. Peddie & Kinnear, architects, Edinburgh, was approved of and adopted by the governors. The site is nearly triangular, and forms a sort of a wedge between two roads, enclosing about five acres. It slopes upwards from the entrance gate, and the hospital is built in the upper and broader portion of the grounds. The design presents a building quadrangular in form, 200 feet in breadth, 150 feet in depth, with an open court inside. The building may be called Flemish Gothic in style, and is two stories in hight, with a center tower rising to the hight of 120 feet, and projecting a few feet from the façade. In the ground floor it contains the main doorway, which is formed in a richly molded archway, surmounted by a crocketed label. Over the doorway, in the second story, is a three-light window, headed with cinquefoil tracery, and opening into a projecting balcony. On reaching the hight of the ridge of the building—the intervening space being filled in with a clock—the tower is corbelled out in the angles into circular turrets, each capped with a steep, slated roof. Connecting the turrets are carved balconies, also corbelled out from the main walls of the tower. From this point the tower rises in a steep roof, formed in two stages, and exhibits in front a carved group of windows, surmounted by an ornamental gablet. The tower terminates in double pinnacles, united by an ornamental crest. On each side of the tower the design exhibits bay windows in the second story, surmounted by steep, crow-step gables. Extending on either side is a range of two-light windows in both stories, the upper being finished by gablets flanked and terminated by pinnacles.



THE MORGAN HOSPITAL, DUNDEE, SCOTLAND.

Dangers of Benzine Scouring.

M. Dumas, at a recent meeting of the French Academy of Sciences, stated that, in examining the process of scouring fabrics as usually practised by cleaners of old clothes (washing in benzine), he had discovered a novel and dangerous cause of fire. Workmen engaged in this industry had frequently complained of the benzine becoming inflamed during the scrubbing; and in order to test the question, M. Dumas caused a piece of cashmere to be dipped in for a length of 18 feet. Every time the stuff partially emerged from the bath, while being rubbed between the hands, a sharp pricking sensation upon those members and on the face was felt; and finally sparks were emitted from the fabric, sufficient, if the scouring had been briskly continued, to have ignited the inflammable fluid.

Hereditary Crime.

Some of the most remarkable statistics regarding hereditary disposition to crime that have ever been collected were lately produced by Dr. Harris at a recent meeting of the State Charities Aid Association. It appears that the attention of Dr. Harris was attracted to a county on the upper Hudson, in New York, in which the proportion of crime and poverty to the entire population was extraordinarily great, there being about one criminal or pauper to every ten inhabitants. The recurrence of certain names among the list of unfortunates also excited his interest, and led him to genealogical investigations which have resulted in the following astonishing statement of fact:

Seventy years ago, a child, having no other name than Margaret, was a vagrant about the locality. There was no almshouse, and it seems that the girl lived as a waif, occasionally helped by the charitable, but never educated and never given a home. She gave birth to children, who became paupers like herself; they increased and multiplied until, up to the present time, nine hundred descendants of the friendless woman can be traced. Of this immense progeny, extending through six generations, two hundred of the more vigorous are recorded as criminals, and a large number as idiots, lunatics, prostitutes, and drunkards. In one single generation there were twenty children, three of which died young, and the balance survived to maturity; but nine were sent to State prisons for aggregate terms of fifty years, and the rest were constant inmates of penitentiaries, jails, and almshouses.

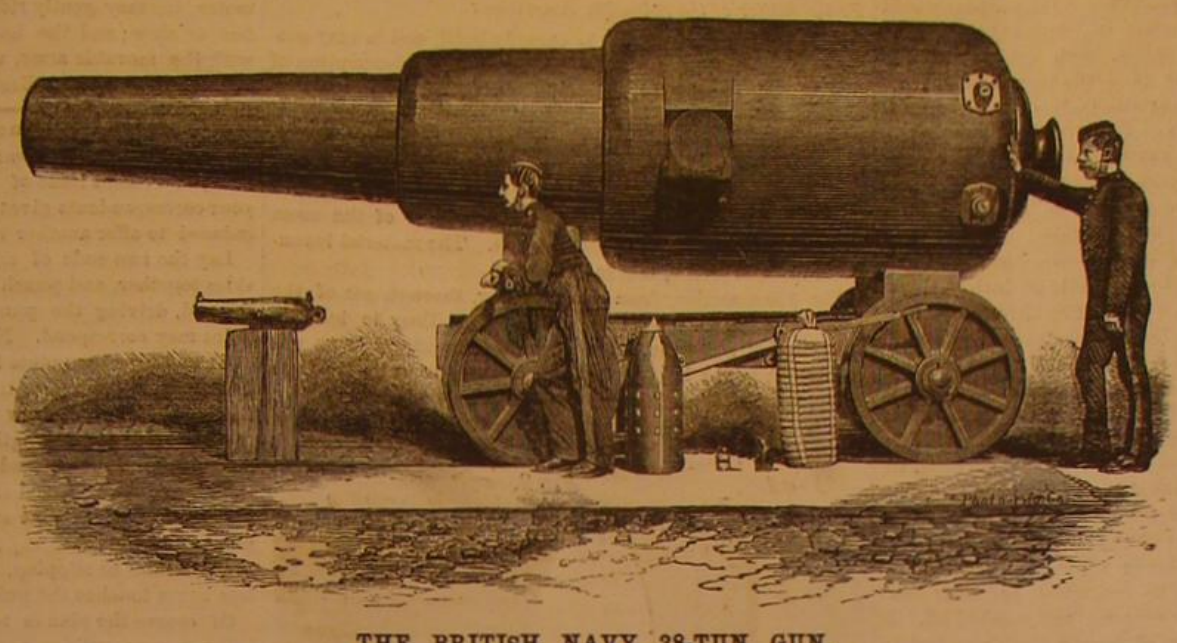
The Theory of Errors of Observation.

Mr. C. S. Peirce, in an interesting article on the laws of errors of observation, and the nature of the so-called personal equation, gives the results of some experiments made upon an entirely untrained observer, a young man about eighteen years of age, who had had no previous experience whatever in observations. He was required to answer a signal, consisting of a sharp sound like a rap, his answer being made by tapping upon a telegraph operator's key, nicely adjusted. Both the original rap and the observer's tap were recorded by means of a delicate chronoscope, and five hundred observations were made on every week day during a month. It was found that on the first day the observations were scattered through a very large range of error, the difference in time between the records of the event and of the observation varying in fact between the extreme values from 0·16 to 0·98 of a second. The personal equation proper on the second day was between 0·2 and 0·3 of a second, and from that time it steadily decreased until it amounted only to one seventh of a second; it then gradually increased until the twelfth day, when amounted to 0·22 of a second. While this variation in personal equation occurred, the range of errors or discordances was constantly decreasing, until on the twenty-fourth day the probable error of the result did not exceed one eightieth of a second. This is considered to clearly demonstrate the value of such practice in training the nerves for observation; and he recommends that transit observers be kept in constant training by means of similar observation of an artificial event, which can be repeated with ease and rapidity, it not being essential, he thinks, that those observations should very closely imitate the transit of a star over the wires of a telescope, inasmuch as it is the general condition of the nerves which it is important to keep in training more than anything peculiar to this or that kind of observation.—*Harpers' Magazine.*

The scrapings from oiled floors should be placed in the open air. They are liable to spontaneous combustion

BRITISH NAVAL GUNS.

The armament of the British ship Thunderer is to consist of four 38-tun guns, originally intended for land service, but which have now been completed as naval guns. The accompanying engraving is a faithful representation of the improved *Enfant Terrible*. A comparison of its majestic proportions with those of the pigmy 7-pounder mountain gun, which the artist has introduced beneath, will enable the reader to form some idea of its actual size. The shells and cartridges for both guns will be seen standing between the wheels of the trolly on which the 38-tun gun rests. The 7-pounder is the weaponwhich gave such excellent results in the Abyssinian war. The dimensions of the 38-tun gun are as follows: Length, 19 feet; diameter at the thickest part of the breech, 57½ inches—being 1½ inches more in this respect than the 35-tun gun; diameter of trunnions, 13 inches; length of bore, 16 feet 6 inches; caliber, 12 inches. The rifling has an increasing twist from nothing at the breech to one turn in 35 calibers at the muzzle. The number of grooves is 9. The cartridge and projectiles are—for the present at least—to be similar to those of the 35-tun gun, namely, of 110 lbs. and 700 lbs. respectively. It is an acknowledged fact that, with the latter, a considerable quantity of the charge is blown out at the muzzle of the gun unconsumed, although, partly with a view of obviating such a difficulty, the weight of the powder employed has been reduced to a minimum. The evident cause of this is the impossibility of obtaining ignition of the cartridge throughout its entire mass in the momentary space of time that elapses before the projectile leaves the muzzle, owing to the extreme shortness of the bore, which is only 13 feet 6 inches in extent. But with the new gun, ample space is afforded for the expansion of the powder gas waves, and for the combustion of the charge, which, it is anticipated, will be entirely accomplished. Thus it may confidently be expected that better results will be obtained from actual practice with this weapon, both as regards range and penetration, than were arrived at in the trials already made with the 35-tun gun. The latter was proved capable of penetrating wrought iron plates 14 inches thick, as well as a backing of 18 inches of timber, and a skin of 1¼ inches plate, at 500 yards; also of piercing, and very nearly of penetrating, wrought iron plates 15 inches thick, with a similar backing, etc., at 200 yards. It penetrated 12 inches armor and a similar backing up to 1,700 yards. The 38-tun gun will probably penetrate 16 inches of armor plate, with a corresponding backing, at a distance of 1,000 yards, as the addition of the 7 lbs. or 8 lbs. of powder to the charge—which was before wasted—must of course make a sensible difference in the amount of energy produced.—*The Engineer.*

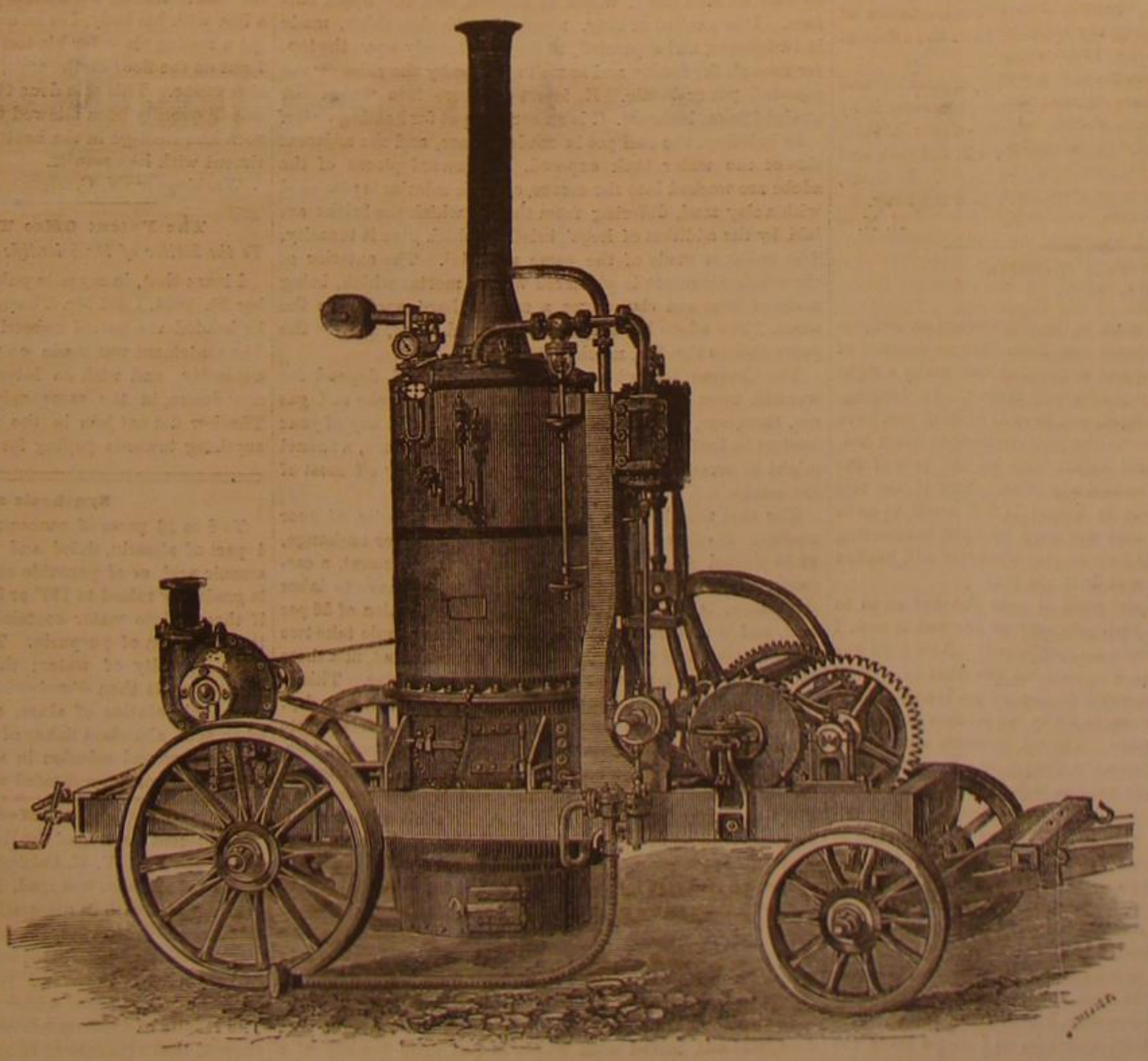


THE BRITISH NAVY 38-TUN GUN.

PORTABLE STEAM WINCH.

The annexed engraving represents a handy little machine which was exhibited at the late Exposition at Vienna. It is a combined steam winch and pump, intended for the use of contractors and others. The whole machine is carried on a rectangular frame of 7 inches by 3 inches channel iron. The boiler is placed in the center of the frame; it is supported by wrought iron brackets, and fired from one side. The engine has a single cylinder, vertical and inverted, carried by light cast iron angle framing, which is bolted to the boiler at its upper end. The winch, in the construction of which there is nothing calling for special mention, is placed on the front of the frame, and driven from the engine in the usual way. A small centrifugal pump is placed at the hinder end of the machine, and is driven by a strap from the fly wheel of the engine, which has a turned rim for that purpose.

The engine can, of course, be used to drive a circular saw or other machinery, external to itself, when required, and is, in every respect, a handy affair. The whole is carried upon four wooden wheels, and fitted with shafts for horse transport. The boiler is intended to work at 90 lbs. pressure.



PORTABLE STEAM WINCH AND PUMP.

Recent Propeller Trials.

A recently published report of comparative tests, made by the Eagle line of steamers, between the Hirsch and the Griffiths propellers, shows a strong preponderance of advantages in favor of the screws of the former system. The steamship Herder was fitted with a Hirsch screw built for an increased speed, and also with a Griffiths propeller. The mean results of ten voyages between Hamburgh and New York show for the Griffiths a speed of 11·59 knots; time under steam, 10 days, 17 hours, 30 minutes; coal consumed on passage, 572 tuns; and 519·05 miles run on 100 tuns of coal. For the Hirsch, 13 knots; 9 days and 13 hours; 505 tuns and 582·79 miles: a gain of 1½ knots per hour, and an economy of 67 tuns of coal

The Goethe, of the same line, the engines of which, like those of the Herder, are of 600 horse power nominal, was fitted with a Hirsch screw designed for saving in coal. The saving effected was 4 tuns per twenty-four hours, and this although the draft of the vessel was 1 foot 7 inches more than when the Griffiths screw was in place. On board the Lessing, another vessel belonging to the same company, the Hirsch propeller caused a gain of 14·7 per cent in speed.

The official reports of the engineers state that the engines driving the Hirsch screw worked exceedingly smoothly, and that there was a noticeable absence of any vibration.

Utilization of Slag.

During leave of absence in August last, Mr. C. R. Roelker, of the United States Navy, visited the ironworks of the "Georg's-Marien Hutte," near Osnabrück, in the province of Hanover, Prussia, and witnessed there some processes which, from their novelty and usefulness, he thinks will be of general interest

The most important, he says, are those which turn the slag of the smelting furnaces into useful material. This necessary product in the manufacture of iron, which is a source of such considerable inconvenience and expense, has been heretofore used for making road beds; it is also sometimes run into molds and formed into building stones. The process invented by Mr. Hartmann, the former manager of the above mentioned works, turns it into more extensive usefulness.

The high furnaces are provided with a continual overflow for the slag, which runs through a narrow gutter formed in the sand into a shallow pit, through which a small stream of water is kept running. By this chilling process the slag assumes the form of a fine gravel. An endless chain at once lifts the slag out of the pit and loads it upon cars. By grinding this material fine in a cement mill, it is formed into an excellent sharp building sand; the great bulk of it, however, is used, without further reducing its grain, for making bricks.

For this purpose it is mixed with one half of its bulk of mortar in a trough in which three shafts provided with long blades are revolving. It is then shoveled into the brick machines, each of which turn out about twenty-five bricks a minute. These bricks are piled up in the open air for drying, and are ready for use after about six weeks. They continue to harden on exposure to the air, and are said to possess greater strength than ordinary burnt bricks. They are extensively used for all kinds of buildings, their light gray color producing a very pleasing effect, and the roughness of their surface fitting them particularly well for retaining a coating of mortar. They cannot be used, however, for foundation walls, as by the absorption of moisture their cohesiveness is impaired.

The most interesting process is the following: As a thin stream of the fluid slag, falling from a narrow gutter, passes the nozzle of the steam pipe, a jet of steam is blown through it, and by this simple process it is solidified in the form of most delicate fibers, resembling asbestos or spun glass; and it falls to the ground like a loose mass of grayish wool. This material is an excellent nonconductor of heat, and is used for covering steam pipes, boilers, etc. The sole expenditure in its manufacture is that of the steam, the exact amount of which could not be ascertained. The material is sold for about $5 per hundred cwt. The steam pipe is about 1½ inches in diameter, and the nozzle is simply a pipe, flattened and then curved into a semi-circular form, in order to give the most advantageous shape to the steam jet. The steam used has a pressure of about 50 lbs. per square inch.

MERCURIAL OINTMENT IN BOILS AND CARBUNCLES.—Dr. T. Roth lauds, in the *Deutsche Klinik*, the local application of gray ointment in boils and carbuncles, especially the early stages. He anoints the affected part with the ointment four times daily, and thereby reduces the inflammation and "backens" the boil most satisfactorily.

Correspondence.

Snow in the Streets.

To the Editor of the Scientific American:

A huge, heavy roller, about four feet in diameter, with its periphery two inches thick, would probably be the most effective thing that could be used; but the one difficulty in the way would be in the heating of it, heat being absolutely necessary to prevent the adherence of snow to the outer surface. It would not be impossible to heat such a cylinder, but it would be costly and difficult.

The next best shape for a machine for the purpose would be a sledge, made something after the following pattern: Instead of simply the two runners with which ordinary sledges are furnished, I would cover the bottom of a snow sledge with fifteen, placing them two inches apart from each other, thus giving to the runners and their intermediate spaces a width of seventy-three inches, which would be the width of the sledge. The runners should be of oak joists, fifteen inches in depth and from eight to nine feet long. The width of these joists would be reduced at their lower faces to one and a half inches, which lower faces would be covered with straps of wrought iron half an inch in thickness. Between the runners, set some other three and a half inch joists, which, at the rear end of sledge, would almost close up the space between the runners, but would be gradually cut away toward the front so as to leave an opening equal in amount to that closed at rear. From midway to rear these intermediate joists would be shod with a malleable casting, having several deep lengthwise grooves covering its lower face, the object which would be to make corresponding depressions in the pressed surface of snow, thus to afford foothold for horses. The front of the sledge should turn up some three feet, at an inclination or angle of 45 degrees, up which face the runners would be continued; and their final termination should be properly rounded and finished off. It might be well to have two rows of harrow teeth attached to extreme rear of the sledge to act as a thorough roughener to the compressed snow surface. Over the runners should be a flooring of two inch pine plank, the stuff to be twelve inches wide and placed transversely with length of the sledge. The runners should be of oak, and all exposed surfaces of the same would necessarily require to be planed perfectly smooth. Three or four tuns of pig iron properly distributed over the floor or platform would complete the craft.

This is a very rough sketch of the idea, but it may answer a purpose in pointing out a proper direction in which to seek for the machine wanted. These machines, as long as the snow lasted, could be used for the transportation of goods, and every movement of them would have the effect of making an admirable surface to travel over.

Finally, let me say that the true, the only economical and rapid way of getting rid of snow as a street obstructor is by compression, by condensing its loose particles into a thin, solid stratum or layer, into which wheels will not sink and over which horses and humanity can move freely. In short, you must make of the obstruction (snow) a new roadway.

N. N.

The Steel Tool Question.

To the Editor of the Scientific American:

I have been much interested in the discussions on tempering steel tools. My experience has been that no amount of skill and care in hardening and tempering can make a right down good tool of one not judiciously forged. In forging, bring the steel to a mellow heat, and keep it so until you have your tool forged to shape. As the heat declines to black hot, compact your steel by light hammering on the face of the tool, but do not hammer the tool edgewise. Now if the tool is ready to harden, when it is heated it will swell so as to loosen up the compacting that was done by light hammering as it was cooling off. So it follows that whatever will harden the steel at the least heat will do it the best.

I use strong cold brine, and want it near the fire so as to utilize all the heat in the tool. As soon as the tool is cool, I dip it in oil (sperm or whale oil preferred). Now hold the tool over a well burnt-down fire, without the wind on. Hold the tool so as to retain as much of the oil on it as possible. Now tip it up slightly so as to make the oil flow from over the hottest part to the edge. The oil becomes a carrier of heat, and will help to let down the temper (exactly alike every time) from any thick part to a delicate cutting edge. I think the color that comes on the steel under hot oil can be depended upon much more with than without oil, although it (the color) will be a little tardy. In letting down the temper, I want to do it slow enough at last, so that I can lay down the tool to cool off, and not have to dip again. But if it is going too low, I invert it and dip the body part and leave the edge out. There are very few tools in which I like to leave heat enough in the body to let down the temper with, for this reason: as I grind back on the tool, the cutting edge is apt to get a little farther from the outside film of refined steel. This film is harder than the steel under it, so I would leave the tool slightly harder a little way back from the end. Whereas, if you run out heat enough from the body of the tool, you will very soon be at work with a tool altogether too soft.

Bennington, Vt. TAYLOR D. LAKIN.

Inversion of Image on the Retina of the Eye.

To the Editor of the Scientific American:

It is a well established fact that the image of every object is inverted on the retina of the eye. How is it, then, that we see every object right side up? The common explanation in works on optics is that we correct it by habit, that is, that we know that the image of the object is inverted; but by an exercise of the judgment or imagination we correct it. This seems to me to be irrational and unsatisfactory, and I set myself to the task of finding a better solution. In studying the anatomy of the eye, I found that the optic nerves, which spread over the retina of the eye on which images and impressions are made, converge or are collected into a bundle, and cross each other (at the back of the retina, on their way to the brain or sensorium) about as far from the retina as the pupil is.

W. S. TURNER.

Napa, Cal.

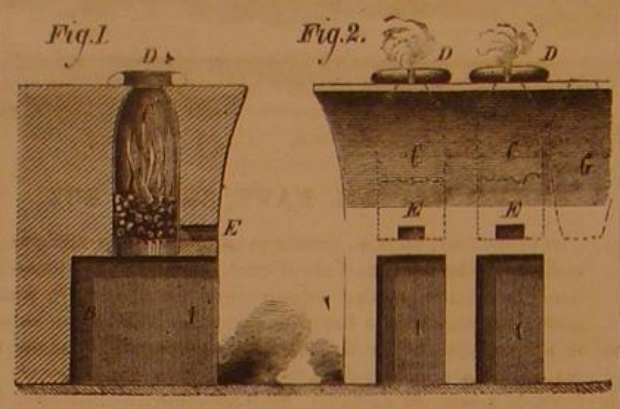
Chinese Cooking Stoves.

To the Editor of the Scientific American:

A Chinese cooking stove is cheaply built, and is very economical of coal. It has occurred to me that a description of it, and of the coal used, might be interesting and profitable to some of your readers.

The accompanying engraving represents the stove, which is used daily in my kitchen, and is a good sample of the common stove used in those parts of northern China where hard coal is used. The stove is built in the corner of the room upon a paved floor, against solid walls. The material is sun-dried brick or adobe, laid in clay mud.

Fig. 1 is a section, from front to rear, through one of the pots. Fig. 2 is a front view, with dotted lines to indicate the interior structure. The scale is 1 to 16. A is an ash pit, which might be opened even to the rear wall; B is the grate, composed of five or six common rods of iron. Above this is a mass of large cinders, about five inches deep. C is



the pot, seven inches in diameter, with hight, from grate to mouth, of fifteen inches. The mouth is about three inches in diameter, and is made in a cast iron plate, six inches square by half an inch thick, which is sunken into the upper surface. D is a collar or ring, about three inches thick, made in two pieces, and separated, as they lay loosely upon the top, far enough for smoke and flame to escape by the sides of the rounded pot or kettle. E is an aperture into which the straight poker is thrust. G is an earthen pot for heating water.

In building, the coal pot is made square, and the adjacent side of the water tank exposed. Afterward pieces of the adobe are worked into the corner, and the interior is plastered with a clay mud, differing from that in which the bricks are laid by the addition of hogs' bristles, which give it tenacity. The collar is made of the same material. The exterior of the whole structure is plastered with a mortar which, being made of lime and clay, gives a smooth hard surface to the stove. The adobe is cheaper than burned brick, and, in the parts near to the fire, much better.

The Chinese live with their doors open, and depend for warmth upon their wadded clothing. The smoke and gas are, therefore, of little account to them. Should any of your readers be inclined to experiment with such a stove, a funnel might be arranged above the stove, so as to carry off most of the smoke.

The coal used here is a flaky, friable anthracite, of poor quality. It costs about $7 a tun, or, allowing for exchange, $8.50 United States currency. To earn this amount, a carpenter or mason, doing first class work, would have to labor sixty days. Coal dust can be bought at a reduction of 25 per cent, and is used more than the pieces. The people take two parts of clay dust and eight parts of the coal dust, mix them thoroughly, and add water to make mud or mortar. This is spread on the ground, about an inch and a half thick, to dry. When partially dry, a shovel cuts or marks the surface into small squares. When nearly dry, these are broken up. Generally, at this stage, a coarse sieve is used, and the cakes, rolling together, lose their corners, and become round. In this form, they burn readily in the stove above described. The advantages of the spherical coals is merely in the fact that they are more easily used than rugged cubical ones.

I see no reason why the poor of our cities in America may not avail themselves of this process, and, buying coal dust at a small price, use the coal balls, as we call them, in common stoves. Perhaps some pieces of coal would be necessary in connection with the balls. But either with or without, it would be a great saving of money.

In the stove which we have described, the common coal dust, wet and mixed with water, is put upon the top of a good fire; a straight poker thrust through this makes a vent for gas, and the fire keeps in with but little consumption of coal.

ISAAC PIERSON,
Missionary of American Board.

Paotinghi, 100 miles south of Peking, China.

The Flying Machine.

To the Editor of the Scientific American:

Allow me to add, to the explanation of my proposed flying machine, published on page 357 of your current volume, the following:

By having the wings revolve in opposite directions, I balance their forces against each other so as to secure the car against a spinning motion, which would attend its flight and its descent if the two wings revolved in one and the same direction.

By disconnecting or separating the arms at the center of the canopy, and giving them an independent action, I am enabled to have one wing shaft incline forwards while the other inclines backwards, and thus to cause the machine to turn round in the air as desired, either to the right or left, and in a smaller or larger circle as the wing shafts are more or less inclined.

Thus it is seen that, with only two wings and a suitable motor, we may gently ride in the air, and fly high or low, fast or slow; and the handles, which are to be connected with the movable arms, will enable us quickly to steer our course in any desired direction.

W. D. G.

Mending Machine Belts.

To the Editor of the Scientific American:

As, in a recent issue of the SCIENTIFIC AMERICAN, one of your correspondents gives his method of lacing belts, I am induced to offer another which I have found valuable.

Lay the two ends of the belt exactly even, with the insides together, and punch one straight row of holes across the end, driving the punch through both pieces so that the holes may correspond. Now take your lace, pointed at both ends, and pass the points in opposite directions through the first hole, still keeping the two ends of the belt together as when punched, and draw the loop tight, observing to keep the ends of equal length. Pass the points through the second hole and so proceed to the last; then tie the ends over the edge of the belt, and the job is done. A belt can thus be mended in half the time and with half the length of lacing required in the usual way; and when the belt is subjected to heavy strains or slipping, it will wear ten times as long, as the lace never touches the pulley faces.

Of course the plan is not applicable when both sides of a belt run over pulleys, nor when the projecting ends would strike anything in their track.

JOS. R. PARKS.

Kansas City, Mo.

Cribbing in Horses.

To the Editor of the Scientific American:

Having seen several communications in your paper on cribbing in horses, I will give you my experience on the subject:

I had a three year old addicted to the habit. I tried various remedies without success, the horse growing worse all the time. Seeing the animal always kept his head nearly in a line with his body, I so arranged the stable that he could not get a resting place for his teeth except on the manger. This I put on the floor of the stall, and kept him confined for a short time. This was done two years ago; and although he has frequently been allowed to exercise in a lot, I have not seen him indulge in the habit. Others have tried the experiment with like results.

B.

Washington, N. C.

The Patent Office Tea Set.—A Correction.

To the Editor of the Scientific American:

I learn that, in my note published in your paper of December 26, 1874, I did Mr. Thacher an injustice by stating that he headed the list of subscribers for the tea set with $50. The statement was made on what was believed to be good authority, and with no intention of wronging any one. I now desire, in the same spirit of fairness, to say that Mr. Thacher did not join in the subscription, and did not give anything towards paying for it.

JAMES.

Synthesis of Purpurin.

To 8 to 10 parts of concentrated sulphuric acid are added 1 part of alizarin, dried and powdered, and 1 part of dried arsenic acid, or of peroxide of manganese. The temperature is gradually raised to 150° or 160° until a drop of the mixture, if thrown into water containing a little caustic soda, gives the coloration of purpurin. The mass is then thrown into a large quantity of water; the precipitate, exhausted with cold water, is then dissolved in a sufficient volume of a cold saturated solution of alum, and deposits, on the addition of an acid, abundant flakes of purpurin, which may be purified by a second solution in alum water, followed by a crystallization from superheated water.—*M. F. de Lalande.*

Monads.

At a recent meeting of the Royal Microscopical Society, a paper by the Rev. W. H. Dallinger and Dr. Drysdale, on the life history of monads, was read. It minutely described a form repeatedly met with in macerations of the heads of codfish and salmon, and traced the development and reproduction in all stages, and was illustrated by drawings. The observations had extended over several years, and had been conducted with the greatest care under various powers up to $\frac{1}{25}$ inch. The results of experiments were also given, and conclusively showed that exposure to temperatures of 220° and 300° Fah. had failed to destroy the germs of these organisms.

Danger from Excavations.

It is well known that the exposure of large quantities of fresh earth, as attends railroad and canal construction, develops intermittent and typho-malarial fevers. To lessen this, Dr. Stephen Smith, of New York city, offers the wise recommendation that sewers be laid only after November 15 and before June 1; and last Tuesday week the Board of Health, accordingly, resolved that the Commissioner of Public Works be requested to omit all excavations between June 15 and October 1, and that no subsoil be exposed during that time.

Double Lattice Wrought Iron Bridge at Springfield, Mass.

Mr. W. Bartlett, in a letter to the *Railroad Gazette*, says:

Few Western engineers have ever seen or heard of the double lattice wrought iron bridge over the Connecticut river, at Springfield, Mass. A bridge which is so carefully designed in regard to economy and durability is well worth taking notes upon. The notes found in the following running description are reliable, and will be valuable to engineers for reference.

The structure was designed by Charles Hilton, C.E., to replace the old wooden Howe bridge on the Boston and Albany Railroad at Springfield. The piers of the old were used for the new structure. There are seven equal spans, each span being 177·15 feet long, making a total length of 1,240 feet. The spans being all similar renders it necessary to describe one span only.

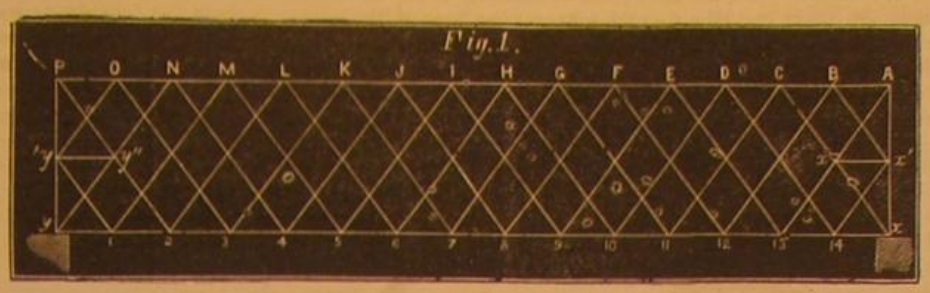


Fig. 1.

The span is composed of three trusses, one central and two outside, the object being to carry a double track. The width between centers of outside chords is 31 feet 6 inches; hight, 24 feet 3 inches. There are 15 panels, each 11 feet 9¾ inches long; inclination of diagonal to horizontal, 45¼° (intended probably for 45°); width of portal, 14 feet; hight, 18 feet 8 inches from top of rail to crown of arch.

The skeleton engraving herewith (Fig, 1) shows the system of bracing.

From a bill of material for one span we find the total weight distributed among the several portions of the span as follows:

	Pounds
Chords	140,022·66
Webs	79,372·15
End posts	10,000·00
Stringers	25,200·00
Cross beams	25,200·00
Pier ends	18,921·00
Total weight of bridge proper	300,715·81
Rails	14,400·00
Timber	39,000·00
Total dead weight	354,115·81

which equals 177·06 tuns. This gives almost exactly one tun per foot run for the dead load.

It is worth noting here that, of the 300,715·81 pounds weight of bridge proper, nearly one half is found in the chords, one fourth in the webs, one sixth in the stringers and cross beams, and one tenth in the pier ends.

The side figure shows section at the center of central truss,

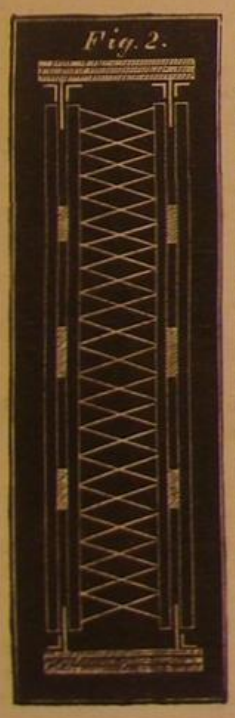


Fig. 2.

where the area of top chord is 74·6 square inches, and of lower chord, 65 square inches. The area of top chord (74·6 square inches) is obtained by three horizontal plates, 30 x $\frac{9}{16}$ inches each, two vertical plates, 12 x ½ inches each, and four angle irons, 3 x 3 x ½ inches each. The area of lower chord (65 square inches) is obtained by the same number of similar plates, and but two angle irons, 3 x 3 x ½ inches each, allowing for rivet holes. From these areas at the center, the areas decrease toward the abutments as the stress diminishes; and near the pier ends the horizontal chord plates are replaced by a system of double lattice bracing, the braces being riveted to the outside angle iron, the inside angle having been stopped two panel lengths from the ends.

Of the diagonals, the struts are riveted on the inside and ties on the outside of the vertical plates. The struts are angle irons united by double lattice bracing. The ties are simply angle iron. The struts and ties are firmly riveted together at their intersections.

The vertical chord plates are connected by zigzag bracing, 2½ inches x ⅜ inches at their lower edges.

All rivets are ⅞ inches diameter, with a pitch of not less than 2⅜ inches.

The lower sway braces are united to chord plates and cross beams by gusset plates.

Stringers are 10½ inches rolled I beam.

The data for computing the strains in the different members are as follows:

Dead load at each joint	11·81 tuns
Live load at each joint	35·43 "
Total dead and live load	47·24 tuns
Length of panel	11·81 feet
Length of diagonal	33·85 "
Depth of truss	24·25 "
Stress allowed for tension	10,000 lbs. per sq. in.
Stress allowed for compression	8,000 lbs. per sq. in.

Paris Green Poisoning.

The question of whether the use of Paris green (arsenite, or aceto-arsenite, of copper) upon potato plants as a means of destroying the bugs will tend to poison the soil, and thus render it unfit to produce vegetation, receives a definite answer from Professor Le Conte, in his paper recently read before the Academy of Sciences. The opinion advanced and concurred in by such high authority as Professors Silliman and Alexander and Dr. Mitchell affirms unequivocally that arsenic and copper are poisons which act with equal energy upon plants and animals. The material diffused upon the leaves of the plants to be protected, which are incapable of absorbing it, is speedily carried into the soil; and if used annually, it is merely a matter of time, how many years will elapse before the soil is poisoned so as to prevent the growth of all vegetation.

Professor Le Conte enters an earnest protest against the present loose yet enormous use of this fearful poison in the hands of uneducated men. It is ordered by Western druggists literally by the tun, and repeated deaths have resulted among farmers through its careless employment.

To this Professor Silliman adds a warning against the too prevalent habit of scattering the substance about dwelling houses as a cockroach poison. The death of several persons in a single dwelling in this city from eating pickles upon which some Paris green had been blown, by a stray draft of wind, occurred quite recently. It should be remembered that the poison contains from fifty-five to fifty-eight per cent of arsenic, and that its deadly effect is as certain as that of the latter mineral. From houses where there are children, the substance should be rigorously excluded. Servants often sift it about on the edges of floors near the mop boards; and we have found it on kitchen sinks, close to the dishes and to food prepared for a meal.

It is well settled that arsenic is dangerous even externally, and experiments have proved that its poisonous effects are developed by a smaller amount inserted in a recent wound than when taken into the stomach. A cut finger, therefore, or a mere scratch on the hands when handling the poison, may serve as a means of the same entering the system.

Paris green, owing to its brilliant color, is employed in so many different uses that to avoid its proximity care is necessary. Professor Alexander, in the discussion which followed the reading of Professor Le Conte's address, said that wall paper has been so thoroughly impregnated with the poison that persons have experienced its effects after half an hour's stay in the room. We have recorded cases of paper hangings which on analysis showed three grains of arsenic to every square foot. Green tarletan, when dyed with the substance, has been found to contain 8·21 grains of arsenic in the same area. In artificial flowers and grasses, *bonbon* papers and boxes, even in the candies themselves, chemical investigation has repeatedly proved the poison to be present. Boxes of toy water colors containing greens, it would seem, are hardly safe children's playthings, as a single cake of paint weighing 38·26 grains has been found to contain 8·89 grains of arsenic. The simplest test for the poison is to put a fragment of the suspected substance in a solution of ammonia. If arsenic be present, a blue color will be produced. For a further test, pour a little of the ammoniacal solution on crystals of nitrate of silver, when the arsenic will appear on the crystals in a yellow deposit. The antidote, as is well known, is peroxide of iron—a tablespoonful to adults every five or ten minutes—together with milk, white of eggs, and other demulcent drinks.

Dr. Le Conte sharply criticised the National Agricultural Bureau for failing to experiment and search out proper remedies for the potato bug, particularly since its ravages were predicted in ample time. Paris green, he certainly thinks, is not a proper nor a safe preventive. The Academy proposes to take active measures against the increasing industrial use of the poison, and before adjourning adopted a resolution appointing a committee to investigate and report upon the subject of the use of poisons applied to vegetables or otherwise for the destruction of deleterious insects and other animals, and also the incautious use of poisons in the ornamentation of articles of food, and for industrial purposes generally, such, for instance, as the coloring of paper.

The Effect of Wind on Sound Waves.

We reverted not long ago to a conflict of opinion between Professors Tyndall and Osborne Reynolds, relative to the proper explanation of the irregularities observed in the transition of sounds under varying conditions of the atmosphere. The former scientist, after experimenting with fog horns and other sound producers, concluded that the unequal range of the sound was owing to the greater or less "acoustic transparency" of the atmosphere, due to the presence or absence of streaks of vapor or unequally rarified air. Professor Reynolds, by similar investigations, was led to the belief that the sound waves, assumed by Professor Tyndall to be quenched, were simply deflected upward and carried over the listener's head, and this lifting he ascribed to the increasing velocity of air currents as the elevation increases, and a direct proportion to the upward diminution of the temperature. For a more extended discussion of these varying theories, the reader is referred to our editorial relating thereto, in the first number of volume XXXI.

The latest contribution in connection with the subject is from a scientist no less eminent than either of the above, Professor Joseph Henry, who, in a paper recently read before the Academy of Sciences, takes direct issue with Professor Tyndall as to the effect of vapor in the air on sound waves, and, at the same time, fails to coincide with Professor Reynold's statement of the upwardly increasing velocity of the air currents. Referring to the fact that sound is heard more distinctly when propagated in the direction of the wind than when in opposition to it, Professor Henry adds that, on the other hand, there are well authenticated cases where sound has been heard a greater distance against the wind; so that the phenomenon is by no means susceptible of ready explanation. The idea that wind accelerates sound in one case, or retards it in the other, has evidently little bearing when it is considered that sound moves at the rate of 700 miles per hour, while a wind of seven miles an hour is sufficient to give a penetrating power, to a given sound, of double the intensity; whereas, from the foregoing consideration, it should have an effect of only one per cent. The only explanation which has been offered for the phenomenon is that, in a river of air of considerable depth moving over the surface of the earth, the lower part moves with less velocity, on account of friction, than the upper part, and that, consequently, the tendency would be to tip the sound wave so as to throw the sound downward toward the earth in the case of the sound moving in the same direction as the wind, and to deflect it upward in case the movement is in an opposite direction, throwing it into the air above the head of the observer. This hypothesis gives a ready explanation of all the phenomena observed, and was fully illustrated by a series of experiments made by Professor Henry in the vicinity of the lightship of Sandy Hook last summer. Two steamers were supplied with whistles producing the same tone, and sent, one to the westward and one to the eastward. A wind was blowing from the west at the time with a velocity of 6½ miles an hour. The whistle on one steamer was heard until it sailed a mile from the steamship on which the observers were stationed, while the sound of the other, which was carried by the wind, was heard 2½ miles. This was in accordance with the most experience of the effect of wind in accelerating the sound waves. At noon, however, the experiment was repeated in a dead calm, and the same effect was observed, the sound from the steamer that sailed eastward being heard two and a half times as far as the sound from the other steamer. Again, in the afternoon, the experiment was tried after the wind had chopped about and was blowing from the east, but the observers were surprised to find no change in the result. Apparently the course of the wind had no effect upon the velocity of the sound. Professor Henry was satisfied, however, that the variation in the wind occurred only at the earth's surface, and that a river of wind was flowing steadily from the west all the time. Next day he repeated the experiments under exactly similar conditions, the wind falling to a calm and then shifting as before. He sent up small balloons at the same time, and found the idea to be correct. A steady current from the west prevailed all the time. By this beautiful experiment, Professor Henry considers the truth of his theory as to the uniform effect of wind on sound to be completely demonstrated.

The fault with Tyndall's experiments was that they were all made in one direction. Last summer Professor Henry placed a large steam trumpet on a steamer. The wind was from the west, and the trumpet was pointed northward. The steamer sailed toward the wind, and carried the sound only 3½ miles, but in sailing in a contrary direction the sound was heard for a distance of eight miles. If Professor Tyndall had observed the sound from one direction only, he would have called the day opaque; if from the other, only he would have concluded that it was quite clear.

Professor Henry's opinion relative to the steady flow of wind from the east revives the idea of the constant easterly current so much discussed during the transatlantic balloon attempts of a year ago. It may be added, however, that, although the aeronauts shared fully in believing the existence of such a vast aerial river, subsequent and repeated ascensions have failed conclusively to demonstrate its presence. It is somewhat difficult, therefore, to reconcile the results, noted by Professor Henry with his small balloons, with those obtained through actual ascents by individuals. Altogether, the subject is like the Tyndall and Draper difference of views on the invisible rays of the spectrum: one of those anomalous instances of doctors disagreeing. With such a triumvirate as Tyndall, Henry, and Reynolds at variance, the humbler physicist is indeed at a loss to determine to which theory to anchor his faith.

A Suicidal Scorpion.

The statement that a scorpion, when driven to bay by its enemies and unable to escape, will kill itself by a blow from its venomous sting has usually been regarded as rather mythical. A well attested instance, however, of the suicide of the insect has lately been published by Dr. de Bellesme. The writer states that, having captured a scorpion, he converged the rays of the sun on its back by means of a burning glass. The insect became furiously enraged, and finally raised its sting and struck itself, dying within half a minute afterward.

WE see it stated that three Dartmouth students, named Colby, Brown, and Dustin, will start for Egypt this month under an engagement with the Khedive for service in the surgical corps of his army. They will reside in Cairo and be attached to the personal staff of the Khedive, who is to pay them $2,500 to $3,500 a year, in gold, and traveling expenses.

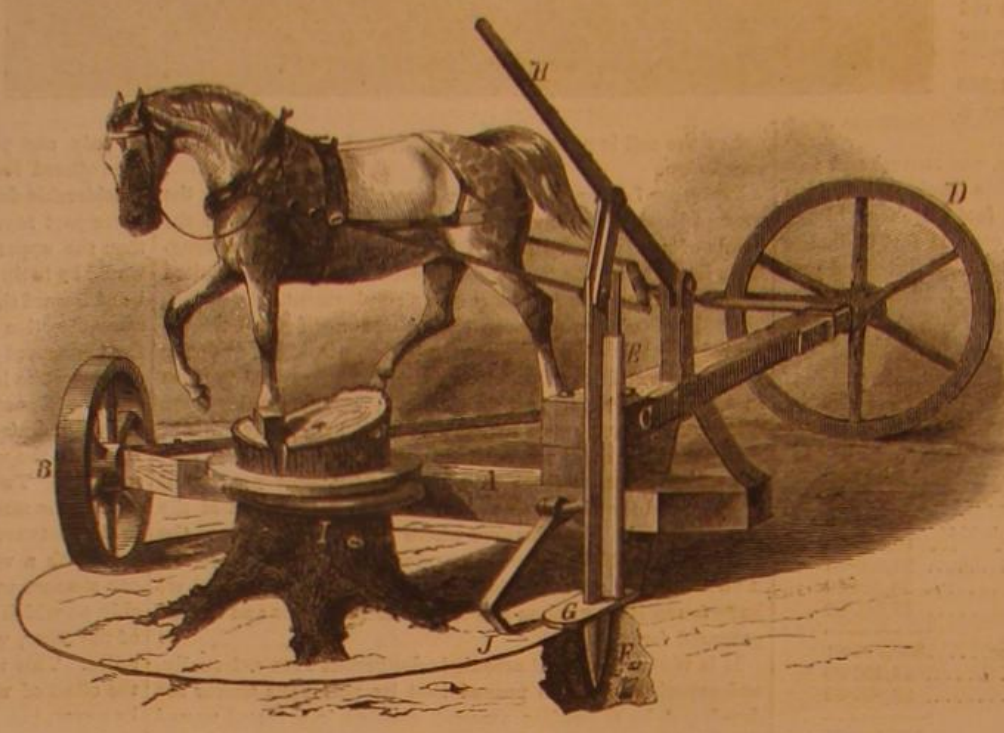
IMPROVED GRUBBING MACHINE.

Farmers and others will find in the invention represented in the engraving a useful apparatus for grubbing up the stumps of trees of even considerable size, which will doubtless prove an efficient auxiliary in clearing land. It is constructed and operated as follows: At one extremity of the beam, A, is journaled a small wheel, B; near the other end is a second beam, C, a block being interposed between the two beams to bring them to the proper relative hight. Beam, C, also has a wheel at its end at D, which wheel, however, is larger than that first mentioned. The journal of wheel, D, is hinged to the beam, so that said wheel may be turned back parallel with the beam, for convenience in drawing the machine from place to place. A loop secured to the ends of the hinged journal carries a hook, to which the harness of the horse is hitched.

At the rear end of beam, C, is a slotted guide, E, grooves in which receive the guide plate which is formed upon the upper part of the knife, F. The lower part of the latter passes through a guide slot in a bar, G, which also serves as a shoe for supporting the machine and as a brace to meet the draft strain upon the knife. By operating the lever, H, the knife, through the interposing connecting rods, may be raised from or lowered into the ground and held down to its work. To the rear of beam, A, in such position as to bring the knife at proper distance from the stump to be operated upon, is secured a loop, I, which encircles the stump, as shown.

In operating the machine this loop is first dropped in place, and a ring is placed above it. A wedge is then driven into the top of the stump so as to fasten the ring, the latter serving both to prevent the loop from slipping off, and also as a band to keep the wedge from spreading the lower part of the stump so as to tighten said loop. The knife is next forced into the ground for five or six inches, so that, on driving the horse around the stump, it cuts off such side roots as may lie in its path. At each round the knife is driven in deeper until all the roots are divided. The hook, J, is then dropped and held down by the foot until it catches upon a root. A few rounds twist off this last, and the stump may then be easily raised from the ground.

Patented through the Scientific American Patent Agency, October 20, 1874. For further particulars address the inventor, Mr. G. E. Reyner, Canton, Iowa.



REYNER'S GRUBBING MACHINE AND EXTRACTOR

IMPROVED HORSE DETACHER.

The object of the invention illustrated herewith is to provide a means of instantly detaching a pair or even three horses from a vehicle in case of their running away or becoming fractious. The advantages gained of course are the prevention of the injury or destruction of the vehicle, and of the greater risk of periling the lives of passengers.

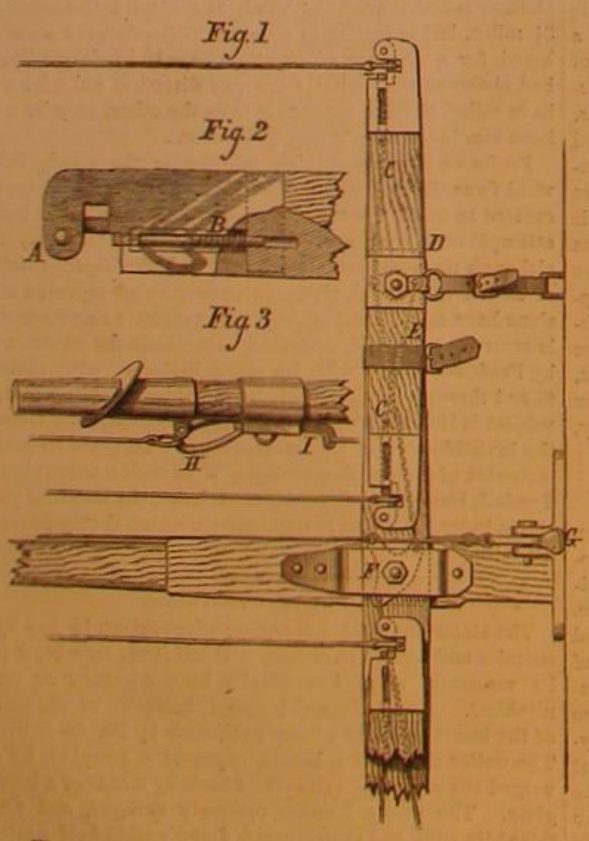


Fig. 1 shows the disconnecting arrangements located on the double tree and front portion of the wagon. Fig. 2 represents in detail the extremity of a single tree, and Fig. 3 is the end of the pole. The traces are provided with loops at their ends which slip over the hinged bolts, A, Fig. 2, at the extremities of the single trees. B is a spring catch which is held in front of said bolt, keeping the same position and thus confining the trace. Chains, C, connect the pair of spring catches, belonging to each single tree, to the sway bar, D; and chains, E, connect the sway bars to two arms of a bell crank, F. The third arm of the bell crank communicates with the detaching lever, G. When this lever is pushed outward, it rotates the bell crank, which thus, by pulling on the chains, E, turns the sway bars; and the latter, through the chains, D, withdraw the catch bolts from before the trace pins, which then, swinging on their hinges, release the four trace loops simultaneously.

H, Fig. 3, is a hook pivoted, as shown, near the end of the tongue, and I is a sliding catch bolt, also operated by the detaching lever, G, through the medium of a connecting wire. This arrangement is for the purpose of detaching a third horse, which may be harnessed to the pole end. Patented through the Scientific American Patent Agency, November 10, 1874. For further information address the inventor, Mr. Anatole Ehret, No. 540 Washington street, San Francisco, Cal.

Hydrocarbons produced on Cast Iron and Steel.

Towards the end of the last century, a French chemist named Proust observed that hydrogen gas, evolved by the action of sulphuric or hydrochloric acid on cast iron or steel, was accompanied by a kind of ethereal oil, which condensed in drops on the sides of the bottle in which the gas was evolved, as well as in the tubes through which it was conducted and the vessels in which it was collected. He also found that not all of this oily product was carried off by the hydrogen gas, but that a considerable portion of it remained in the black carbonaceous residue left by the action of the acids on cast iron. To obtain this portion, it is only necessary to treat the residue with alcohol, and after filtration to add water to this extract, when it becomes milky and the oily substance all separates.

Cloez, in his experiment on this subject, employed a beautiful spiegeleisen, which contained about 4 per cent combined carbon, 6 per cent manganese, some silicon and traces of phosphorus and sulphur. It was reduced to pieces of moderate size, and treated with hydrochloric acid diluted with twice its volume of water. The action of the acid or white iron in the cold is very feeble; to aid it, Cloez placed the iron and acid in a flask on a water bath, the temperature of which was 167° to 194° Fah. Under these conditions, the gas was evolved regularly, and about 600 grains of iron were dissolved daily in a single apparatus. The gas generated was first passed through two Woulfe's bottles with cold water, then through an apparatus containing pumice soaked in sulphate of copper, and afterwards through a two-necked bottle where it came into contact with bromine covered with a stratum of water. With this apparatus the following substances may be collected:

1. The oily liquid, which is condensed in the first two bottles, and which was first observed by Proust. According to Cloez's experiments, the quantity of this substance formed equaled about 1 per cent of the weight of the iron employed.

2. The bromated products formed by the absorption of the hydrocarbons, $C_{2n}H^{2n}$, by bromine. These products are very complex.

3. The liquid and solid products obtained by treating the insoluble residue with sulphide of carbon and alcohol.

The oily liquid obtained directly by condensation is lighter than water, colorless, and very fluid. After two days' contact with fused chloride of calcium, it was subjected to distillation, and began to boil at 248° Fah. About one third of the liquid distils over below 284°, a small quantity between 293° and 320°; and the boiling point of the remainder gradually rises to 392° Fah.

Cloez next endeavored to obtain a pure product out of the most volatile portion of the liquid by fractional distillation, but this was difficult, since he only had 20 to 30 grains of the liquid. He succeeded, however, in isolating a hydrocarbon which distilled completely between 240° and 248°, and had the composition and properties of caprylen or octylen, $C_{16}H_{16}$. Analysis gave: Carbon, 84·92; hydrogen, 14·17; total, 99·09

An examination of the bromated liquid discovered the presence of several homologues, $C_{2n}H_{2n}Br_2$. Cloez separated the bromide of propylen by distillation; but then he sought in vain for the bromide of ethylen, which boils at 444° Fah. The mixture of bromated compounds began to boil at 266°; the temperature rose rapidly to 284° and 295°, where it remained stationary quite a long time; it then rose progressively to 320°, where it again stopped for a while, and then rose gradually until finally it reached 374°. At this temperature hydrobromic acid was given off from the decomposition of the more condensed bromated hydrocarbons. The distillation was not carried any farther. The least volatile portion of the bromated product, which did not distil over, was set aside to be treated with an alcoholic solution and thus converted into more permanent products of more simple composition. He succeeded in this way in obtaining bromide of heptylen, $C_{14}H_{13}Br$, boiling at 130°, and the next member of the series, bromide of caprylen or octylen, $C_{16}H_{15}Br$, boiling at 302° Fah.

In the first bottle through which the gas passed there was deposited on the sides, in addition to the oily product, a solid, perfectly crystallized body, which sublimed without decomposition. Cloez obtained it only in very small quantities, but hopes, on dissolving in hydrochloric acid the whole quantity of 150 kilogrammes of iron, to obtain enough of it to make some investigations and determine its composition.

Before taking up this white speigeleisen, Cloez operated on ordinary gray iron, but obtained no oily hydrocarbon on dissolving 50 kilogrammes, and only very little of the bromated product, less than $\frac{1}{1000}$ part of the weight of the iron. This small yield represents only a very small fraction of the carbon which is present in a combined state in gray iron.

SHADE ATTACHMENT FOR PLOWS.

Every farmer who has trudged after a plow under a hot sun has doubtless wished for just some such an invention as that illustrated in the annexed engraving. It is simply an attachment readily applied to any convenient portion of the plow, the object of which is to support an umbrella and to allow of the same being adjusted so as always to throw its shade upon the plowman.

A cranked arm is secured in a socket by means of a set screw, and is free to revolve in a horizontal plane. The outer end of this crank is jointed, and provided with an adjusting brace, whereby it may be inclined and secured at any desired angle. A suitable socket, at the upper end of the arm, holds the umbrella handle, retaining the same by a simple spring catch.

The umbrella shade is largely used, in this city, by stage drivers, cartmen, and others whose labor requires them to be constantly out of doors, and it proves a very welcome comfort. It obviates, besides, by warding off the sun's rays, the danger from sun stroke, and is a convenient shelter in case of sudden showers.

This invention was patented through the Scientific American Patent Agency, October 27, 1874, to Jefferson G. Darby, of Fort Motte, S. C.

SIR SAMUEL BAKER'S EXPEDITION.

Sir Samuel Baker, who was commissioned by the present enlightened Khedive of Egypt to proceed into the interior of Africa and suppress the slave trade of that immense wilderness which lies south of the Khedive's territory, has recently published an interesting and valuable book of travels. In describing his journey up the White Nile, he states that he had European vegetables of all kinds. "Having cleared and grubbed up a portion of the forest, we quickly established gardens. The English quarter was particularly neat The various plots were separated by fences, and the ground was under cultivation for about two acres, extending to the margin of the river. I did not build a house for myself, as we preferred our comfortable barge, which was moored alongside the garden, from the entrance of which a walk led to a couple of large mimosas, that formed my public divan, where all visitors were received. In a short time we had above ground sweet melons, watermelons, pumpkins, cabbages, tomatoes, cauliflowers beetroot, parsley, lettuce celery, etc.; but all the peas and beans, and a very choice selection of maize, that I had received from England, were destroyed during the voyage. Against my express orders the box had been hermetically sealed, and the vitality of the larger seeds was gone."

We select an engraving from this interesting book, in which the gigantic aquatic vegetation of the district is well shown, together with the curious rig of the boats used for inland navigation in Africa, of which a yard of immense length, made of one cane stalk, is the distinguishing feature.

VEGETATION ON THE BANKS OF THE WHITE NILE.

THE GREAT WELL AT PROSPECT PARK, BROOKLYN.

The Brooklyn Park Commission have provided, for the needs of the beautiful pleasure ground, a supply of water which enables them to be independent of the Ridgewood water, the yield of which is already well taxed in furnishing the city, with a prospect of a much larger demand in the immediate future. The well is situated under the shadow of Look-Out Hill, the highest ground in the park, on the summit of which a reservoir, 175 feet above the surface, has been constructed.

We give herewith a view of the upper part of the well, by which its ample proportions may be well conceived. Three quarters of a million gallons of water daily flow into the well, to be pumped, by the engine on the platform shown in our engraving, up to the distributing reservoir above described. It will be seen that the well is not, as it is sometimes called, an artesian well, and differs from the ordinary well only in its great size. The water flows horizontally, through pervious soil, till it reaches the intercepting drains, four of which are shown in the engraving (which we select from the *Christian Weekly*), delivering their water into the well. The structure is surrounded by a skylight, and access to the spiral staircase is found on walking into the engineer's office, shown on the left hand of our engraving, immediately over the engine.

THE GREAT WELL AT PROSPECT PARK, BROOKLYN.

The Latest Artificial Butter Process.

La Nature, of recent date, contains a description of a new artificial butter manufacturing process, the invention of M. Mège-Mouriès, which is being practised in Paris. A comparison of the details with those of the compounding of the oleo-margarin butter, made in this city and not long ago fully described and illustrated in these columns, shows the operations to be identical up to the churning. At this point, the oleo-margarin process is to mix the oil prepared from the fat with one fifth its weight of sour milk, and churn in the ordinary way. M. Mouriès' mode of manufacture seems to be a closer copy of Nature. He adds to 110 pounds of the oil about 25 quarts of sweet milk, in which are dissolved the soluble portions of 1,500 grains of cow's udder. This last is very finely divided and macerated for some time previous to use. The mixture, after agitation, transforms itself first into a cream, and, after about two hours, into butter, from which the buttermilk is drained. It is then washed and salted in the usual manner.

MM. Bondet and L'Hote, two chemists who have analyzed the product, give the rather anomalous opinion that the artificial compound is more nearly real butter than the genuine article prepared from cream. It contains less water, and less animal substance apt to turn rancid, than natural butter.

The imitation, it is stated, is largely employed by dairymen in France for adulteration purposes. Its taste is not agreeable, as it savors strongly of the suet.

In this connection we may remark that there is a very simple and sure way of distinguishing genuine cow butter from the oleo-margarin mixture. It consists in dissolving a small portion of the suspected substance in ether, and evaporating to dryness by the application of a gentle heat. The residue has the true butter smell if genuine, which may be greatly intensified by cooking. If artificial, however, the deposit has the easily recognizable odor of suet. A complete description of a test for artificial butter, by Mr. John Horsley, F.C.S., by the use of methylated ether, was given on page 370 of our volume XXXI.

The Slang of the Stock Exchange.

Gamblers of every grade, says a contemporary, have their slang terms to convey to the initiated just what they mean; and however blind it may be to the uninitiated, it is perfectly intelligible to those possessed of the high civilization (?) necessary to "manipulate stocks." Four different forms of contracts are known under the general term of stock privileges. The "put" and "call" are single privileges. The "straddle" and "spread" are double privileges. A "put" is a contract giving the holder the right of delivering a certain amount of stock within a definite time at a stipulated price. A "call" is exactly the reverse of a "put," being a contract giving the holder the right of calling for the stock instead of delivering it. A double privilege is a "put" and "call" on the same stock in one contract. When a double privilege is drawn at the market price of the stock, it is called a "straddle," and costs from two and a half to five per cent premium. But when drawn at a distance of from one to two and a half per cent above and below the market price, it is called a "spread," for which a fixed premium of two per cent is paid. The distance from the market at which a "spread" is drawn depends on the class of stock and the activity of the market.

Unhealthy Plants.

Whenever plants begin to drop their leaves, it is certain that their health has been injured either by over-potting, over-watering, over-heating, by too much cold, or by applying such stimulants as guano, or by some other means, having destroyed the fine rootlets by which the plant feeds, and induced disease that may lead to death. The case is not usually important enough to call in a "plant doctor;" so the amateur begins to treat the patient, and the practice is in all probability not unlike that of many of our household physicians who apply a remedy that increases the disease. Having already destroyed the, so to speak, nutritive organs of the plant, the stomach is gorged with food by applying water, or with medicine by applying guano or some patent "plant food." Now the remedy is nearly akin to what is a good one when the animal digestion is deranged—give it no more food until it reacts. We must then, if the roots of the plant have been injured from any of the above named causes, let the soil in which it is potted become nearly dry; then remove the plant from the pot, take the ball of soil in which the roots have been enveloped, and crush it between the hands just enough to allow all the sour outer crust of the ball of earth to be shaken off; then re-pot in rather dry soil (composed of any fresh soil mixed with equal bulk of leaf mold or street sweepings), using a new flower pot, or having thoroughly washed the old one, so that the moisture can freely evaporate through the pores. Be careful not to over-feed the sick plant. Let the pot be only large enough to admit of not more than an inch of soil between the pot and ball of roots. After repotting, give it water enough to settle the soil, and do not apply any more until the plant has begun to grow, unless, indeed, the atmosphere is so dry that the moisture has entirely evaporated from the soil; then, of course, water must be given, or the patient may die from the opposite cause—starvation. The danger to be avoided is in all probability that which brought on the sickness, namely, saturation of the soil by too much water. Other causes may induce sickness to plants, such as an escape of gas in the apartment, or smoke from a flue in the greenhouse; but in all cases, when the leaves fall from a plant, withhold water, and, if there is reason to believe that the soil has been poisoned by gas or soddened with moisture, shake it from the roots as before advised, and re-pot in a fresh flower pot. Many years ago, when I used smoke flues in my greenhouses, some kindling wood, carelessly thrown on the top of one of them, ignited, and the smoke caused the leaves of every plant to drop. There were some 3,000 plants, mostly tea roses, in the greenhouse; it would have been too much of a job to re-pot all, but, by withholding water for some ten days, until they started a new growth again, very few of this large number of plants were injured.
—*Peter Henderson.*

OCEAN TELEGRAPHY.

BY GEORGE B. PRESCOTT.

NUMBER I.

If the unexpected discoveries and gigantic works which have been realized during the past half century had not familiarized us with the marvelous, we should consider the accomplishment of ocean telegraphy to be the eighth wonder of the world: a wonder, on account of the almost supernatural results which it furnishes, the numerous difficulties which it has encountered, the physical results which it has produced: and even a wonder on account of the enormous amount of money which has been expended in its development. In discussing the extent of this marvelous system of international communications, it seems proper to consider to whom is due the credit of taking the first steps toward its accomplishment. Up to 1847, no substance suitable for the insulation of a submarine wire was known. During that year, Mr. John J. Craven obtained and experimented with some gutta percha, and discovered its insulating qualities and its adaptability to subaqueous communication. The Trenton, N. J., *State Gazette*, for May 10, 1848, contains the following paragraph: "Gutta percha is now used for insulating telegraphic wires. Mr. Craven has tried it for the old New York and Philadelphia line in the Passaic river, and has been so successful that the company intend to try to cross from Jersey City to New York by laying several wires, thus insulated, under the water." The New York *Tribune* of June 17, 1848, contains the following paragraph: "The wires of the New York and Philadelphia Telegraph have been extended across the Hudson from Jersey City, and are now in successful communication with that place. They are encased in a double covering of gutta percha, and laid on the bottom of the river in the track of the ferry boats."

In 1846, Mr. James Reynolds, of New York, invented a machine for covering wire with india rubber, and during the year 1847 covered a large amount of wire with this substance; but in consequence of the difficulty of drying it (vulcanization of rubber being then unknown), it proved a failure. Early in the spring of 1848, Mr. Craven brought a piece of wire covered with gutta percha to Mr. Reynolds, and asked if he could cover wire with gutta percha with his machine. Mr. Reynolds undertook to do so, and immediately proceeded to manufacture gutta percha covered wire. He covered the cable which was laid across the Hudson river between New York and Jersey City, *which was the first gutta percha cable ever made, and the first submarine wire ever constructed and successfully operated for the transmission of intelligence over a distance of half a mile.*

One of Mr. Reynolds' workmen, named Champlin, shortly after this cable was laid, went to England and communicated the process to the Gutta Percha Company, who at once commenced the manufacture of gutta percha covered wire.

On the 16th of December, 1859, Mr. Charles Vincent Walker, an experienced telegraph engineer, testified before the joint committee, appointed by the British Government to inquire into the construction of submarine telegraph cables, as follows: "I was the first to use gutta percha in England. I advised Mr. Foster, of Streatham, to apply it in our very early difficulties in telegraphing. We purchased and used the first wire covered with gutta percha, on November 11, 1848."

The first submarine cable ever laid in the open sea was laid between Dover and Calais, in 1850. It was a single strand of gutta percha, unprotected by any outside coating, and worked only one day. The next cable was also laid between Dover and Calais, in 1851. This cable contained four conducting wires, was 27 miles in length, and weighed 6 tuns per mile. This cable is still working, after having been down 23 years. The next long cable was laid in 1853, between Dover and Ostend, a distance of 80 miles, and contained six conducting wires, and weighed 5¼ tuns per mile. It is still in working order. It 1853 a cable of one conducting wire was laid between England and Holland, 120 miles, weighing 1¼ tuns per mile. This cable worked for 12 years. From 1853 to 1858, 37 cables were laid down, having a total length of 3,700 miles: of which 16 are still working, 13 worked for periods varying from a week to five years, and the remaining 8 were total failures.

On the 6th of August, 1858, the first Atlantic cable was laid between Ireland and Newfoundland. The weight of this cable was 1 tun per mile, and its cost was as follows: Price of deep sea wire per mile, $200; price of spun yarn and iron wire per mile, $265; price of outside tar per mile, $20. Total per mile, $485. Price, as above, for 2,500 miles, $1,212,500; price of 25 miles shore end at $1,450 per mile, $36,250. Total cost, $1,249,235. This cable worked from August 10 to September 1, during which time 129 messages were sent from Valentia to Newfoundland, and 271 from Newfoundland to Valentia. The failure of the cable was mainly due to carelessness in the manufacture and subsequent handling. When the cable was in process of manufacture, it was coiled in four large vats, and left exposed day after day to the heat of a summer sun. As might have been foreseen, the gutta percha was melted, and the conductor which it was desired to insulate was so twisted by the coils that it was left quite bare in numberless places, thus weakening and eventually, when the cable was submerged, destroying the insulation. The injury was partially discovered before the cable was taken out of the factory, and a length of about thirty miles was cut out and condemned. This, however, did not wholly remedy the difficulty, for the defective insulation became frequently and painfully apparent while the cable was being submerged. Still further evidence of its condition was offered when it came to be cut up for charms and trinkets.

The next long cable which was laid was from Suez to India, a distance of 3,500 miles in 1859. This cable was laid in five sections, which worked from six to nine months each: but was never in working order from end to end.

The total length of all the cables which have been laid is about 70,000 miles, of which over 50,000 miles are now in successful operation. The 20,000 miles of cables which have thus far failed represent 58 in number. Up to 1865, none of them had been tested under water after manufacture, and every one of them was covered with a sheathing of light iron wire, weighing in the average only about 1,500 pounds per mile. These two peculiarities are sufficient to account for every failure which has occurred. No electrical test will show the presence of flaws in the insulating cover of a wire, unless water or some other conductor enters the flaw and establishes an electrical connection between the outside and inside of the cable; and all cables laid in shallow water should have an armor weighing not less than five tuns per mile.

The core of long submarine cables generally consists of several wires of pure copper covered with alternate layers of gutta percha and Chatterton's compound, the latter consisting of gutta percha, resin, and Stockholm tar. Over this is placed a layer of tarred yarn, and the whole is finally included in a sheathing of iron wire laid on spirally, to give the cable sufficient strength to withstand the strain of paying out, or that to which it may be subjected by the inequalities of the ocean bed. Not infrequently the iron wire of the sheathing is also protected from corrosion by tarred hemp. Figs. 1 and 2 show the construction of the Malta and Alexandria cable. The different layers are so far peeled off as to show the construction. The strand of seven copper wires is shown at the top; then follow three layers of gutta percha and one of tarred yarn, the whole enveloped in the eighteen wires constituting the sheathing. The diameter out in the sea is 0·85 of an inch. Near the shore the sheathing is made stronger, to meet the danger of accident from the dragging of anchors.

Fig. 1.

Including the original 1858 cable, five cables have been laid down between Ireland and Newfoundland, of which only three are now in working order. These three were laid in 1866, 1873, and 1874. The cable of 1865 of a similar type as the above has not been working for over two years.

Fig. 2.

Fig. 3.

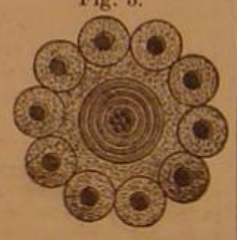


Fig. 4.

The following are the details of construction of the last four Ireland and Newfoundland cables. Fig. 3 shows the section, and Fig. 4 the external appearance and construction, of the 1865 cable in the full size, 1¼ inch in diameter. Fig. 5 shows the shore end in section. The construction of the 1865 cable is the same as that of all the subsequent ones, with one or two non-essential differences.

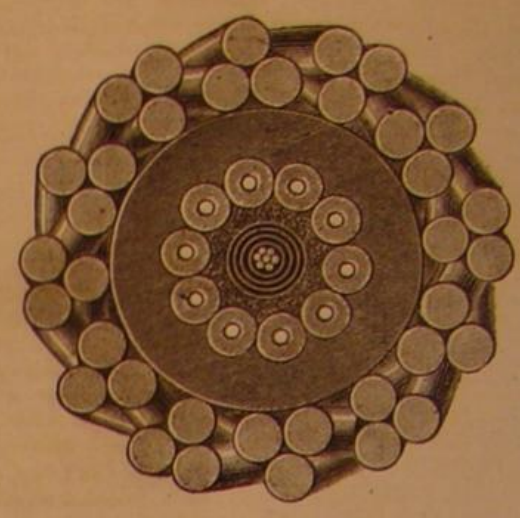
The conductor of this cable consists of a copper strand of seven wires, six laid round one, and weighing 300 pounds per nautical mile, imbedded, for solidity, in Chatterton's compound. Gage of single wire, 0·048 of an inch; gage of strand, 0·144.

The insulation of each cable consists of four layers of gutta percha, laid on alternately with four thin layers of Chatterton's compound. The diameter of core (conductor and insulation) is 0·464 of an inch.

Its external protection consists of ten steel wires, 0·095 of an inch in diameter, each wire surrounded separately with five strands of tarred manilla hemp, and the whole laid spirally round the core, which latter is padded with tarred jute yarn. The weight in air is 35 cwt. 3 qrs. per nautical mile; weight in water, 14 cwt. per nautical mile. Any of the cables would bear eleven knots of itself in water without breaking.

When a telegraph wire at a distant station is disconnected from the ground and placed in connection with one of the poles of a battery, the other pole of which is to earth, a charge flows into the wire at the instant in which the connection is made and, if the insulation of the line is perfect, almost instantly ceases. The needle of the galvanometer makes a sudden deflection, and then returns to its position of rest. If the battery is cut off and the line, at the same moment, put to earth, the needle deflects momentarily in the opposite way, and the charge given to the wire returns and goes to earth. In land lines, this return charge is very slight except upon very long lines, but in submarine cables it is very marked. This return charge shows that a telegraph wire may be charged like a Leyden jar. The wire is the inner coating, the air or gutta percha the dielectric, and the earth or sea the outer coating. The statical charge of which a line of telegraph is then capable shows that the electric force tends to propagate itself not only longitudinally but laterally. The effect of lateral induction is to retard the time of delivery of a signal and to prolong it, so that, although it is a momentary signal at starting, it becomes a prolonged signal at its destination. The mere slowing of the signal would not matter much, provided it was delivered at its destination as sent; but it is not. Each signal at the receiving station takes a longer time to leave the line than it did to enter it. Hence, in a cable, if the sender transmitted at the same rate and with the same apparatus that he does in land lines, the signals would run into each other at the receiving station, and be indistinguishable. Time must be given to allow each signal to ooze out of the cable before another is sent. Retardation increases with the square of the length of the line. The maximum speed of signaling through 2,000 miles of the Atlantic telegraph of 1858 was two and a half words a minute. The copper core had a conducting power somewhat higher than a No. 4 iron wire If the ratio of the thickness of the core to that of the insulating coating be kept the same, the number of words that can be sent varies as the amount of material employed, or as the square of the diameter of the cable. Thus, if a cable be of the same make and of equal length as another, but twice as thick, four times as many words may be sent by it.

Fig. 5.



The conductor of the Atlantic cable of 1858 consisted of a strand of seven copper wires of No. 22½ gage, weighing 93 pounds per mile, while those of 1865, 1866, 1873, and 1874 have each 300 pounds per mile. The highest rate of speed obtained through the 1858 cable was 2½ words per minute, while through the 1865, 1866, 1873, and 1874 cables they have obtained a speed of 17 words per minute in regular working, and of 24 words per minute upon an experimental test.

THE CONSTITUTION OF THE SUN.

BY PROFESSOR C. A. YOUNG.

Number III—Conclusion

THE ENVELOPE OR CHROMOSPHERE.

The edge of the sun's visible disk is much less brilliant than the central portions, and this fact was long ago recognized by Arago and others, as evidence of an atmosphere of some depth, covering his surface and cutting off a portion of the light.

This lower portion of the solar atmosphere, which is rich in the vapors whose condensation produces the photosphere, and in which most of the dark lines of the spectrum originate, is comparatively shallow, not more, probably, than from 500 to 2,000 miles in thickness.

But it is surmounted to the much greater elevation of some 8,000 or 10,000 miles by the hydrogen and other non-condensible gases which form the rose-colored envelope to which Mr. Lockyer has given the name of chromosphere. This is a sheet of scarlet flame which clothes the whole surface of the sun, and here and there rises in cloud-like forms that ascend to enormous hights above the general level.

The upper surface of the chromosphere is exceedingly uneven, such as fully to justify the expression "a sheet of flame;" for the whole appearance suggests the idea that it is formed of jets of heated gas rushing up from the central fire through countless orifices and rents between the clouds which constitute the photosphere. And yet "flame" is hardly the right word, for in the chromosphere, so far as we can learn, there is no true combustion; the heat does not come from chemical combinations. These solar flames are mere masses of intensely heated gas, absolutely too hot to burn—at a temperature above what chemists call the "dissociation point," where all play of chemical affinity ceases.

Occasionally the up-rising jet attains a very great velocity, and spreads out in the upper regions of the coronal atmosphere into precisely such forms as those familiarly assumed in our own air by smoke and vapors. For many years they were the subject of much discussion, but in 1868 the spectroscope for ever set the question at rest by showing that they are nothing but heated clouds of gas, largely hydrogen. Their spectrum exhibits conspicuously the bright lines of that element, and besides them another very prominent one, which, from the circumstance that its place in the spectrum is very near the two lines of sodium, D_1 and D_2, is commonly referred to as the D_3 line. Many circumstances make it nearly certain that this line is due to some other

substance than hydrogen, a congener in lightness and many other properties, but as yet undiscovered by our terrestrial chemistry. To this hypothetical element the name of helium has been assigned by Lockyer and Frankland, though with rather doubtful propriety. Sometimes, not unfrequently indeed, other lines also appear, among which those of sodium, magnesium, barium, chromium, calcium, titanium, and iron are most common.

That the prominences are merely extensions of a continuous envelope had been maintained, on more or less satisfactory evidence, by several astronomers as early as 1855. It is found that the prominences may be broadly divided into two classes, the nebulous and eruptive. The former, in their appearance, closely resemble our terrestrial clouds: of a delicate filmy texture, often enormous in extent, they seem to float in the upper atmosphere, and gradually dissolve away.

The eruptive prominences are composed usually of vertical filaments, are very brilliant, and undergo the most rapid and extreme changes of form. Their spectrum is often very much complicated by the injection of metallic vapors, and the lines are often widened by pressure, and distorted by violent motions along the line of sight. As a rule, these prominences do not attain so great an elevation or magnitude as those of the other class, but in exceptional cases they far surpass them. The ejected filaments have been known to reach a hight of 100,000, 135,000, and, in one single instance, 210,000, miles.

In most cases, the appearance is that of a jet of heated gas issuing through an orifice, under a great but nearly steady pressure; but in those instan[illegible]where the greatest velocities are attained, the action is almost invariably paroxysmal, and suggests the idea of veritable explosions. It was the jet-like appearance of these eruptive prominences that led Zöllner to the conclusion that the sun must be covered by a shell or crust (*trennungs-schicht*) of some kind, and he concluded it to be a continuous liquid surface. There seem to be almost insuperable objections to this view in its unmodified form: a stable liquid shell, like that of a bubble, of greater density than the underlying gases, would seem to be impossible, considering that it must be everywhere pierced by up-rushing currents from within. But though such a shell cannot well exist in a condition of statical equilibrium, something considerably like it may result from the constant down-pour of the products of condensation. It seems quite possible, or even probable, that the descending masses of mingled liquid and solid matter, falling through increasingly denser layers of gas, resisted and partially upborne by the furious streams of vapors rushing up from below, may unite into sheets or flakes of considerable extent, and form a kind of shell, which, though not continuous, would still answer many of the purposes of a continuous crust, by confining the ascending currents into narrow channels, in this way increasing their velocity, as well as by the pressure due to the resistance offered to its descent. It is quite probable, moreover, that in these narrow channels the mingled gases, expanding as they rise and becoming cooled by their expansion, may have their temperatures lowered below the point of dissociation, in which case explosions would certainly result. Viewed in this light, the phenomena of the chromosphere and prominences appear as natural consequences of the received theories of the gaseous constitution of the sun.

THE CORONA.

Observed at every total eclipse from remote antiquity, and described by Plutarch in almost the same terms as one would now use, it seems to have eluded investigation until recently. It appears during a total eclipse as a radiant glory surrounding the dark body of the moon, intensely bright near the edge of the lunar disk, fading gradually, but not regularly, as the distance increases, and terminating in a very irregular outline, which is perhaps rather more definite than might have been expected. It seems to be made up of brushes of light emanating from the sun, and reaching an elevation which in some cases fully equals his whole diameter. These brushes or streamers are, for the most part, straight and vertical, but here and there are curved into curious forms, like the petals of a flower. The color of the light is slightly greenish (pearly is the term usually employed in describing it), in beautiful contrast with the ruby-colored prominences which blaze at its base, like carbuncles.

As to the nature of the corona, we have as yet no certain knowledge; the principal line in its spectrum apparently coincides with one which has been ascribed to iron; but there are abundant reasons for refusing to believe that it is really due to iron; and if not, the chemists have presented to them an interesting and important problem to ascertain its real origin. The observations of Janssen and Lockyer, in 1871, seemed also to show the presence of hydrogen in the coronal regions. Probably the corona consists of minute particles, solid and liquid, disseminated through a highly rarefied gaseous atmosphere; but to what extent it is composed of meteoric matter rushing toward the sun, or of solar dust thrown upward, and what forces form and direct the streamers and pencils of light, and why the polar regions are left so bare, these are problems of the future, to be classed with the explanation of the aurora borealis and the tails of comets, and, more than probably, require the recognition and investigation of other forces than that of gravitation.

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Recent American and Foreign Patents.

Improved Scaffold Clamp.

William Smith, Philadelphia, Pa.—This is a scaffold clamp bar, having flat and perforated feet adapted to be held to poles by a pair of screws. With this clamp the scaffold is made safe, and the ledger boards are not injured.

Improved Cotton Press.

John C. Stokes, Villanow, Ga.—In this vertical press the follower is forced downward upon the matters to be pressed by toggle-jointed levers worked by an overhead windlass, which is operated by a double-acting brake lever, pawls, and a ratchet wheel arranged at one side of the frame. The power can thus be applied by one or more hands standing upon the ground at the base of the machine. The follower is raised by a hand-cranked drum and rope, the latter running up over pulleys at the top of the frame.

Improved Sawmill Dog.

Nathan Hunt, Salem, O.—This an improved dog for holding the last remnant of a log upon a sawmill while being sawn into boards. A block adjusted by a set screw slides on a vertical rod secured beside the knee of the head block. Upon the journal of the block is a sleeve, which carries a claw. By raising a rod attached to the sleeve the claw is forced into the timber, where it is locked in place by screwing the rod into a socket of the sleeve.

Improved Plow.

Adna B. Kellogg, Oakland, Oregon.—This is a point, landside, and a share on the landside, for cutting under the land, constructed of one piece of sheet metal cut out in suitable form, and bent in the shape required.

Fastener for the Meeting Rails of Sashes.

Charles P. Sandford, Mont Clair, N. J.—In this fastening a sliding and revolving bolt is supported in a rotary pillar, and cannot be pushed aside or thrown back from the outside, owing to a rib being cast on the end. The bolt passes through a metal plate secured to the upper sash, and is then turned so as to throw its ribs out of position, thus forming a lock which will also serve to hold the sashes snugly together, and thereby prevent them from rattling.

Combined Fork, Hook, Shovel, and Hoe.

Gardner H. Perkins, Cazenovia, N. Y.—The fork is pivoted between two side plates and is held by pressing against the handle, and by a spring bar, the last secured by a band. To change the fork into a hook, this band is slipped up, and the tines adjusted at an angle to the handle. A flat plate attached to the fork by lugs renders it either a shovel or a hoe, according as it is placed in either of the above mentioned portions.

Improved Hillside Plow.

Minot Ellis, Greenfield, Mass.—By making the mold board in this invention separate from the point, and reversing it by swinging it over instead of under the plow, and bisecting the back part, a furrow can be turned thereby on level land on any kind of soil. For plowing on a hillside, the point and moldboard are reversed while the team is turning round, so that the furrows are all turned down the hill.

Improved Distance Measuring Apparatus.

James B. Thomas, Montgomery, O.—This invention relates to and consists in means whereby the distance from a firearm to the object at which it is to be aimed may be quickly and exactly measured, the sportsman or the army officer thus knowing the precise allowance that is to be made, and which has been carefully obtained by previous experiment. It also allows measurements of land to be readily taken while on hunting excursions.

Improved Harness Attachment.

James D. Truss, Ferryville, Ala.—By this attachment the horse is prevented from throwing his tail over the lines, while it gives him at the same time the proper use of his tail. The invention consists of a round and stiffened strap, which passes over the outer part of the tail, and is buckled, by end straps, to the breeching stays, being also connected, by stays at both ends of the tail, to the back strap, for securing exact and steady position of the tail strap.

Improved Roof Truss.

Uriah G. Spofford, Appleton, Wis.—This consists in the combination of a suspended king post of peculiar construction with the rafters and tie rods, so that by turning nuts, so as to contract the tie rods, the wall plates bear upon the base parts of the rafters, and carry the rafter heads against the head of the king bolt, relieving thereby the wall from the outward pressure of the roof, and raising the roof at the same time.

Improved Cotton Press.

William Koehl, Huntsville, Tex.—Into this cotton press the cotton is transferred in certain quantities by a traveling carriage with removable bottom. The material is then condensed by a vertically moving follower turning in a movable frame on the top part of the press, and finally compressed by a horizontally moving follower, the bale being tied and taken out of the bale box by means of hinged side and bottom doors.

Improved Estimator.

Fredric Maurice Stapff, Stockholm, Sweden.—This invention is one which will find a ready welcome from all engineers, since it substitutes for laborious calculations, by formulæ extremely intricate, a simple mechanical operation, easily performed. The device is a sliding rule so constructed that, by moving certain portions, the necessary results for determining the volume of bodies such as embankments, etc., or of cuts, ditches, and the like, having prismoidal shape, may be instantly picked out through coincidences of lines and similar means. The estimator may also be used for deducing mechanically from a given volume the average hight of the prismatoid containing such volume. Thus applied, it will prove of great use for determining how much the grade of a preliminary railroad line ought to be attached, or how much such a line ought to be thrown to the side for balancing the quantities in the cuts and embankments of a given railroad section, provided the ground on the sides of the preliminary lines has previously been cross-sectioned.

Improved Windmill.

Henry J. Wolcott, Albion, Mich.—This invention is an improvement in windmills whose pivoted wheel sections are automatically adjusted or controlled in position by means of weighted levers. The improvement relates to a slotted disk, which is attached to a sleeve or tube, which slides on the crank shaft, and acts as a guide for the connecting rods of the levers which operate said sections.

Improved Step Ladder.

Jeremiah O. Brown and Orange M. Sweet, Forrestville, N. Y., assignors to Jeremiah O. Brown, same place.—This is a two part adjustable brace pivoted near the foot of the post, and to an upper step of the ladder, to securely hold the post at any angle to the body.

Improved Screen Window Blind.

John P. Clark, Jr., Jackson, Mich.—This is a hinged window frame having an interior bottom hinged part, which may be partially opened, and which is arranged with a blind in connection with a detachable top piece and sliding pane and screen. In hot weather, the screen would be used and the pane taken out, while during the cold season the pane is reinserted and the screw removed. The window would thus furnish a summer protection against mosquitoes, flies, etc., while giving the proper ventilation.

Improved Water Wheel.

Milo E. Washburn, Indian Lake, N. Y.—The buckets are made in two parts, and secured between parallel cone-shaped plates. Each bucket has an adjustable part, which is pivoted through the heads, which may be adjusted to increase or diminish the size of the water issues. The interior openings between the buckets are broad, one portion of the surface of one bucket being concave and curved obliquely, and the surface of the opposite bucket being convex and curved to correspond, so as to make the issue of a curved oblique form. The water, it is claimed, acts by its gravity as well as by the reactive force on the wheel.

Improved Sash Fastener.

William C. Alden, New York city.—In using this device, the lower end of a vertical bar is placed upon the base of the window frame. The plate is raised to the desired hight, and the sash or blind is raised and lowered thereupon. The plate is held by a loop encircling the bar, catching in a corrugation in the rear side of the same. The device is portable and convenient for travelers' uses.

Improved Cotton Press.

William H. Walker, Charleston, S. C.—The upper side of the cross head of a vertical engine is provided with cams to work sectors, which are arranged above the cams and under the beam which raises the platen, so that the lower corners of the sectors to be acted on by the cam hang vertically from their axis, while the others, which act upon the beam, are in a horizontal position. The said cams are so formed that, in the fore part of the operation, they present a descending plane to the rollers of the sector until they are moved a certain distance from the vertical line in order to give the necessary direction to the force. Afterwards the cams ascend as the sectors change their direction, and they rise above the hight of the starting point, so that, besides applying the power to the best advantage in point of the direction, they also cause a greater range of movement to the follower than is due to the movement of the piston.

Improved Process for Filling Fiber in Paper Pulp.

Herman Duemling, Fort Wayne, Ind.—This invention consists mainly in the chemical fixing of the filling material in the fibers of the pulp in the beating engine, or in a separate mixing vessel, by means of the sulphates and silicates of the alkaline earths. A solution of chloride of barium is first added, followed by a solution of sulphate of magnesia, by which an exceedingly white precipitate of sulphate of baryta is obtained. A solution of chloride of magnesium is then introduced to the pulp, and allowed to act thereon, to be then precipitated by a solution of silicate of soda, which produces a white and very voluminous precipitate of silicate of magnesia, which adheres firmly to the fiber. The pulp is then worked up into paper in the usual manner, furnishing a paper of superior whiteness.

Improved Device for Taking up the Slack of Lines.

Hugh Douglas, Dubuque, Iowa.—This is a portable device for stretching slack lines. A forked base frame is provided with a lateral stretching roller, having side ratchets and a retaining pawl, to be operated by a lever with a pivoted pawl. The line is guided and secured when stretched by a pivoted double eccentric, with lever handle.

Improved Sleeve Adjuster.

Alfred Perego, Brooklyn, N. Y.—This device enables the cuff to be readily raised upon the arm and held above the wrist, so that when at work, or when washing the hands, the cuff may be removed from contact with dust or water, and may thus be kept neat and clean. It is a tab, secured at the cuff and arranged to be buttoned to a button on the sleeve when it is desired to raise the wristband.

Improved Plenum and Vacuum Pumps.

Daniel L. Cameron, Madison Station, Miss.—A hollow shaft forms the axis about which a spiral tube is disposed. The supports for the axis are hollow, and there are inlet and exhaust valves at each end of the shaft. The latter is partitioned between the ends, so as to cut off communication through it from one end of the coiled tube to the other. A portion of the coil is filled with mercury as high as the arms of the shaft. By turning the coil, the mercury, flowing along the tube from one end to the other, will create a vacuum in the side and plenum on the other side, and will draw air or water through the inlet valve at one end of the hollow shaft, and expel it at the other end through the exhaust valve. If the motion be reversed when the mercury has traversed the length of the coiled tube, the suction will open the opposite pair of valves, thus producing continuous suction and exhaust.

Improved Fruit Protector.

Aaron S. Dyckman, South Haven, Mich.—An upper platform rests upon cap hoops that hold a wire gauze cover over the peaches or other fruit. The two platforms are clasped upon the baskets and caps by end-threaded rods working in a nut formed in the cross piece. By putting four to six baskets in this crate, they are readily manipulated. The fruit is visible, and yet it cannot be purloined.

Improved Washing Machine.

Adam Cook, Pittsburgh, Pa.—When the clothes are put in the tub with the water and suds, a clamping device, which holds the apparatus in position, is released, and the wash board swung back and lowered thereon. The tub is then rotated or reciprocated by the fly wheel until the clothes are cleaned. The latter are then taken out and passed through the wringer, which is attached to its supporting piece. The bottom of the wash board, and also of the tub, has corrugations for rubbing the clothes.

Improved Hay Derrick.

Christopher Lidren, La Fayette, Ind., assignor to himself and R. Jackson, same place.—In this invention, the beam of the derrick is pivoted to the standard, so as to swing up and down, and the rope is so contrived that the fork is raised and lowered by this action of the beam, and at the same time caused to travel through a greater range than the beam does. For operating the beam, a cam is fitted around the base of the standard, to be revolved by a horse, and a lifting post is combined with this cam and the beam, so as to transmit the motion of the cam to the beam. The cam is also contrived so that it carries the beam, by means of the foot of the lifting post, around over the stack, and lodges it upon another stationary cam inside of the revolving one, down which it returns by gravitation to the place of starting. The revolving cam then escapes from the foot, leaving the horse ready to raise the beam and fork again by continuing in his course, and without backing up.

Improved Ore Separator.

Charles H. Campfield and John M. Hornbeck, Ellensberg, Oregon.—This invention relates to a method of attaching a covering of villous or fibrous fabric of hair to the bottom of an inclined frame. When the machine is adjusted to the proper angle, the friction produced by the bristling surface of the lining is so great that it gives the water and sand a rolling motion, which carries the light, flaky, and floating particles against and gradually into the fibrous projections of the lining. The weight of the water and the gravity of the gold tend to carry the particles down to the base of the bristles, which form so many little pockets for collecting and retaining the gold until removed by the miner.

Improved Feather Renovator.

John C. West, Morenci, Mich.—This is a large drum provided with a steam jacket and longitudinal central tube, the whole so arranged as to ensure a constant circulation of the steam. The steam sections have a common valve, and there are suitable arrangements for treating the feathers by direct admission of steam.

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The Board of Managers unanimously approved the report, and recommended for this machine the Gold Medal of the Institute.

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Notes & Queries

W. H. C.'s idea for driving a propeller by a spring is not likely to prove practicable.—W. E. H. will find directions for making a storm glass on p. 75, vol. 30.—C. B. will find a recipe for fireproofing shingles on p. 280, vol. 28.—W. C. B. will find an explanation of the moon's variations on p. 251, vol. 31.—R. R. R. will find an elucidation of the weight on an inclined plane question in our recent issues.—M. will find directions for tempering springs on p. 10, vol. 25.—J. H. L. can harden tallow for making candles by the process described on p. 201, vol. 24.—G. E. O. will find Warren's works on mechanical drawing and Davies & Peck's "Algebra" to be good and practical.—R. W. W. will find a description of the philosopher's or hydrogen lamp on p. 242, vol. 31.—C. H. H. will find full particulars as to Colgnet stone on p. 124, vol. 22.—J. M. will find recipes for hard soap on pp. 331, 379, vol. 31, and for boot blacking on p. 284, vol. 31.—J. J. D. will find directions for tanning skins with the fur on on p. 233, vol. 26.—W. P. P. will find a description of processes for preserving wood from decay on p. 319, vol. 31.—J. F. should refer to p. 203, vol. 31, for a recipe for polishing shirt bosoms.—J. M. H. and others can unite rubber to leather by using the cement described on p. 119, vol. 28.

(1) J. M. asks: 1. What horse power would it take to run a boat 16 feet long by 5 feet beam? A. An engine of ½ horse power would answer. 2. What is the cost of an engineer's certificate? A. See p. 282, vol. 31.

What is camphor composed of? A. It is a crystalline substance obtained from a tree. It contains carbon, hydrogen, and oxygen.

(2) G. G. L. says: I wish to make a large clock dial for my windows, and drive the hands by electricity from a regulator in the shop. Please say how I can make it? A. The electrical part consists of an electro-magnet and armature worked by a battery of two Daniell's cells. The armature is attached to a lever, having a pawl connected at its upper extremity, which moves a toothed wheel. Whenever the regulator closes the circuit, the pawl causes the wheel, which carries the hands, to advance one tooth. The regulator may be arranged to close the circuit every second or every minute, as desired.

(3) J. R. says: 1. Alexander Watt recommends to electroplaters, from personal experience, the following battery: A stoneware jar holding about four gallons receives a cylinder of thin sheet copper, dipping into water acidulated with 2 lbs. sulphuric acid and 1 oz. nitric acid. A solid zinc cylinder is put into the porous cell, which is filled with a concentrated solution of common salt, to which a few drops of hydrochloric acid have been added. What should be the diameter of the copper cylinder inside the stone jar? A. The diameter should be nearly as great as the jar. 2. Should it have a bottom to it? A. It is immaterial whether it has a bottom or not.

(4) C. A. W. asks: How are Callaud's and the Minotti batteries constructed? A. The Callaud battery consists of a glass vessel with a copper plate at the bottom, upon which are placed crystals of sulphate of copper. A zinc plate is suspended near the top and the jar filled with water. The Minotti battery consists of the same materials as the Callaud, and, in addition, a thick layer of sawdust is interposed between the copper plate at the bottom and the zinc plate at the top.

(5) W. L. L. asks: Will electricity give forth a spark sufficiently strong to light a gas jet? A. Yes, whenever it has a sufficient potential. In cold, dry weather, a person may charge himself sufficiently with electricity to light gas with his finger, by walking briskly over a carpet or rug.

(6) R. C. W. and others.—Liquids, complex or otherwise, can be analyzed with the same accuracy as solids. But it is possible so to muddle things that an experienced chemist cannot separate them again; but only by artificial means. Nature never presents such difficulties.

(7) W. C. W. asks: In what proportions shall I mix the acids and alcohols to make respectively sulphuric and nitric ethers? A. The method at present in general use for the preparation of ordinary ether—ethylic ether, sometimes improperly called sulphuric ether—is that known as the "continuous process" of Boullay. It consists in mixing together equal measures of alcohol (specific gravity 0·830), and concentrated sulphuric acid; the mixture is submitted to distillation in a capacious retort, which must be connected with an efficient condenser. Through the tubulure of the retort a tube is introduced, which is in connection with a reservoir of alcohol, designed to maintain a supply of spirit sufficient to keep the amount of liquid at a uniform level in the retort during the course of the subsequent distillation. The temperature is then rapidly raised so as to maintain the liquid in steady ebullition. The liquid which passes over consists almost wholly of ether and water, mixed with a small proportion of alcohol which has distilled over unchanged. The process may go on without interruption until a quantity of alcohol, about 30 times as great as that originally taken, has become converted into ether. Isethionic acid is gradually found in the residue. Nitric ether is obtained by gently heating one volume of nitric acid, of specific gravity 1·40 (to which a few grains of nitrate of urea have been added in order to prevent the formation of nitrous acid), and 2 volumes of alcohol, of specific gravity 0·842; the quantity of the mixture operated upon should not exceed a quarter of a pint; under these circumstances the operation proceeds quietly. The first portion of the distillate contains little except alcohol; but as soon as the liquid which distils over becomes turbid on the addition of water, the receiver must be changed and the nitric ether collected separately: the distillation must be stopped when about three fourths of the liquid has passed over, in order to prevent the ether from becoming mixed with secondary products, which cannot be removed without difficulty. The ether is purified by agitation with a weak solution of alkali, and rectified from chloride of calcium. It burns with a white luminous flame; and if heated to a little beyond its boiling point, it is decomposed with an explosion on the approach of light.

(8) J. C. B. says: A. claims that 1 lb. feathers will be heavier than 1 lb. lead, as the surface of the feathers is larger than that of the lead. Can there be circumstances that will render 1 lb. feathers heavier than 1 lb. lead? A. The weight of a body in a vacuum is increased by the weight of an equal volume of air. Hence, if the feathers displace more air than the lead, they would weigh more, in a vacuum.

(9) A. F. asks: Is there a nozzle, in use by fire departments, that can be made to throw a large or small stream at pleasure? A. Yes. It is quite a common device.

(10) P. W. asks: 1. Can a Leyden jar be charged with voltaic electricity? If so, how? A. Yes. Connect one pole of the battery with the inner coating, and the other pole with the outer coating. 2. Is a simple galvanic Bunsen cell enough to generate electricity to charge a jar? A. One cell would charge it very slightly. 3. How many Bunsen cells does it require to burn metals? A. Fifty cells would burn a small wire. 4. Would it answer the purpose, instead of coating internally, to drop strips of tinfoil in the jar as high as the internal coating should come? A. It would not, unless the strips were connected together so as to be continuous. 5. Should the bottom be coated outside? A. No. 6. Is it necessary for the jar to have a brass cap? A. No. 7. Would an iron wire passing through the cork connecting with metallic filling answer to conduct the electricity? A. Yes. 8. Is it necessary for the rod to have a brass head? A. No.

(11) J. J. J. asks: What makes water in a well look blue when sunlight is deflected on it? A. The blueness is due to a partial absorption of the red and yellow components of the solar ray, leaving the light with an excess of blue, which imparts to it its peculiar tint.

(12) P. T. M. asks: What is the easiest and best way to polish marble, agate, and granite? A. The polishing is differently carried on, according to the nature of the work. For small slabs or objects of an ornamental kind, the highest degree of finish is requisite. Polishing is commenced with pumice stone and water, and with snake stone, after which various rollers or rubbers are employed. If the object be large and flat, the rubber may be a large wooden block faced with thick woolen cloth, or a mere bundle of woolen or other cloth, compressed in a rectangular iron frame, and moved about with a handle. For smaller work, rollers of woolen cloth or list, about 3 inches in diameter are employed; some of these are charged with flour, emery, and a slight degree of moisture, which produces a kind of greasy polish uniformly over the surface. A similar cloth, charged with putty powder and water, completes the process. In some of the more delicate works, crocus is used intermediately between the emery and putty powder.

(13) W. C. B. asks: What is the difference between a high and a low pressure engine, and what effect has the difference on the draft? A. The high pressure engine has no condenser, and frequently discharges the exhaust steam into the smoke pipe, thereby increasing the draft.

(14) J. P. says: I am burning slack under my boiler, and my tubes want cleaning two or three times a week. I am thinking of blowing them out with steam. Will the steam injure them by corrosion? A. No. This is ordinarily a very good plan.

(15) C. S. A. asks: I am using a wire rope, with a windlass and pulleys, subjected to very heavy strain. The rope seems to get stiffer from use. If I heat it red hot and let it cool slowly, it will be more flexible; but will it injure the rope? A. Not appreciably.

(16) B. F. G. says: We are burning Gross creek coal; it is very soft, and very much like the ordinary blacksmith's coal, but is of a higher grade. We find that in wet weather we burn more in weight than when dry. A few days ago I weighed very carefully 500 lbs., dry, and afterwards added ½ gallon of water. I then reweighed it, and found that it had gained 20 lbs. I spoke of this experiment to a friend, and he said that it was impossible for it to gain 20 lbs., as the only weight that the coal could gain would be the weight of the water. Am I or is my friend right? A. Even in the face of the very stubborn facts that you present, we agree with your friend, and question the facts. 2. What is the weight of 1 gallon of water? A. A United States gallon of water weighs about 8·3 lbs.

(17) A. F. C. asks: 1. What would be a safe pressure to carry on an upright tubular boiler 15x20 inches, having 52 one inch tubes made of three sixteenths iron? A. A safe pressure would be 100 lbs. per square inch. 2. What would be the bursting pressure? A. About 600 or 700 lbs.

(18) H. K. asks: 1. What, in your opinion, is the best and cheapest method of preventing incrustation in steam boilers? A. In some special cases the tannate of soda seems to act beneficially. 2. What do you think of steam heaters and filters to prevent scales in boilers? A. In general we recommend the use of a good heater and frequent blowing. 3. What is mostly used in the East to keep the boilers clean? Is the water in the Eastern States generally impregnated with lime? A. The water used in boilers at the East ordinarily gives as much trouble from scale as that at the west.

(19) J. C. M. says: With the intention of increasing the capacity of a steam boiler (horizontal, 42 inches in diameter and 18 feet long, with 32 tubes), I introduced some 4 inch tubes under the boiler, commencing just behind the bridge wall and running back the length of the boiler. These pipes had cast iron connections at the bends. I placed them 8 inches below the bottom of the boiler, connected them at the back end of boiler near the bottom, and attached the feed pump near the front, and fed with hot water. The first day they worked well and improved the boiler greatly in steaming capacity; but on the third day, just after starting up, with the first stroke of the pump, the cast iron end on the pipe where the feed pipe was connected burst with a loud report, and for a few seconds nothing but blue steam escaped, and finally water and steam. Thinking the trouble was in pumping in water so near the fire and bridge wall, I changed the connection, putting the feed pipe into the mud drum, and then letting the back connection stay as it was, making a series of circulating tubes. On firing up this time, I was alarmed by a succession of concussions or jars in the boiler that shook the walls; but by firing slowly, we got up steam without any accident. In an hour or two we noticed that the tubes nearest the fire and bridge wall were red hot, and blue steam was escaping from the joints of the connections on the ends of the tubes. We drew the fire and removed the tubes. We found a great improvement by the use of these tubes, and did not like to abandon the use of them. We are at a loss to account for the phenomenon of blue steam being where we expected nothing but water. What is our remedy? A. The trouble seems to have been that the pipes got so hot that they made steam faster than it could be carried off, the circulation being imperfect. It will probably be necessary to use larger pipes, or to discard the return bends, to make the present arrangement successful. The same trouble has occurred with some forms of sectional boilers, whose use has been abandoned on account of the poor circulation.

(20) S. J. P. asks: I have a telegraph instrument, which I wish to attach to a railroad line. Will it work without a relay? A. Not on the main line. A relay will cost about $16.

(21) M. R. H. asks: How can I prevent beech wood lasts, subject to a temperature of 200° Fah., from being affected by the heat? A. There does not appear to be any way to do this, better than well seasoning and drying the wood before using.

(22) H. R R. asks: A rectangular wooden tank lined with zinc is used in the second story as a reservoir for rain water. Since its erection, we are told that the zinc will soon corrode and the vessel become useless. Is there any way to preserve it, by paint or otherwise? A. The zinc becomes coated with a white oxide which washes off with the water, and by repetition of this process the metal is reduced in thickness and strength. There is a slate paint for application to iron tanks which might be serviceable when applied to zinc.

(23) A. B. C. says: "We have just started a new steam pump in a mine, at 700 feet level. To prevent the steam from exhausting in the shaft, a pipe was fixed to convey it into what we call the suction pipe, and the connection at the suction pipe was a globe valve or chamber, as the valve was taken out, and the exhaust pipe inserted in its place. This was the engineer's plan. I said that I did not think it would answer, as the chamber or pipe where the exhaust steam meets the water was too small, and the steam would cut off the water, or at least some of it; and it so happened that, when they started the pump, it would not pump ⅓ of the stream it ought to, which proved my words true. He took it away from there, and put it to exhaust in a wooden pipe which brings air down to the bottom of the mine, and it would be just as well if he let it exhaust right in the shaft as in that pipe; for the air strikes it, and it condenses, and as a matter of course fills the shaft with smoke. Now I think I can put the exhaust steam into the suction pipe so that it shall work all right. My plan is to have a larger and a more suitable connection with the suction pipe. Do you not think this will answer? The reservoir stands about level with the pump. The suction pipe is of 4 inches diameter." A. You are just entering on a field in which a great deal of money has already been spent for experiments, namely, condensers for steam pumps. The matter has already been worked out practically, and we think your cheapest and most satisfactory plan would be to obtain a condenser.

(24) J. McD. asks: Your article headed suction in your issue of December 5 leads me to make the following inquiry: Suppose a vessel be filled with water, and there be placed in the top of said vessel a tube extending upwards for fifteen feet, and there be attached to said tube two stop-cocks, one at either end. If the lower cock be closed, and the air be exhausted from the tube, after which the upper cock be closed and the lower opened (allowing free access to the tube for the water), will the water rise into the tube from the vessel? A. Yes.

(25) W. A. W. asks: 1. How thick ought a cylindrical boiler of cast iron to be, to sustain a steam pressure of 5, and 6, atmospheres? The cylinder is about 10 inches diameter. A. If not more than 12 inches in diameter, make it from 5/8 to 3/4 of an inch in thickness; but better still, do not make the boiler of cast iron. 2. What should be the diameter of the safety valve? A. Three fourths of an inch.

(26) W. D. and others: Our opinion is that power will always be got from coal for at least one fiftieth part of the cost of getting it from electric motors, using acid and zincs.

(27) T. C. C. says: I have a pump of which the pipe runs 12 feet horizontally and 8 feet perpendicularly. Would there be any difference in the pressure if the same pipe be all perpendicular? A. Yes, as we understand your question.

(28) E. asks: How much more steam does it require at 100 lbs. per inch to produce the same result with a plain oscillating cylinder, taking steam through the side to full stroke (as it must do), than it does with a stationary cylinder, using a slide valve and cutting off the steam at the most economical point? I think that a better result would be attained with oscillating cylinders than could be attained with the slide valve, provided that the slide valve had no lap or lead, taking steam to full stroke, from the fact that the ports of the oscillating cylinders open almost instantaneously and at a point where the piston is traveling at its slowest: whereas, with the eccentric movement, no such rapid change can be attained. A. There are oscillating engines with ordinary slide valves in use.

(29) J. A. C. says: A saw was burnt, and, as the new one came to the mill, the men remarked: "We'll need a blower to make steam enough to drive that big fellow." I said: "I don't think you will need any more steam for the same work than for the little old one." The men were all against me. All things else being equal, does a large saw require more power than a small one? If so, why? A. All other things being equal, the large saw would require the most power, since the resistance is overcome at the end of a longer lever arm, the lever arm to which the driving force is applied remaining the same.

(30) J. E. G. asks: What is a safe working pressure for a flat cast iron boiler, head 3/4 inch thick and 1½ inches in diameter? A. About 50 lbs. per square inch.

(31) W. & B. ask: Is there a treatise published, explaining how to set a steam flue boiler, over a brick arch, so as to use the least possible amount of fuel? A. We do not know of any book that gives precisely the information you want. You will find some valuable hints in Wilson's "Treatise on Steam Boilers," and "Heat and Steam Engines," by Professor Trowbridge. See our advertising columns for booksellers' addresses.

(32) H. C. McE. asks: Enclosed find a piece of scale taken from a boiler. What will loosen it from the boiler? A. The best plan is to prevent the formation of scale by the use of a good feed water heater and frequent blowing. You can soften the scale somewhat, by hauling the fire at night, and leaving the water in the boiler until next morning.

(33) Mc. Bros. ask: Is there a work on the care and management of ordinary steam engines and boilers? A. We do not know of any such work. A great deal of information is scattered through treatises on steam machinery, and appears, from time to time, in scientific periodicals. The most valuable information is, however, unwritten, and can only be acquired by experience.

(34) C. M. B. asks: Can the tone of organ or flutina reeds be changed? If so, how? A. It can be done by changing the length of the vibrating part of the pipe or plate. Most wind instruments are arranged so that this adjustment can readily be made.

(35) M. E. J. asks: What is the rule for setting iron buggy axles, front and behind? A. There is considerable difference of practice; and beyond setting them so that the wheels will clear, we do not think there is any definite rule. Some of our readers will please correct us if we are in error.

(36) J. O. S. says: 1. I wish to build a flat bottomed steam pleasure boat, 16 feet long by 6 feet wide, with side wheels. How will a portable engine work in it, to run by a belt, and how many horse power should there be in proportion to that size boat? A. It will be better to discard the belt. Use an engine of from 2 to 3 horse power. 2. Is any license required to run such a boat on a river? A. Yes.

(37) E. S. S. says: I have some boxwood that I wish to make into croquet balls. It requires the whole size of the stick for a ball. Can it be seasoned without checking for next spring's use? A. Allow it to season slowly, in a moderately cool place at first, and finally in or near a chimney corner.

(38) W. E. H. asks: What is the process of manufacturing the small round glass beads which are sold by the pound? They seem to have no fractured edges. A. They are made from tubes cut into the proper lengths, the sharp edges being rounded by fusing, being heated in sand to prevent their fusing together.

(39) D. H. L. asks: Are the trade dollar coins issued by the United States government stamped or molded, to give the impressions? I wish to make similar medals. A. They are struck; but for your purpose it would doubtless be better to cast them

(40) G. M. R. says: Suppose a locomotive engine is running at the rate of 30 miles per hour, in full fore gear, and is suddenly reversed to full back gear. Is there much danger of the cylinder heads being blown out? A. No. The danger would be of breaking some of the moving parts.

(41) J. O'C. says: In your answer in regard to belts on pulleys, you say: "Belts will move towards that part of the pulley where the radius is the greatest." I discovered this high side theory to be a fallacy in 1855. Let a main line of shafting be lined up by any of the usual methods; then the countershafts can be made right by moving them until the belts run even on the pulleys. In most cases, this can be done when the machinery is running. It is an expeditious and accurate method. A. You confound two distinct cases. Our remark had reference to two pulleys whose axes were parallel, one of the pulleys having a swell or convexity. Your illustration applies to the case in which the axes of the two pulleys are not parallel, and different principles are applicable. You will find this case ably treated in Professor Rankine's "Manual of Machinery and Millwork."

(42) R. T. asks: Would the compressing of a bale of cotton at a power of 1,000 tuns injure the staple? Would the oily nature of the fiber of the cotton be impaired when compressed so compactly? Would the density of such packing render it more expensive to the manufacturer in giving it the flexibility required? A. We see no objection to any degree of compression, and the ordinary practice in commercial circles confirms this view.

(43) S. S. B. says: 1. It is stated in Auchincloss "On the Slide Valve and Link Motion" that an engine of the Allen type, under Mr. Porter, attained the rapid piston speed of 1,400 feet per minute. Is this correct? A. Mr. Auchincloss is a very reliable engineer, and such a statement coming from him is worthy of full confidence. 2. How far is it from the Battery to Central Park, through Broadway and Fifth avenue? A. About 4½ miles.

(44) C. H. S. says: I am building a steam yacht, length 18 feet, beam 5 feet, cylinder of engine 3x4 inches. What would be the best dimensions of screw to get the highest rate of speed, and how fast could such a boat be driven, provided that she be very sharp and with good lines? A. Screw, from 16 to 18 inches diameter, with 34 to 36 inches pitch. Six or seven miles an hour would be a very good performance.

(45) C. M. B. asks: Would it be safe to make the firebox of an upright boiler of cast iron, cast in one piece and made very heavy? A. No.

(46) W. G. asks: How many square inches has a 7 inch piston? A. About 38·485. To find the area of a circle, square the diameter and multiply it by 0·7854.

(47) W. W. G. asks: 1. What proportion should the suction pipe of a direct-acting steam pump have to the size of the water cylinder? A. Make it so that the velocity of the water shall not be over 800 feet a minute. 2. What is the velocity of water flowing into a vacuum under atmospheric pressure? A. It will depend upon the orifice, being about the same as water would have in flowing into the air under a head of 34 feet, *plus* the head required to overcome the friction in the pipes.

(48) J. M. says: Let there be four steam engines, similar in all respects with the exception of their cylinders. The mean pressure per square inch, the length of stroke, and the number of strokes in a given time are all equal, but the diameters of the cylinders are 8, 10, 12, and 14, respectively. Would the horse power of the four engines be in the proportion 8, 10, 12, and 14? A. Neglecting friction and other prejudicial resistances, the powers would vary as the squares of the diameters of the cylinders.

Are there any steamers provided with two steam engines, and do these engines work simultaneously? A. Such an arrangement is quite common.

(49) J. F. says: I wish to make my greenhouse tighter by puttying the laps of the glass. Ordinary putty comes off after a year or two. Can you suggest a mixture, to be applied with a putty knife, that will adhere permanently and can be removed, when necessary, for repairs? A. Use soft putty, composed of 10 lbs. whiting, 1 lb. white lead, ½ gill olive oil, and sufficient linseed oil to give the mixture the proper consistence.

(50) D. D. P. asks: 1. Which kind of wood is best for railroad ties, oak, chestnut, or other kind? A. Oak is the best material. 2. Which is best to preserve them? A. The Bethel process of preservation, used in Europe, and to some slight extent in this country. 3. How long will one last if prepared with coal tar? A. A proper treatment is said to double the duration of service of a tie, making it last from 14 to 20 years.

(51) M. G. asks: 1. How is brass spun, and what tools are used? A. It is secured to a revolving mandrel on which the pattern is fixed, and pressed up against this with a blunt tool. 2. How many pounds pressure will a copper boiler, 3 feet long, 11 inches in diameter, and 1/8 inch thick, stand? A. About 60 lbs. per square inch.

(52) G. asks: How is lead given to the valve of a hoisting engine, running both ways with only one eccentric? The cam or eccentric rod works on an upper and lower hook of a rock shaft. How much should the valve overlap the port? A. The lead cannot be quite equalized by this arrangement, and you can probably adjust it best by a few trials.

(53) J. M. R. asks: 1. What is the composition of the cheapest brass? A. Apply to a cheap brass founder. We have seen so-called brass of such poor quality that but for its color we should have judged it to be lead. 2. Can bronze be cast in other than clay molds, renewed for each cast? A. Metallic molds are frequently used. 3. Is there any composition of metal which, while cheaper than brass, will be as hard and as tough? A. No. 4. What will prevent common gray iron from rusting? A. It can be covered with varnish or other preparation to keep off the air.

(54) W. J. P. asks: What is the best means for consuming smoke? We have two Cornish boilers, 30 feet long by 6 feet diameter, with return flues 2 feet in diameter, and 5 feet furnace. We use soft coal which throws off a very thick smoke. How can we burn it? A. No general rule can be given. There are a number of patent furnaces for completing the combustion.

(55) C. W. asks: Why is it that, when the water in a boiler gets low, the steam becomes blue? A. It becomes so hot that it does not condense readily.

A friend of mine says that the water is not forced into a pump by the air, for if so, how does the water come up the drive wells? He says that there is no air at the bottom of the well. I think that there is air in the ground that forces the water up in the pump. Which is correct? A. The water rises in such a case from the pressure due to a higher source of supply.

(56) B. & H. say: We have put a mortice bevel wheel on our line shafting. The hangers are bolted to joists in the usual form, but it is very noisy. Is there any way to deaden the sound? A. Use cut gears, and some arrangement to make the shaft run steadily.

(57) B. G. says: Blacksmiths often have broken carriage springs to mend; and after getting them welded, it is difficult to get them tempered again. Please give me a good recipe for tempering them. A. Harden the spring in the usual manner, and draw the temper by heating to a temperature at which oil or tallow will just take fire.

(58) D. B. S. asks: What is the best composition to cast in brass molds, to be hard and strong and take a fine impression of small lines, figures, etc.? A. White metal is ordinarily used for such purposes.

(59) S. G. asks: What will be the flow of water per minute through a pipe under the following conditions: The pipe is 3 miles long, 20 inches in diameter, two thirds full, on a descending grade of 23 feet in the whole distance. The head pressure is no more than enough for the supply. Can you give a rule for such a calculation? A. By the aid of the following rules you can readily solve the example: Measure the length in feet of that part of the girth of the pipe which is in contact with the running water, and the sectional area in square feet of that part of the pipe which is occupied by the water, calling the first quantity b, and the second A. Also measure the length of the pipe, l, and the diameter d, taking both dimensions in feet. You can then calculate a coefficient of friction, f, by the rule. $f = 0{\cdot}005 \times \left(1 + \frac{l}{12d}\right)$, and the total friction, F, will be $F = f \times \frac{l \times b}{A}$. Then, calling the head under which the water is flowing, or the total grade, h, and the velocity in feet per second, v: $v = 8{\cdot}025 \times \sqrt{\frac{h}{F}}$. These formulas will give a close approximation having been constructed from careful experiments. There are, however, so many things that are apt to affect any particular case in practice that an absolute result cannot be obtained except by a test.

(60) R. M. asks: 1. At what heat will fowl's eggs hatch in an oven? A. 102° to 104° Fah. 2. How are hatching ovens constructed? A. You will find a full description on p. 428, *Science Record* for 1873. 3. Are chickens so hatched as strong and healthy as those hatched by a hen? A. If proper care is bestowed upon the eggs while hatching, the chickens will be strong and healthy.

(61) H. A. S. asks: 1. What elements may be detected by the spectroscope? A. Potassium, sodium, lithium, rubidium, cæsium, barium, strontium, and calcium are the elements sought for in the usual course of spectrum analysis. 2. What is the usual charge for spectral analysis, when further examination is not required? A. From $1 to $10, according to the difficulty of the examination and the number of the substances to be examined for.

(62) G. P. asks: What is the best part of the States to go to, to shoot prairie chickens and other game? A. Iowa is considered the best State for prairie chicken shooting; but it is rather late in the season for good shooting at these birds. You would probably get the best sport during this month in the State of Georgia, making headquarters at Savannah. The game would be snipe, woodcock, quail, and duck. In some parts of this State, good wild turkey and deer shooting is to be had.

(63) H. J. E. asks: Has skilled labor advanced or receded in price in the United States since the introduction of factories, machine shops, etc.? A. It has advanced.

How does the gold dollar of the United States compare with the coin of other countries in fineness? A. The law of the United States, passed in relation to this subject, is as follows: "Be it further enacted, That the standard for both gold and silver coins of the United States shall hereafter be such that, of one thousand parts by weight, nine hundred shall be of pure metal, and one hundred of alloy; and the alloy of the silver coins shall be of copper, and the alloy of the gold coins shall be of copper and silver, provided the silver do not exceed one half of the whole alloy. The English pound has 916 grains pure gold in a thousand, the twenty franc piece of France has 899, the Austrian ducat has 986.

What wood is best for lightness, elasticity, and durability? A. Try lancewood. Your other questions are not suited to our columns.

(64) F. E. R. asks: At what speed would an engine having 2 inches bore and 4½ inches stroke drive a boat 18 feet long, 5 feet wide, and drawing 6 inches of water? The engine will have 100 revolutions per minute and 50 lbs. steam. A. The engine would be entirely too small to give a satisfactory result, unless a much higher pressure of steam and greater piston speed were employed.

(65) A. R. & G. K. ask: 1. What number of revolutions is perfectly safe for a 24 inch grist millstone of sectional French burr, imbedded in cast iron band with plaster of Paris? A. Each maker generally gives a table of safe speeds for his mills. 2. How much more power will be required to drive a 24 inch millstone if driven by a 20 feet countershaft than if driven direct from the driver wheel, all things being properly arranged? A. Probably about 5 per cent.

Our water contains iron. Is it safe to use in a boiler that cannot be scoured out or cleaned except by blowing off through the ordinary style of mud valve? A. From your experience, we judge that it is quite safe.

(66) G. W. K. says: I have a foot lathe with only one speed. The driver is 26 inches in diameter by 3 inches face; the driver, on the lathe spindle, is 3 inches in diameter. I want to fix it so as to run a small emery wheel and circular saw, and I purpose to belt from the face plate on to the arbor. How large should the pulley on the face plate be? A. You may have to use a countershaft to get up the speed. A 6 inch emery wheel should make about 2,400 revolutions a minute; an 8 inch, 1,800; a 12 inch, 1,200.

(67) V. M. J. says, in reply to E. M. C., who speaks of difficulty of running his engine on account of heating of bearings: The construction of the engine and the comparative steam pressure has much to do in the case. If the crank is overhung, and high steam pressure is used, 80 or 100 lbs., there will probably be considerable spring to the shaft when the engine is working full, with the size of shaft as given, 3¼ inches. Again, the shaft may not be lined properly, in which case it will be impossible to run without heating or knocking; and although the crank may be in line with the cylinder, it may not be in line with the slides, or the wrist may not put in square with the face of crank. Any one or all of these errors may be the cause of the trouble.

(68) E. B. W. says, in reply to F. J. H., who asked how to calculate the distance between two points on the surface of a globe, angle and radius being given: Multiply the radius by 0·28318, which gives the circumference of the globe; then 360° : the given angle :: circumference : distance between proposed points measured on the surface. The distance measured on a straight line may be found by a simple operation in triangulation.

(69) B. K. W. says, in reply to R. C., who asks if there is any way to test the sourness of vinegar: I find that the pickle manufacturers use the soda test, as follows: Put in a proof glass 1 oz. of vinegar, weigh out a certain number of grains of English bicarbonate of soda, and slowly drop it into the vinegar until it ceases to foam. If it will stand 35 grains, it is fit for their use: but much less strength would do for table use.

(70) A. L. W. says, in answer to R. O. B., who asks for a rule for finding the radius when an arc and its chord are given: The logarithmic sine of ½ the arc is to ½ the chord as the logarithmic cosine of ½ the arc is to the cosine of ½ the arc. That is: $\log \sin. \frac{\text{arc}}{2} : \frac{\text{chord}}{2} :: \log. \cos. \frac{\text{arc}}{2} : \cos. \frac{\text{arc}}{2}$

Then: $\sqrt{\left(\frac{\text{chord}}{2}\right)^2 + \cos.^2 \frac{\text{arc}}{2}} = \text{radius}.$

(71) A. W. S. says, in reply to several correspondents, who asked how to keep cider sweet: Fill a barrel with new cider, plug it up with a cork, and through the cork put a lead pipe. Bend the pipe over and put the other end in a pail of water. This will allow the gas from the cider to pass off through the pipe, and the water will keep the air from getting into the barrel.

W. S. M. asks. What chemicals will keep tallow in solution with crude petroleum at a low temperature?—J. E. W. asks: How can I tin small lead castings?

COMMUNICATIONS RECEIVED.

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

On Mind Reading. By W. E. H.
On Coinage Free of Charge. By A. S. S.
On the Spider's Ingenuity. By I. T. T.
On Patents and Patent Laws. By G. W. P.
On Powdered Fuel. By J. J. S.

Also enquiries and answers from the following:

J. H.—W. B. R.—C. T. S.—V.—A. N. W.—J. P. T.—C. L.—D. de F.—A. R. J.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who makes the odontograph, for laying out teeth of gear wheels? Who sells diamond drills? Who sells lithographs of marine engines? Who makes the best evaporator, heated by steam? Who sells nail making machinery? Who makes drive well apparatus?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending

December 8, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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EXTENSIONS GRANTED.

30,877.—CHAIR.—P. J. Hardy.
30,909.—VENTILATED HAT.—W. F. Warburton.

DESIGNS PATENTED.

7,914.—BUTTON CARD.—G. P. Farmer, Brooklyn, N. Y.
7,915.—THERMOMETER BACK.—G. Gano, Cincinnati, Ohio.
7,916.—STEAM ENGINE.—A. Kipp, *Jr.*, Sing Sing, N.Y.
7,917.—MIRROR FRAME, ETC.—G. Lowe, Philadelphia, Pa.
7,918.—POCKET BOOK LOCK.—D.M. Read *et al.*, N.Y. city.
7,919.—CLOCK DIALS.—G. Gano, Cincinnati, Ohio.
7,920.—TRIMMINGS.—G. H. Prindle, Philadelphia, Pa.
7,921.—CHILD'S SLED.—A. Schoenhut, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,106.—MATCHES.—Early & Lane, New York city.
2,107.—HAIR TONIC.—M. A. Kaler, New York city.
2,108.—WINE.—Kelley's Island Company, Ohio.
2,109.—GLOVES.—Linnemann & Co., New York city.
2,110.—UMBRELLAS, ETC.—T. Miller, New York city.
2,111.—SAFES, ETC.—J. W. Norris, Canton, Ohio.
2,112.—LAUNDRY GLOSS.—G. A. Bassett, Washington, D.C

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, DECEMBER 3 to DECEMBER 11, 1874.

4,122.—J. B. McCune and R. M. Wanzer, Hamilton, Ont. Improvements in apparatus for sand molding for metal castings, called "McCune's Molding Machine." Dec. 3, 1874.

4,123.—J. Modeland, Ypsilanti, Washtenaw county, Mich., U. S., assignee of A. McNicol, same place. Improvements on cements for rendering leather waterproof, called "The McNicol Cement." Dec. 3, 1874.

4,124.—C. H. Haskins, Milwaukee, Milwaukee county, Wis., U. S., and Z. G. Simmons, Kenosha, Kenosha county, Wis., U. S. Improvements on duplex telegraph, called "Haskin's Duplex Telegraph." Dec. 3, 1874.

4,125.—J. L. Smith, Toronto, P. Q. First extension of No. 825, called "Smith's Combination Roadway." Dec. 3, 1874.

4,126.—J. L. Smith, Toronto, P. Q. Second extension of No. 825, called "Smith's Combination Roadway." Dec. 3, 1874.

4,127.—J. Treat, Boston, Suffolk county, Mass., U. S. Improvement in buckles for supporting stockings, etc., called "The Trent Stocking Buckle." Dec. 3, 1874.

4,128.—G. Rackham, Charlottetown, Queen's county, Prince Edward's Island. Improvements in potato diggers, called "Rackham's Potato Digger." Dec. 3, 1874.

4,129.—S. B. Castle, Syracuse, Onondaga county, N. Y., U. S. Improvements on elevators, called "Castle's Improved Elevator." Dec. 3, 1874.

4,130.—D. Renshaw, Boston, Mass., U. S. Improvements on superheaters, called "The Renshaw Superheater." Dec. 3, 1874.

4,131.—O. V. Flora and J. B. Ross-Madison, Indiana U. S. Improvements on saddletrees, called "Flora's, Eureka Saddletree." Dec. 3, 1874.

4,132.—H. S. Parmelee, New Haven, New Haven county, Conn., U. S. Improvements on automatic fire extinguishers, called "Parmelee's Fire Extinguisher." Dec. 3, 1874.

4,133.—W. H. Foye, Portland, Cumberland county, Me., U. S. Improvements on bill and paper filers, called "Foye's Bill Holder and Paper File." Dec. 3, 1874.

4,134.—B. Levy, New York city, U. S. Improvements on combined overcoats and carriage robes, called "Levy's Combined Overcoat and Carriage Robe." Dec. 3, 1874.

4,135.—W. Inglis, Bolton, Lancaster county, Eng., and J. Inglis, Montreal, P. Q. Improvements on the construction of vessels used for floating elevators, and on the arrangement of the screw propellers used in the same, called "Improved Floating Grain Elevator." Dec. 3, 1874.

4,136.—S. D. Keene, Providence, Providence county, R.I., U. S. Improvements on a machine for cleaning cotton, called "Keene's Cotton Cleaning machine." Dec. 3, 1874.

4,137.—J. Dilworth and J. C. Hodgins, Toronto, P. Q. Extension of No. 171, called "Dilworth & Hodgins' Condensing and Heating Apparatus for High Pressure Steam Engines." Dec. 5, 1872.

4,138.—J. B. Baldwin, Toronto, P. Q. Improvement in hot water reservoirs for stoves, called "Baldwin's Patent Evaporator." Dec. 9, 1874.

4,139.—I. P. Merwin, Syracuse, Onondaga county, N. Y., U. S. Improvements in drain pipe molding machines, called "Merwin's Improved Tile Machine." Dec. 15, 1874.

4,140.—D. Mortimer, Ottawa, Carleton county, Ont. Improvements in the art of ruling paper, called "Mortimer's Ruling Machine." Dec. 10, 1874.

4,141.—E. W. Leavens, Boston, Suffolk county, Mass., U. S. Improvements in car washers or sash brushes, called "Leavens' Car Washer." Dec. 10, 1874.

4,142.—W. E. Calhoun, St. John, New Brunswick. Improvements on corn shellers, called "Calhoun's Corn Sheller." Dec. 10, 1874.

4,143.—C. Skinner, Waterloo, Shefford county, P. Q. Improvements on drum heaters, called "Skinner's Drum Heater." Dec. 10, 1874.

4,144.—J. Kaiser, York township, York county, Ont. Improvements in grain or corn crushing and spice mill, called "Kaiser's Improved Grain or Corn Crusher and Spice Mill." Dec. 10, 1874.

4,145.—O. S. Hosmer, Boston, Suffolk county, Mass., U. S. Improvements on machines for darning stockings, called "Hosmer's Darning Machine." Dec. 10, 1874.

4,146.—T. Johnson, Brooklyn, Kings county, N. Y., U. S. Improvements in ball casters, called "Job Johnson's Universal Caster." Dec. 10, 1874.

4,147.—H. B. Stockwell and E. L. Megill, Brooklyn, Kings county, N. Y., U. S. Improvements on fulminate gas lighters, called "The Stockwell Self-Lighting Gas Burner." Dec. 10, 1874.

4,148.—G. Desgeorges, Montreal, P. Q. Improvements on apparatus for the storage and transportation of petroleum," called "Le Reservoir Inexplosible." Dec. 10, 1874.

4,149.—T. Galbraith, Port Hope, Durham county, Ont. Improved device for holding or locking nuts or bolts, called "Galbraith's Lock Nut Bolt." Dec. 10, 1874.

4,150.—Wm. Haarmann, Berlin, Prussia. Improvements on the artificial manufacture of the vanillin (aroma of the vanilla) from the coniferin, or the cambial juice of the coniferæ containing coniferin, or from an extract of all those parts of the coniferæ which contain coniferin, called "D. W. Haarmann's Artificial Manufacture of Vanillin." Dec. 10, 1874.

4,151.—J. J. Higgins, New York city, U. S. Improvements on umbrella runners, called "Higgins' Automatic Umbrella Runner." Dec. 10, 1874.

4,152.—William Stafford, Montreal, P. Q. Improvements on iron harrows and cultivators, called "Stafford's Harrow and Cultivator." Dec. 10, 1874.

4,153.—F. Marsh, Northampton, Hampshire county, Mass., U. S. Improvements on rotary steam engines, called "Marsh's Rotary Steam Engine." Dec. 11, 1874.

4,154.—G. Barclay and J. Kennedy, Oshawa, Ontario county, Ont. Improvements on horse hay rakes, called "The Oshawa Self-Dumping Horse Rake No. 1." Dec. 11, 1874.

4,155.—J. Tesseyman and P. Smith, Dayton, Montgomery county, O., U. S. Improvements on valve gear, called "Tesseyman's Valve Gear." Dec. 11, 1874.

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4,157.—T. Head, Capetown, Beverly township, Wentworth county, Ont. Improvements on a machine for digging potatoes, called "Head's Potato Digger." Dec. 11, 1874.

4,158.—E. A. Smalley, Hyde Park, Lamoille county, Vt., U. S., assignee of J. F. Reed, North Walcot, Lamoille county, and T. O. Andrus, same place. Improvements on rein holders, called "The Vermont Rein Holder." Dec. 11, 1874.

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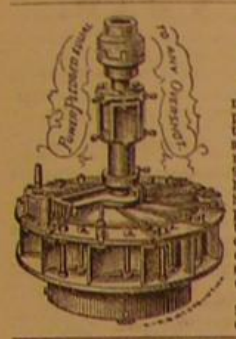

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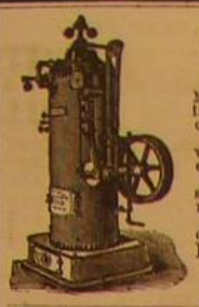

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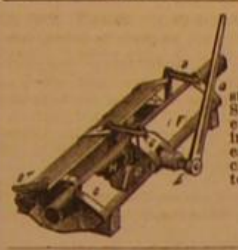

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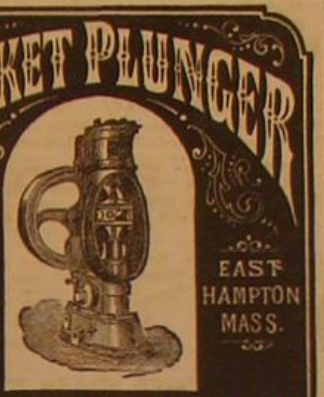
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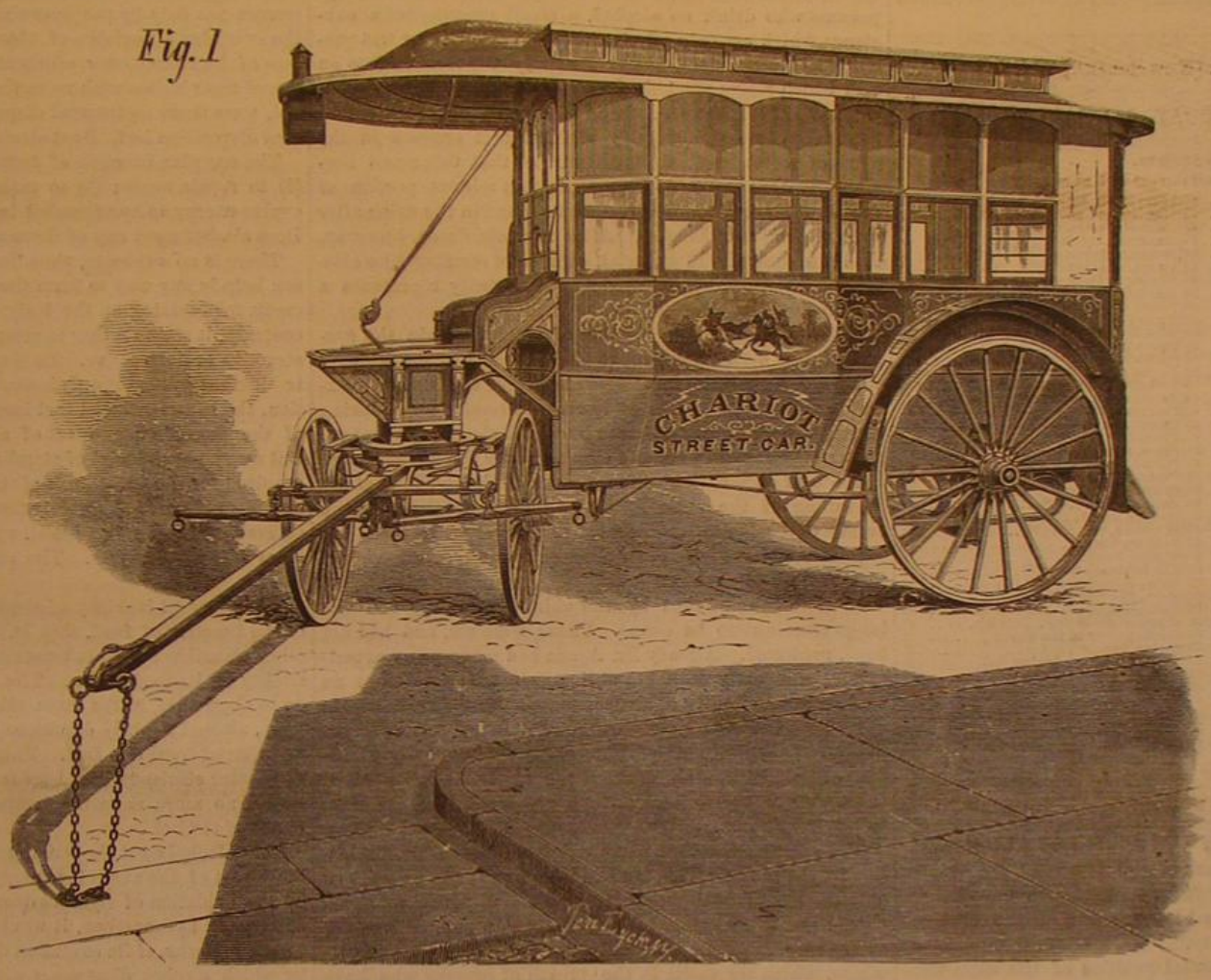
The novel vehicle represented in the engravings given herewith is designed as a substitute, in city streets, for both omnibuses and horse cars. Like the former, it requires no tracks, nor the acquisition of a right of way, and in common with the latter it has easy motion and superior facilities of accommodation. The form is handsome and symmetrical. The front part of the body in the swell forms a kind of oblong octagon, while the bottom is of equal width along the entire length, excepting a rounding at the hind end, forming a recess, so that the hind wheels do not project outward beyond the front part of the vehicle. The whole body is mounted on a combination of springs.

The front axletree is short, so that the car can be started more easily than the ordinary omnibus, also turned around in its own length, and guided more accurately, so as to avoid irregularities in the roadway. Two doors are provided, placed obliquely at the rear. Access is obtained by a low step, so that, when the vehicle is driven close to the edge of a sidewalk, a lady or infirm person may step therefrom directly into the car. The arrangement of the interior resembles that of horse cars; the hight of the roof is sufficient to allow a person to stand erect with comfort, and the usual straps for support while in this position are provided. A patent double reflecting lamp—a device of the inventor—is supplied, by which light is afforded in advance of the chariot as well as within the same. The weight of the entire vehicle is about the same as that of an ordinary omnibus, and the cost of manufacture, we are informed, is no higher.

We learn that a car will probably be brought to this city, when those interested will be given opportunities for its examination.

For further particulars, address the patentee and proprietor, Mr. Chauncey M. Murch, No. 278 W. Sixth street, Cincinnati, Ohio.

Fig. 1



MURCH'S PATENT CHARIOT STREET CAR.

Electro Music.

A correspondent, Dr. G. P. Hachenberg, calls our attention to his plan for playing one or more pianos by electricity, and suggests, among other remarks, that instruments thus arranged might prove an interesting feature in the coming Centennial Exhibition. Dr. Hachenberg says: "The electrical union of ten pianos is a very simple arrangement, but is controlled with singular effect to render volume and expression. One instrument serves to play upon, and the rest are connected with it by electro magnetic attachments, so that the pressure" of a certain key on the key piano determines the striking of nine other like keys on the rest of the instruments. The pedals are governed by similar arrangements, and there is an apparatus whereby the music may be played upon as many or as few of the ten pianos as desired.

The invention is not unpractical; and in fact, a similar contrivance is in use upon the two organs of St. Thomas' church, in this city, where the tower bells are also chimed in connection with the organs, by electricity. It suggests possibilities of future musical performances quite interesting. There is no reason, for example, why pianos, minus keyboards, should not be provided in houses, and their works connected with the keyboards of three or four instruments, say in a central office. In the latter, at certain hours of the day and night, celebrated performers might be engaged to play, one, for example, executing classical, another sacred, another operatic, and a fourth dancing music, on as many separate pianos. These last could all be connected with any number of piano movements all over a city, so that the playing of one instrument in the central bureau would, of course, be repeated on every other piano, no matter how many or how widely separated, and the effect would be exactly as if the performer were individually in the parlor of every subscriber. The latter might be provided with a printed daily programme, specifying that at such and such an hour Signor So and So would play certain music; Monsieur Somebody Else some other kind, and so on. The subscriber then watches his clock, and at the specified hour turns a switch on his wall, which places his instrument in connection with either Monsieur's or the Signor's piano. Then all he has to do is to listen until he gets tired, when, without apologizing to the eminent performer, he shuts him up, by a touch of the finger on a button.

Fig. 2

Discovery of a New Mammoth Anthracite Coal Vein.

The finding of the Mammoth vein of coal at the Reading Company's Norwegian shaft, between Pottsville and St. Clair, Pa., illustrates the correctness of the reasoning by which the conclusion was reached that an immense and almost inexhaustible basin of coal was lying deep underground at that point.

When the shaft had been sunk to the depth of nearly 1,200 feet, it was resolved, says the *Pottsville Miners' Journal*, to drill a test hole with the diamond drill, to find exactly how the veins of coal were situated. This work went quietly on for several weeks, until a few days ago, when the above-mentioned Mammoth vein was reached.

Gen. Pleasants' original calculation was that the Mammoth vein could be found at a depth of about 1,500 feet. The actual distance from the surface of the earth vertically down to the Seven Foot vein, the twin vein to the Mammoth, is 1,909 feet. The discrepancy is accounted for by the singular formation of the veins of coal as developed by the test drill. The Big Tracy vein basin is found to be 176 feet deeper than expected. And the Orchard vein is so curiously formed that it was cut three times, the distance from its first appearance to the last being 250 feet. The strata overlaps or closely folds in a very remarkable way. Taking these two entirely unexpected and unforeseen distances out of the account, the calculation would have held correct.

The Seven Foot vein, which is the upper member of the Mammoth, was found to be thirteen and one half feet thick, and of excellent coal. Underneath this vein there are seven feet of slate, three and one half feet of good coal, four feet of slate, two feet of good coal, sixteen feet of slate containing iron ore balls, and six inches of carbonaceous iron ore, or black band. Then comes the Mammoth vein, *twenty-one feet thick*, next one and one half feet of partition slate, and under this it is thought there is a nine foot vein of coal. Below this, it is believed, comes the solid rock.

Besides the red ash veins, which will be worked, there are the following white and gray ash coals: Primrose, fourteen feet deep; Seven Foot vein, seven and one half feet deep, and the Mammoth, twenty-one feet deep, making a total depth of forty-eight and one half feet of coal.

The importance to Pottsville of the success of this great and plucky undertaking by the Reading Company cannot be overestimated. It makes Pottsville the great mining city of the future. For years and years to come, in all reasonable probability, hundreds, perhaps thousands, of men will be at work here, taking the black diamonds from this inexhaustible supply. It takes no great stretch of the imagination, says our contemporary, to see in operation here the largest and finest colliery in the world.

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VOLUME XXXII., No. 3. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, JANUARY 16, 1875.

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ANSTIE AND DUPRE ON THE ACTION OF ALCOHOL.

About the last literary work of the lamented Dr. Anstie was to describe, in *The Practitioner*, what with unconscious prophecy he called his "Final Experiments on the Elimination of Alcohol from the Body."

Though fatal to a fundamental position of the ultra-temperance party, that alcohol is treated by the body precisely like a poison and eliminated without chemical change, the investigations thus closed will be more fruitful for good to the genuine temperance cause, we believe, than anything else that has been done during the period of Dr. Anstie's labors. Moral and social reform can have no permanent basis other than in truth. And seeing no possible cure for the curse of intemperance except through remedies suggested by real knowledge of the physiological as well as the moral and social problems involved, we cannot but regard Dr. Anstie—notwithstanding the opposition of the nominal temperance party—as one of the truest and most efficient temperance apostles of the time. This in justification, not apology.

The controversy began, some fifteen years ago, on the appearance of M. Lallemand's work, in which, on the evidence of certain qualitative experiments detecting alcohol in the urine, it was asserted that alcohol passes through the system unchanged. This being true, the alcohol contained in wines and other spirituous beverages—as the temperance party were not slow to discover and teach—could be regarded only as a disturbing element, a poison, not only unserviceable to the system but positively harmful.

A result so strikingly in opposition to universal experience could not go long unchallenged. Among others, Dr. Anstie immediately instituted several series of experiments which proved that the idea of the non-destruction of alcohol in the body under normal conditions, and its copious elimination by the kidneys, must have arisen from nothing less than an experimental blunder. Except in conditions of profound alcoholic intoxication, there appeared in the urine only the most minute fraction of any substance which the comprehensive chromic acid test would lead one to believe might be alcohol: a position confirmed by the subsequent researches of Schulinus and Drs. Dupré and Thudichum.

In 1867 Drs. Anstie and Dupré together made another series of investigations, covering a period of six months, and carrying the question of elimination as regards the urine to a higher certainty of conclusion. It was found that when, during any twenty-four hours, not more than an ounce and a half of absolute alcohol by volume was taken—whether under the form of beer, wine, or spirit of any kind—it was never possible to obtain evidence of the presence, in the whole day's urine, of more than a small fraction of a grain of unchanged alcohol, reckoning as such everything that affected the bichromate test. When, however, the daily quantum of one and a half ounces of absolute alcohol was greatly exceeded, a larger portion of alcoholic substance was found in the urine, though never more than one or two grains, notwithstanding as much as three or four ounces of absolute alcohol had been consumed.

These experiments were followed, and in a general way confirmed, in 1870, by those of Drs. Parkes and Wollowicz, who, while admitting that it was quite improbable that any large amount of unchanged alcohol escaped through the kidneys, yet maintained that the amount might be larger than Drs. Dupré and Anstie had estimated, the period of elimination assigned by them being, it was said, too short.

The objection seemed well taken, and Dr. Dupré made, in 1872, a new series of investigations to test the matter more thoroughly. Two unexpected and very important observations resulted. Some time previously Dr. Dupré had established the fact that—contrary to the assumption of Lallemand—it was possible to recover from urine, by distillation, any alcohol it might contain, within an exceedingly minute fraction. He now discovered that there is, in the urine of persons who drink no alcohol, a small quantity of a substance, which not only affects the chromic acid color test precisely as alcohol does, but is similarly convertible into an acid which reacts precisely like the acetic acid derived from alcohol. If it is alcohol, it is certainly not alcohol which has been taken into the body as such, since it appears in the urine of teetotalers. He found further that this small normal constituent of urine represents that minute portion of supposed alcohol which can alone be found in the urine after moderate doses of alcohol. After narcotic doses, however, the larger quantity of material, capable of reacting like alcohol, which appears in the urine, undoubtedly represents a real alcoholic elimination.

As for the temporary retention of alcohol within the system, as had been suggested, to be eliminated by the kidneys at a later period, the facts were altogether adverse. For example, during the course of twelve successive days, during which something over nineteen ounces of alcohol were taken, not one thousandth part was eliminated by the kidneys; and the rate of elimination was no greater at the end than at the beginning of the period. There remained fully nineteen ounces of alcohol to be accounted for: it certainly could not remain unchanged in the system without creating violent disturbance.

Possible eliminations by the skin, the bowels, and the lungs remained to be tested. These were not, and had not been, neglected. Already Dr. Anstie had made many experiments, admittedly rude but still sufficient to prove that no considerable quantity of alcohol escaped by the skin except during dead drunkenness. In 1866 Dr. Dupré estimated the alcohol in the fæces of a typhus patient whose daily allowance of brandy was six ounces: the alcohol eliminated by the bowels proved to be less than one tenth of a grain in twenty-four hours.

The question was thus narrowed down to possible elimination by the lungs. This too had been repeatedly tested, and only the most trivial quantities were found to be so eliminated; and as Professor Binz subsequently pointed out, the amount would naturally be overestimated, since the volatile ethers, which we smell in the breath of persons who have been drinking wine, brandy, whisky, and the like, affect the chromic acid test precisely like alcohol. During the twelve days above mentioned, Dr. Dupré found, by methods proved by careful check experiments to be capable of indicating at least two thirds of the alcohol which might pass out with the breath, that about half as much alcohol was eliminated in the breath as in the urine.

Experiments like these would seem to be sufficient to dispose of the elimination theory; but more exacting ones followed, in consequence of Victor Subbotin's study of the action of alcohol on rabbits enclosed in a Pettenkofer chamber, a plan which made it possible for the whole of the excretions—breath, urine, dung, and sweat—to be collected, and the amount of alcohol in them estimated. The experiments made by Subbotin were unsatisfactory in that the doses of alcohol administered were enormous, and the rabbit is an animal specially incapable of withstanding severe alcoholic narcotism.

It was unfortunate at this stage of the investigation that London did not contain a Pettenkofer chamber large enough for research on human beings, and Dr. Anstie and his associate were unable to provide the four thousand dollars which one would cost. So they were forced to content themselves with a smaller apparatus and smaller animals. Dogs were selected, being known to bear alcohol with some approach to human tolerance for that substance. Two healthy terriers were chosen, one (A) weighing 10 pounds, the other (B) weighing 9 pounds 12 ounces.

We have no space for a description of the apparatus prepared, or the processes and precautions taken to guard against deceptive results. Suffice it to say that the experiments on the dog, A, showed that two drams of brandy, containing 47·73 grains of absolute alcohol, can be disposed of by a little terrier within eight hours, with the elimination of only one fifth of a grain of unchanged alcohol by all channels together. It was further ascertained (before brandy had been given) that there was in the dog, as in man, a small normal elimination of substances capable of reacting like alcohol.

With dog, B, the experiments were even more conclusive. For a period of ten days he was given daily one ounce of brandy, containing 190·92 grains of absolute alcohol, administered in two portions. On the eleventh day he was killed, quickly cut into minute fragments—bones, skin, and all—and the amount of alcohol in him carefully determined: or rather, the whole of the substances in the body and blood capable of yielding acetic acid. The experiments on this dog showed that a terrier of less than ten pounds' weight could take with comparative impunity nearly 2,000 grains of absolute alcohol in ten days; that on the last day of the regimen he eliminated by all channels only 1·13 grains of alcohol; and that on being killed two hours after swallowing half an ounce of brandy, there were recovered from his whole body and all its contents (elaborately treated, so as to provide against material loss during the examination) only 23·66 grains of what might be taken for alcohol, a considerable portion of it due, undoubtedly, to the normal constituents of the unalcoholized body, previously noticed.

These results tally so closely with those obtained from the human organism, by other methods, that it is altogether unlikely that the case against the theory of alcoholic elimination could have been made much more conclusive had Dr Anstie lived to submit a human subject to the chamber test.

Alcohol in less than narcotic doses is thus evidently disposed of almost entirely within the body. What becomes of it? That it cannot be stored up permanently in the body is proved not only by the experiments above narrated, but by the everyday experience of thousands of drinkers. The excess of ingestion over elimination would long since have stored their bodies with more than their own weight of alcohol, were there no internal disposition made of it. What can that disposition be? Does alcohol play the part of a food?

The complex function of food is (1) to build up the body; (2) to repair waste; (3) to maintain the bodily heat; (4) to evolve energy to be expended in internal and external work. Does alcohol meet any of these requirements?

There is no evidence, thus far, to show that its products can help in any way to form tissues; hence we cannot give it credit for building up the body or repairing waste. On the contrary, it seems rather to retard tissue change, either constructive or destructive. To those who hold the ancient doctrine that pysical energy is developed only by tissue destruction, the last-mentioned fact bars the way to any recognition of the possible usefulness of alcohol as a force producer. But every physiologist of standing now admits that the force required for the great bulk of the work done in and by the organism is evolved directly from the food carried to the several organs by the blood, without its previous employment in tissue forming. The objection is therefore groundless

The apparent inability of alcohol to perform the third part of the function of food, that is, to produce heat, affords another plausible but unsubstantial argument against the possibility of its food action. The observations of Dr. Parkes go to show that, so far from raising the temperature of the body, alcohol slightly depresses it. But too much must not be inferred from this fact. There is no heat-producing food of greater efficiency than beef fat; yet an ounce of beef fat would no more raise the temperature of the body than an ounce of alcohol.

Does alcohol meet the fourth requirement of food? A very large part of the available energy of the body is developed by the oxidation of hydrocarbon, like fat. Being a highly oxydizable hydrocarbon, it would be strange indeed, as Dr. Anstie remarks, if its oxidation did not prove to be the mode by which alcohol disappears within the system. There is much to sustain this view, and not a fact to disprove its correctness. The theoretical force value of the alcohol daily disposed of by multitudes of sober people is very great. It is incredible that so much alcohol can be transformed in the body without the evolution of energy, for good or evil. It does not, in the temperate people in question, produce any visible disturbance of their bodily functions. It must therefore be vitally useful, and belong, where Pavy and universal experience put it, among the force-producing foods, its usefulness depending very largely, it would seem, in the rapidity of its transformation, and the promptness with which it supplies available energy.

This, it is proper to add, with important limitations. Beyond a certain small dosage, perhaps six or eight hundred grains in twenty-four hours for an average adult in health, alcohol is demonstrably a dangerous narcotic poison, not the least of its disadvantages being that it cannot be eliminated to any considerable extent. If employed at all, in health, it is obvious that it should be used for special purposes and with great care, unless it be in the diluted condition in which it appears in cider, beer, or light wine.

In many diseases, the system seems to be able to make use of almost unlimited quantities of alcohol, with strikingly beneficial effects; but that is a field upon which it would be out of place here to enter.

OUR NAVAL EFFICIENCY.

Large standing military establishments have always been justly viewed as unnecessary and inexpedient in this country; and it is the standing argument, of those who would defend the paucity in numbers of our war vessels, that we can afford to remain quiet, watching the development and trial of new systems by foreign nations, gaining experience without sharing in its cost, and simply maintaining a nucleus which, in time of need, the resources of the country could speedily augment to formidable dimensions. In the abstract, certainly, no exception can be taken to this reasoning, but unfortunately practice and theory are at wide variance. Instead of devoting moderate sums to the thorough construction and maintenance in the highest possible efficiency of a small number of vessels which, though even not embodying the very latest refinements, are nevertheless types of their kind, the enormous sum of fifty millions of dollars of the people's money has literally been frittered away during the

past five years in tinkering old ships of war, not one of which is thoroughly fit for severe service. Three million two hundred thousand dollars has been appropriated for eight new sloops, it is true, but this is not included in the above amount; nor is any portion of the same, except one million dollars, chargeable to any other necessary expenditure save repairs. The money that has been wasted is sufficient to have provided a powerful fleet, armed with every accessory of modern warfare, instead of a navy the crack ships of which could not, as the Key West drill proved, steam at a higher rate in company than four and a half knots per hour, and which are armed with guns contemptible before the modern European ordnance.

A very brief examination of the present condition of the array of vessels now borne on the navy register, as recently given by the *Army and Navy Journal*, will show to the reader that the status of affairs is the reverse of encouraging. Beginning with the wooden vessels, there are five large steam frigates; one is utterly rotten and worthless, and the newest of the rest, the Franklin, built shortly after the war, is armed with old-fashioned smooth bore 9-inch guns, and can, as the writer knows by personal experience, just hold her own against a stiff gale, under full steam power. The next class or second rate includes thirty-three vessels; three are old paddlewheel ships twenty years and over old, one being changed to a screw steamer. Eight are "Isherwood's failures," rotten, not worth repairing, and will shortly be broken up. Five are old-fashioned but in moderate condition; the boilers are so placed as to be unprotected. Four have Isherwood engines and Martin boilers, and are small vessels built of white oak, moderately rotten. Five built before the war are the best vessels in the service. Six are not launched, one never will be, the rest have engines—Isherwood again—every one of which has gone into the scrap heap. One is being tinkered at, and has cost two and a half millions alone thus far for repairs, and one has never been to sea except for a deceptive trial. Her total weight is 4,339 tuns, and of this her machinery and coal alone weigh 2,010 tuns.

The third class numbers twenty-four vessels; one, the Swatara, has been rebuilt and fitted with compound engines. She consumes 15 tuns of coal under six boilers per 24 hours, and makes an average speed of 6½ knots. Five are in fair condition, though merely old-fashioned gun boats. One has had her machinery condemned and is being repaired. Two are old sailing vessels on which attempts at conversion into steamers are being made. Two are unsafe in a seaway; two are condemned and are to be broken up. Another is old and useless. Two are in Asia and cannot get back; two are unseaworthy. Two more are worthless, and are to be repaired, if possible. Five are three-gun gunboats, (boilers above the water line and bad machinery), and the last is an old paddle wheel steamer, 25 years old, stationed on Lake Erie. The fourth class includes a couple of old blockade runners and some dispatch boats.

The ironclads number fifty-one. There are twenty "light drafts," which are condemned and perfectly worthless. The department is selling them at any price. Next, there are seven of about 1,200 tuns displacement. These have laminated armor, which guns equal in power to the 7, 8, and 9 inch Woolwich rifles can pierce like so much cardboard. Six monitors have about 1,500 tuns displacement, open to the same fatal objection. Four are double turreted, and displace 3,000 tuns. These have green white oak hulls, thoroughly rotten, and armor also no shield to modern heavy projectiles. Four more are on the stocks, have never been launched, and are so much decayed that it is recommended that they be broken up. Three are a remnant of the old Mississippi flotilla, of course now of no value. The Dictator has weak armor; but if this could be replaced with solid plating and modern guns be mounted in her turrets, she would be one of the most formidable ironclads afloat. The same may be said of the unfinished Puritan. The Roanoke is an old frigate razeed and covered with worthless armor.

Add to this category a few tugs, two torpedo boats, and a few ancient sailing vessels (used for practice, store, and receiving ships), and the entire United States Navy is summed up.

PRINTING THE PATENTS.

Recently, in the House of Representatives, the committee on appropriations reported a clause authorizing the expenditure from the patent fund of $40,000, for producing copies of current and back issues of the patents, whereupon several gentlemen took occasion to express their sentiments.

It is gratifying to observe that all of the speakers were in favor of having the back patents printed as early as practicable: and although they did not sanction a sufficient appropriation for the work this time, they did something towards it, and expressed the opinion that next year it should be wholly accomplished. Mr. Meyers thought that the proposed printing would greatly benefit inventors. "We should," he said, "consult their best interests, and in doing so will always best develope the inventive genius of our people."

Mr. Conger said: "I think it very necessary and essential to the interest of inventors, who pay all these expenses in the end, that as large an amount as it is possible shall be appropriated."

Mr. Garfield was in favor of a larger appropriation, but thought it impracticable at present to use it, owing to the crowded state of the Patent Office, and the consequent necessity of hiring space, at a heavy cost, if additional draftsmen were to be employed.

NINE THOUSAND dollars has thus far been contributed toward the Agassiz monument.

THE CULTIVATION OF OYSTERS.

In our last issue, we traced the oyster from the spawning bed through its four or five years of development. It is now on what may be called the fattening ground, the firm gravelly bottom of a channel between rocky islands, swept by a tide which runs like a river in flood. Here the oysters spend their last season, with as much enjoyment, we fancy, as oysters are capable of. The conditions of oyster life are here evidently at their best, for the oysters improve astonishingly, doubling in bulk of meat, it may be in six months. Here the crooked are made straight by their own efforts, the slender grow broad and round, the lank become stout, and the flesh of all grows plump and hard to the very gills. Notice the difference between the opened "natural" and a "transplant" of corresponding age, especially in front of the circular muscle commonly called the heart!

But the oyster is not yet in condition to tickle the palate of the epicure. It is full of bitter, salt sea water; the gills are discolored, and the whole system needs renovating. It must have a drink of fresh water. The common run of oysters are taken direct from the "salt" to the market. Not so the fancy product of cultivation. These are taken to the mouth of a sweet-watered river and placed for a few hours in a shallow float, which swims near the surface of the water. Here the oysters "drink," as it is technically called, spirting vigorously, and freeing themselves of all deteriorating matter. Open one now. It lies plump and white in the shell, rounded to the gills, which are scarcely visible, in every part clean and tempting to the most fastidious. Taste it, and know how sweetly delicate an oyster may be!

Not many people know it, but there is as great a difference between a thoroughbred oyster, properly handled, and an ordinary oyster such as one sees in the markets, as there is between a rough seedling pear and a Bartlett which melts in the mouth. Those who have learned the difference experimentally will eat no other where the cultivated are to be found.

The variety we have been studying are genuine "saddle rocks," raised on their native soil. Other varieties differ in color and flavor, and have their local admirers; but none surpass the true saddle rock in all the qualities that form the perfect oyster.

We set out to describe the cultivation of oysters, and have done so as one might describe the cultivation of wheat in Nebraska, omitting to mention grasshoppers. It will not do, however, to leave out the shadows of the picture. The oyster eater may care but little for the long battle that has been waged with various enemies to secure the development of the savory morsel that lies before him on the half shell; but to the man who raised the oyster it is a matter for serious consideration. If a crop of wheat required five or six years to come to maturity, and during all that time was subject to invasion by destructive insect pests, not to mention human marauders and elemental dangers, it would bear some resemblance to a crop of oysters. The likeness would be still closer if the attacks were made invariably in the dark. It is hard watching against enemies which work under cover of from ten to a hundred feet of water.

The chief animate enemies of the oyster and the oyster cultivator are (barring oyster thieves) the starfish, the drill, and—shall we say it?—the periwinkle. The starfish is perennial. It is to the oyster grower what the grasshopper or the army worm is to the farmer on *terra firma*. Its worst assaults, too, are made in like manner, that is, in overwhelming masses. The sea is full of them, and at times they will come up from deep water in solid column, broad enough to run over large areas, and so numerous that not a living

STARFISH AT WORK.

thing remains in their path. Miles of oyster beds have been laid waste by them, and the perpetual possibility of such invasions makes the oyster grower's investment extremely precarious. It is only by constant dredging that it is possible to do anything on the north shore of the Sound, the cost of carrying on the war, with the losses entailed, making the heaviest of the oyster breeder's taxes. On the Long Island shore they have been, we are told, less troublesome of late. By persistent labor many grounds formerly given over to their ravages have been recovered; and when steam comes to be more generally used in dredging, it is possible that the pest may be quite overcome and exterminated.

A short time ago one of our scientific cotemporaries published a digest of a French report, in which the starfish was described as helping to complete the work of destruction begun by the drill. It would be fortunate, indeed, for our oyster breeders if the stars were thus dependent. It is true enough that the drill paralyzes the oyster (chiefly those under three years old) by boring a hole into the oyster's heart, as its large muscle is called; but the star waits for no such intervention. On the contrary it destroys both the drill and the oyster, and every other mollusc it comes across.

In the current issue of the *Popular Science Monthly*, Mr. Lockwood gives a more correct account of this baleful star's proceedings. He errs, however, in saying that the star merely clasps the oyster, then patiently awaits its opening, whereupon it drugs its victim as a burglar might blow chloroform through the crack of a partly opened door. The rapidity with which stars destroy oysters, and the invariable corrosion of the outer edge of one of the valves of the oyster's shell, making it shorter than the other and the junction of the

WORK OF STARFISH.

two imperfect, is evidence enough that the burglar waits for no opening of the door. By what process the shell is eaten away, whether by an acid secretion or otherwise, we do not know. That it is eaten away, the shell of every oyster killed by stars bears unmistakeable testimony.

The case of the periwinkle is less clear. The assertion of certain naturalists that the 'winkle is a harmless and innocent vegetarian is met with such derision, by oystermen, as shepherds would be likely to greet the assertion with that wolves eat nothing but grass. They regard 'winkle as the chief destroyer of mature oysters, and will show you just how the oyster's nose is broken off between the tough foot of the 'winkle, and its outer shell. They have caught the rascal in

WORK OF PERIWINKLE.

the act time and again, with more or less of the oyster devoured. It is a pretty case of conflicting testimony as it stands, possibly one of mistaken identity.

The drum fish, which makes such havoc among the oysters of other localities, is but an occasional visitor in the Sound, and never in sufficient force to do much harm.

It must not be supposed that this exhausts the list of the difficulties and dangers which the oyster grower has to contend against. Inanimate as well as animate Nature bears hard upon him in more ways than we have space for mentioning. Nevertheless endurance, pluck, and energy prevail in this as in other forms of industry, especially new ones, in which everything has to be learned by experience. Though greatly extended during late years, the business of oyster culture is yet in its infancy. It cannot fail to become more and more important as rapid transit broadens the area over which live oysters may be distributed, and more of the inhabitants of the interior learn to know the oyster's capabilities.

In closing, we must express our special indebtedness for information, for opportunity to study the workings of oyster culture on the spot, and for the specimens selected for these illustrations, to the Messrs. Hoyt Brothers, oyster farmers and dealers in fancy oysters, at Norwalk, Conn.

Prizes for Chemical Discoveries.

The following prizes for chemical discoveries are offered by the *Société d'Encouragement*, Paris: Disinfection and prompt clarification of sewage, $200, 1875. Ink not attacking metallic pens, $200, 1875. Economical production and application of ozone, $600, 1875. Fixation of atmospheric nitrogen, either as nitric acid, ammonia, or cyanogen, $400, 1876. Artificial production of graphite, suitable for lead pencils, $600, 1877. Artificial preparation of a compact black diamond, $600, 1877. Industrial application of oxygenated water, $400, 1878.

The Railway World.

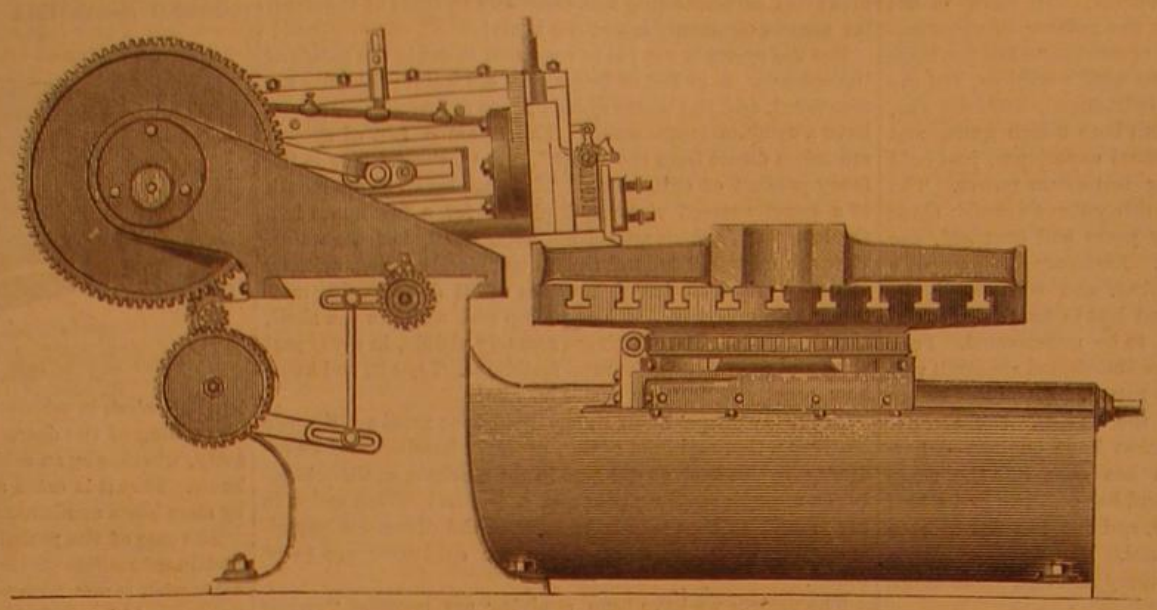
This is the title of a new and handsome weekly paper, 16 quarto pages, $4 a year, lately established at Philadelphia. It is the successor of the United States *Railroad and Mining Register*. If we may judge from the contents of the first number, the new periodical is in the possession of the real requisites for success, namely, ability and enterprise. We cordially wish for it the highest prosperity.

IT is reported that the owners of the Great Eastern are contemplating the project of turning the ship into an immense hotel, and sending her to the Centennial Exposition.

FINISHING LOCOMOTIVE WHEELS.

On page 6 of our current volume, we illustrated an ingeniously designed machine for slotting curvilinearly the insides of locomotive wheels made of wrought iron; and in further illustration of the subject of finishing such wheels, we publish two views of a tool of German origin, exhibited by the Chemnitz firm at the Vienna Exposition. It is designed for planing the spokes of locomotive wheels, the tool traveling at an angle to the horizontal to provide for increased thickness of metal at the hub. The tool holder is located at the outer end of a reciprocating ram, said ram working in guides formed on a plate which can be adjusted at different angles, so that the tool is made to take its cut in a direction corresponding to the desired taper of the wheel spoke.

The tool holder at the end of the ram is adjustable vertically, and it is also provided with a toothed arc actuated by a worm, and so arranged that the point of the tool can be made to traverse on the arc of a circle, convex upwards, this traverse being self-acting. In this way the desired rounded form can be given to the edges of the spokes. The motion is given to the ram by a crank of adjustable throw in the ordinary way, and it will be noticed that the carriage on which the ram is mounted is capable of being traversed along its bed by self-acting gear, the machine being thus made available for a variety of work besides that of spoke edge planing. This machine is, in fact, a very useful one for a locomotive shop where it is desired to turn out highly finished wheels, and is of very good design generally.



WHEEL SPOKE PLANING MACHINE.

The Protection of Iron Surfaces.

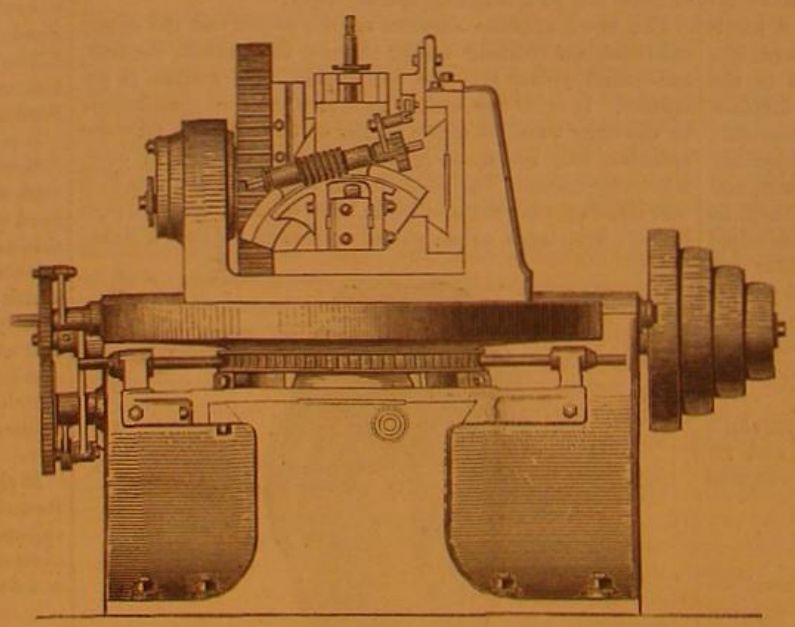
The increasing utilization of iron as a material of architectural and engineering construction, and the necessity for protecting it from surface deterioration by means of some kind of paint which is at once economical and durable, have given the subject to be considered in this article a very great practical importance to painters. Until within a short time, our painters have not seemed to realize that iron required special treatment, very different from that which would answer with wood or brick; and during the first ten or fifteen years of the history of iron architecture in this country, the best effects of design and ornamentation were spoiled by heavy coats of white paint, which were sure to become streaked with reddish stains very soon after they were put on. There has been a very decided progress—towards a style of painting at once tasteful, durable, and adapted to iron as a material of construction—since white iron fronts were general, and many of the iron buildings in New York are models of beauty as well as strength; but we may consider the painting of iron an art yet to be learned by a majority of painters, if we may judge by the many conspicuous examples of ugliness and bad taste which disfigure our finest business streets.

In mixing paints for iron surfaces, it is of the first importance that the best materials only be used. Linseed oil is the best medium, when free from admixture with turpentine. A volatile oil, like turpentine, cannot be used with advantage on a non-absorbent surface like that of iron, for the reason that it leaves the paint a dry scale on the outside, which, having no cohesion, can be readily crumbled or washed away. Linseed oil, on the other hand, is peculiarly well adapted for this purpose. It does not evaporate in any perceptible degree, but the large percentage of linolein which it contains combines with the oxygen of the air, and forms a solid, translucent substance, of resinous appearance, which possesses much toughness and elasticity, and will not crack or blister by reason of the expansion and contraction of the iron with variations of temperature. It is, moreover, remarkably adhesive, is impervious to water, and is very difficult of solution in essential oils, spirits, or naphtha, and even in bisulphide of carbon. Another important advantage of linolein is that it expands in drying, which peculiarly adapts it to iron surfaces; since cracks, however minute, resulting from shrinkage, expose enough of the metal to afford a chance for corrosion, which will spread in all directions, undermining the paint and causing it to scale off, besides discoloring it.

With all its advantages, however, the best linseed oil paint is but poorly adapted to long service as a protection to iron surfaces exposed to extreme variation of temperature and to all kinds of weather. Even the continuous film of linolein, notwithstanding its compactness and the additional substance afforded by the body of the paints, gradually losses its toughness, curls up, and peels off. If chipped off by accident before it had lost its hold on the iron, we find, if we carefully examine the exposed spot, that a thin film of oxide has formed under it. This fact accounts for its diminished adhesion. Iron, in uniting with oxygen to form a rust, increases its bulk in proportion to the amount of oxygen it has taken up, and necessarily occupies increased space. In a word, it swells, and in so doing pushes off the paint film, which, sooner or later, drops away from it. This undermining action of the rust is the chief difficulty to be contended with in effectually preserving iron surfaces by means of paints or varnishes. It is not improbable that the linolein itself an oxide, may impart oxygen to the iron, and thus promote its rusting. This idea has been suggested by Professor Williams in a recent treatise on the subject; and while it is purely speculative, it may account for the oxidation of iron surfaces, when to all appearance effectually protected by a film of paint thick enough and continuous enough to exclude both air and dampness.

In selecting a paint for iron, mechanical adhesion is a consideration of the first importance. In this respect, paints differ widely, but it must be remembered that, in painting or varnishing a metallic surface, mechanical adhesion is all we have to depend upon. With absorbent surfaces it is different. Professor Williams gives it as his opinion, based on observation and experiment, that pitchy or bituminous films are especially effective as regards their adhesion to iron: for example, solutions of asphalt or pitch in petroleum or turpentine. These are also very effective as regards continuity, owing to the fact that, in drying, they form plastic films, which yield with the expansion and contraction of the iron, and manifest no tendency to crack. If the surface is rusty, they penetrate the oxide scale, and envelope the particles very effectually, making them a portion of the paint. The solubility of such a film in water may be counteracted by mixing it with linseed oil. The experiment may easily be tried by mixing about two parts of Brunswick black with one of white, red, or stone colored paint, the body of which is composed of red or white lead or litharge. Red lead is the best for many reasons, if finely ground and thoroughly mixed with linseed oil. Any one of several kinds of bitumen may be used, either natural mineral asphalt, pine pitch, or artificial asphalt, such as gas tar or the residuum of petroleum distillation in cases where the crude oil has been distilled before being treated with acid. This gives a very hard, bright pitch, which is soluble in "once run" paraffin spirit, and which makes the base of an excellent, cheap, and durable paint for ironwork in exposed positions.

During the past few years the writer has heard many accounts of the preservative influence of paraffin when applied to iron surfaces, and can recommend it for all classes of ironwork which can be treated hot. The most effective method of applying it is to heat the iron in vacuo, in order to expand it and open its pores, when paraffin, raised to the proper temperature, is run upon it. By this means the iron is penetrated to a sufficient depth to afford a very effectual protection against oxidation, especially when a suitable paint is subsequently applied. Any non-oxidizable substance would probably answer, but paraffin is as cheap as any, and quite as good if not better, the only exception as to quality being made in favor of some kind of vitreous enamel, which, while costing more, would certainly be more permanent in its benefits. Brushed upon the outside merely, it is doubtful if paraffin would have much effect in preserving the iron, while it would certainly tend to lessen, if not destroy, the mechanical adhesion of a surface paint. There is no reason, however, why bridge work, iron fronts, etc., should not be treated with paraffin before they leave the shops where they are made, which would greatly simplify the problem of their easy and economical preservation from oxidation. In the absence of such treatment, a careful coating with the paint above described will probably prove the most effectual means of protecting iron surfaces.—*Painters' Magazine.*



WHEEL SPOKE PLANING MACHINE.—END VIEW.

An Unhappy Attachment.

The Dover (Ohio) *Reporter* states that a painful scene occurred in a church in Bucks township, Ohio, a few Sundays ago. The church had lately undergone repair. Among other improvements a new coat of paint was placed on the pews, followed by a coat of varnish; the result was most pleasing to the eye, but unfortunately the varnish had been applied so late in the week that it had not had time to become hard before Sunday, when the congregation flocked to their seats. No apparent inconvenience was suffered until the clergyman was about to deliver the benediction, when the congregation were horrified to find that they were unable to stand up; they were, in fact, glued, or rather varnished, to their seats. Their spasmodic efforts to rise were most distressing to witness; in vain did the clergyman exhort them from the pulpit to resignation. They were seized with a kind of panic, all the more frightful because they were for the moment powerless; at last, by what seemed to be a simultaneous and herculean jerk, they managed to tear themselves from their sittings; but at what a sacrifice! The pews were literally covered with fragments of Sunday apparel. Shreds of silk, lawns, calico, broadcloth, and cassimeres were left as souvenirs of the tenacity of the varnish used in beautifying that church and the hapless congregation, rushing from the doors, hurried homewards with an expression on their faces as though their hearts were even more severely rent than their garments.

Chemical Action of Sea Water on Boilers.

In all boilers in which salt water is used, the plates are attacked and the portion of the iron dissolved is ultimately found in the scale, or the mud, to which it imparts a brick red tinge. Out of the three principal salts always present in salt water, namely chloride of sodium, chloride of calcium, and chloride of magnesium, to the former two the deleterious action mentioned is ordinarily attributed. This, however, is an error, since both salts are neither decomposed nor altered at the highest temperatures, and hence they cannot be caused to affect the iron through the heat in the generator.

The chloride of magnesium, however, a writer in the *Annales de l' Industrie* points out, decomposes into hydrochloric acid and magnesia. The former in contact with the iron attacks it, forming chloride of iron, which is soluble in water. When the chloride of magnesium is deposited by the salt water on the portions of the boiler, this result takes place; and the chloride of iron, dissolving in combination with the carbonate of lime already in solution, forms chloride of calcium and red oxide of iron, which is found in the scale. It remains, therefore, to find a means of combatting this action of chloride of magnesium, in order to preserve marine and other boilers in which sea water is used.

DISAPPEARANCE OF A VALUABLE BOOK.—The London *Builder* states that the Book of Kells, written by Saint Columbkill in the year 475, the most perfect specimen of Irish art, with illuminations, and valued at $60,000, has disappeared from Trinity College library. It is alleged to have been sent to the British Museum for the purpose of being bound. The volume is regarded as the palladium of Ireland. A receipt for it, signed by a Mr. Bond, purporting to be from the British Museum, has been placed in the hands of the Provost of Trinity College, Dublin. The greatest excitement prevails in the College respecting the mysterious disappearance of the volume.

APPLES HALF SWEET, HALF SOUR.—We are indebted to Mr. J. H. Parsons, of Franklin, N. Y., for specimens of fruit as above. They are of the greening species, sound and ripe. The two flavors are quite distinct; the sour portions have a greener and more full appearance than the sweet parts, which are softer and of a yellow hue.

HILLSIDE MINING IN COLORADO.

The mineral wealth of California, Colorado, and Nevada is such as to render it probable that there will consequently be an increase in the values of all commodities, owing to the vastly increased amount of the precious metals which will, during the next few years, be brought into the market. Moreover, the labor interests of this country will be largely affected by recent discoveries, as the want of employment in the Eastern States creates a steady flow of travel to the El Dorado of the Great West.

The San Francisco *Chronicle* reports as follows:

"The recent wonderful developments on the Comstock are far ahead of anything before made on that famous lode. The great *bonanza*, or ore body, running through the Consolidated Virginia, California, and Ophir mines, seems to be improving in all directions. The general character of the ore is the same as in all mines—being a mixture of red chloride and sulphuret ores. The California mine has come suddenly forward as the richest mine on the Comstock, and Belcher and Crown Point, producing over a million a month, are thrown into the shade by the developments in the mine above mentioned. Mining experts who have visited the lower levels place most astounding estimates on the amount of ore in sight. Some of these estimate that in the Consolidated Virginia there is, standing in the mine above the 1,550 feet level, over $43,000,000 worth of ore, or about $27,000,000 in dividends. The estimates of the value of the ore in the California vary from $50,000,000 to $150,000,000.

"Plenty of ore is found in the Consolidated Virginia, assaying on an average $600 per tun. At one place the ore body is found to be 140 feet wide.

"In the California mine the discoveries are attracting universal attention. Quite recently the north drift on the 1,500 foot level was connected with the south drift on the same level in the Ophir, thoroughly ventilating the mine and creating a fine circulation of air. The cross cut from the bottom of the south winze on the south line of the Ophir, 60 feet below the 1,465 foot level, is developing a more valuable body of ore than anything yet found in that section, no longer leaving a doubt that the California has one of the richest and most extensive ore bodies ever discovered on the line of the Comstock.

"The ore in the Ophir is the same as that in the Consolidated Virginia, showing that both companies are at work on the same body. On the 1,466 foot level the *bonanza* is constantly expanding, and the value of the ore is almost daily increasing. It is estimated by those who have taken the pains to make the necessary measurements that there are now in sight, on the 1,465 and 1,300 foot levels of the Ophir, not less than 150,000 tuns of ore. Specimens are here found that are so pure as to be malleable on some of their surfaces. A specimen taken out here lately assayed over $8,200. It is thought that the ore in this drift will average $1,200 per tun. At last accounts the face of the drift was in the same material."

Our engraving, taken from *Harpers' Weekly*, shows the manner in which mining is carried on in the mountainous districts where the lodes lie above the surface of the valleys, embedded in the hills. Many of the slopes are literally honeycombed by these horizontal workings, and the labor expended in prospecting for paying ores, frequently without adequate result, has been very great. But in the aggregate, the yield of the gold and silver has been enormously profitable to the Colorado miners, and the occasional failure of a lode, or an unsuccessful prospecting scheme, is not likely to discourage so hardy a race.

HILLSIDE MINING IN COLORADO.

The Cause of Earthquakes and Volcanoes.

The interesting paper of Professor Robert Mallet on the above subject, an abstract of which was first published in this country (we believe) in the *Science Record*, January, 1873, is attracting much attention. We will briefly recapitulate the points of the new theory.

The various relations and points of connection between volcanic phenomena, earthquakes, and lines of mountain elevation imply that they are the results of the play of one set of cosmical forces which have been brought into operation by the gradual cooling of the earth from an incandescent sun-like state to its present condition. His argument is as follows: As the cooling of the earth proceeded, the crust gradually thickened and contracted less and less as the temperature became lowered. The hotter nucleus, on the other hand, contracted more, being at a higher temperature than the crust and having a higher co-efficient of contraction for equal loss of heat. By this process, which is still going on, the crust of the earth would shrink at one rate, and the vastly hotter central portion at another and greater rate; and cavities would be formed between the crust and the nucleus, cavities which would be inevitably filled by the crushing down of the solid crust on the more swiftly contracting nucleus, by the force of gravitation, which is sufficient to crush the hardest rocks; and as the solid crust follows the shrinking nucleus, "the force expended in mutual crushing and dislocation of its parts is transformed into heat," by which, at the points of crushing, the rocks are heated even to fusion. The access of water to such points determines volcanic eruption. These points of crushing may occur at various depths in the solid crust. He then proceeds to measure the amount of actual contraction by the annual amount of heat lost by radiation into space, which is sufficient to liquefy 777 cubic miles of ice into water at 32°, and comes to the conclusion that less than one fourth of total annual loss of heat would suffice to produce the contraction necessary for his hypothesis. The actual amount of annual contraction is estimated at a reduction of three fifths of an inch, an amount too small to be measured by any astronomical method, and yet more than enough to produce all the volcanic phenomena now to be observed on the surface of the earth.

Aggregate Steam Power of the World.

Dr. Engel, director of the Prussian Statistical Bureau, has been making estimates, on such statistical data as is available, of the total horse power of steam engines in the world, as every country has tolerably correct railroad statistics. Dr. Engel thinks that the following returns with reference to locomotives is not far from right:

	Year.	Number.
United States	1873	14,223
Great Britain	1872	10,933
Zollverein	1871	5,927
Russia	1873	2,684
Austria	1873	2,369
Hungary	1869	506
France	1869	4,933
East Indies	1872	1,323
Italy	1872	1,172
Holland	1872	531
Belgium	1870	371
Switzerland	1868	225
Egypt	1870	212
Sweden	1872	185
Denmark	1865	39
Norway	1871	34
Total		45,467

It may be assumed that there are still four or five thousand additional locomotives in countries from which no statistics have been received, so that something like fifty thousand engines of that description, of an aggregate of 10,000,000 horse power, are now in use. Dr. Engel estimates all the engines in use—locomotive, marine, and stationary—at about 14,400,000 horse power.

Assuming that the above statistics are approximately correct, it would appear that one third of all the steam engines and steam power in the world are employed in the United States. This will, in some degree, account for the extraordinary industrial progress of this country and the high rank it maintains in all departments of practical engineering. The population of the United States is 40,000, while the aggregate population of the other countries above named exceeds 350,000,000.

Extraordinary Inundation of the Nile.

The Nile inundation for 1874 reached a higher level than has ever been the case within the memory of man. On the 10th of October, whole villages along the banks, it seemed, must be swept away; and had it not been for an immense levy upon the population for workmen, the losses and destruction would have been enormous. No less than 700,000 people were set at work opening ditches and channels for the flood. It was only by the protracted and severe effort of this multitude that the danger was averted.

Greenhouse and Window Plants.

Ventilation is one of the most important things to look after at this season, as by a little injudicious opening of ventilators many choice plants may be ruined. Always open on the side opposite to that from which the wind blows. When the weather is very cold and freezing, air enough will enter through the little cracks to afford the necessary ventilation.

Water should be applied only when the soil is dry; and then give an abundance, otherwise the plants will soon perish. Shower the foliage once or twice a week, except during the coldest weather.

House plants usually suffer from the dry, dusty atmosphere of the rooms in which they are placed. If showered occasionally, and the thick-leaved kinds wiped off with a damp sponge, they well grow much better.

Wardian cases or ferneries are now in general use among plant lovers, as they enable one to grow a few ferns and other plants very readily and with but little attention, except to shade from the direct rays of the sun. But little water is needed after that given the plants when first set out; if any mold appears, the case should be opened for an hour or two every day.

Bulbs that have made good roots may now be brought up from the cellar, and in six weeks' time will give an abundance of flowers.

Succulents, such as echervias and tender sempervivums, will winter in a cool part of the greenhouse, if kept dry. Water should only be given sparingly.

Cactuses coming into flower will require plenty of water, and those at rest scarcely any.

Insects should be looked after closely; give the house a thorough smoking once or twice a week, to kill the green fly and other pests.—*Agriculturist.*

Sheet Metal Pipes.

M. Vanche Denis, of Gaulier (Ardennes), France, says the *Ironmonger*, has invented a system of manufacture of lap-jointed metallic pipes, by forming a bend in and turning up the longitudinal edges of a long, narrow sheet of metal. By curving this band by the aid of a special shoulder piece, and then passing the band, thus prepared, between a series of grooved pulleys, which draw toward each other, and clasp and press together the edges of the metal band, curved so as to produce a cylinder, he makes a pipe with perfectly tight joint, and of the required diameter.

CLOSING CRACKS IN CAST IRON STOVES.—Good wood ashes are to be sifted through a fine sieve, to which is to be added the same quantity of clay finely pulverized, together with a little salt. The mixture is to be moistened with water enough to make a paste, and the crack of the stove filled with it. The cement does not peel off or break away, and assumes an extreme degree of hardness after being heated. The stove must be cool when the application is made. The same substance may be used in setting the plates of a stove, or in fitting stove pipes, serving to render all the joints perfectly tight.

W. R. S. says: "In making a rubber joint, take a piece of chalk and rub it on the side of the rubber and flange where the joint is to open; and when required, they will come apart easily, and not break the rubber, although the latter may be burnt and hard. Repeat the chalking before screwing up, and you will have as good a joint as ever, and the rubber can be used a great number of times. I have seen a blacksmith measure a piece of iron and put chalk marks where he wanted to cut it; he then put it in the fire and heated it to a bright red, and the chalk was still there, unaffected by the heat."

A CURE FOR BRIGHT'S DISEASE.—Dr. Hegewald says: Half pint, thrice daily, of a fresh infusion of the leaves of *asplenium scolopendrium*, L., is a most successful treatment in Bright's disease. This is the hartstongue or spleenwort, and is said to be popular, in Devonshire, England, and elsewhere, for its medicinal virtues.

Correspondence.

Zinc in Boilers.

To the Editor of the Scientific American:

In your paper of December 12, a correspondent states that zinc is a preventive of boiler incrustation. Seven or eight years ago, I tried the experiment, under the idea that an electrical condition might probably have something to do with boiler incrustation. The boiler I had was an upright one. I placed a piece of zinc, weighing about two pounds, on the dome inside, between the tubes; it remained there about two months, and during that time the boiler was opened at the bottom, on three sides, for a weekly cleaning. I noticed that the mud (Mississippi mud) was quite different from that previously deposited. Before it was mostly made up of scales; but after the zinc was put in, the deposit was soft, and scarcely a sign of scale was visible, the surface of the iron within looking fresh and new.

Notwithstanding this favorable action of zinc, it is not to be recommended for this purpose. I found the cylinder, piston rod, and piston head badly incrusted by something which I could not understand; the pump worked badly and frequently failed, becoming incrusted within. I sent it to be repaired to the maker, who, on opening it, expressed his surprise at its condition, and said: "How came this stuff on the pump? It looks like calamine." Zinc as a preventive of boiler incrustation will not do; if, however, the zinc produces a galvanic current, and renders the iron negative, then the experiment is suggestive of a principle that can be used by an external application of the galvanic force.

Carondelet, Mo. L. T. WELLS.

To the Editor of the Scientific American:

I saw in your issue of December 12 that an engineer on the steamship St. Laurent, running between New York and France, had left an ingot of zinc in one of his boilers; and on looking for it at the end of the next trip, he found it all wasted away to a mere mud. This is not new here. Mr. J. J. Illingworth, Chief Engineer of the Utica Steam Cotton Mill, first introduced zinc in their boilers nearly 20 years ago; and by his recommendation it is now used in the New York Mills' boilers and in many other places. Mr. I. claims that the zinc has a great affinity for oxygen, and therefore absorbs the oxide in the water, and thus prevents its affecting the iron of the boiler. I herewith send you a couple of pieces which I obtained from him; and you will see that they are not all gone to mud, as they would have been if they had been left in the boiler a week or two longer. These pieces have been in the boiler about four weeks. In the New York Mills where soft water is used, the zinc will lay there without being affected; but as soon as the hard water of the Sauquoit Creek is used, it begins at once to affect the zinc. Nor is this all the effect of the zinc in the boilers; it prevents the steam pipes (running round the mill for heating purposes) from rusting.

To show this more conclusively, I will say that the piping in the above mill, where zinc has been so freely used, has been in 25 years, and has needed no more than the ordinary repairs that such pipes require. But on the other hand, the company built a new mill (which was started in October, 1869), and, for some reason not explained, there was no zinc put into the new boilers for about 3 years. The result of this neglect or oversight was that the heating pipes all through the mill began to leak at the elbows, couplings and Ts; and on taking the pipe apart for repairs, it was found that, wherever the steam either struck the T or elbow or dripped into it, there was a hole eaten into it; and when a piece of pipe was to be taken down, there was no telling where the workman could stop, because the pipes, Ts, elbows, and couplings were generally eaten away. I also send you a T, which is a fair sample of all the pipe and other joints connected with it.

When this was brought to the knowledge of Mr. I., he began at once to put zinc into the boilers of that mill, and the result of it is that the rusting of the pipes has entirely stopped, and the bill of repairs lessened accordingly. I am told that the above engineer has used zinc in his boilers for over 25 years, with the same results in all cases.

Utica, N. Y. AJAX.

Phosphor Bronze.

To the Editor of the Scientific American:

The manufacture of this alloy was commenced in our city in 1872, and has since gradually gained its way into many of our industrial works. At the time of its introduction, I had charge of the machinery of one of our large rolling mills, and was induced to try it for journal bearings for our rolls and other heavy machinery. The disadvantage that bearings in rolling mills labor under is that they are scarcely ever bored or fitted in any way, the pattern being made as exact as possible, so as to save the work of fitting. Thus the bearings are subjected not only to the heat induced by friction, but also to that imparted to the rolls by the hot iron passing between them. Add to this the muddy, gritty water run upon the necks to keep them cool, the immense amount of cinder thrown into them from the hot iron, and often bad grease and a careless roller, and you have a combination of difficulties that are hard to overcome. The brass bearings in an eight inch train of rolls last for from one hour to six months, the latter being the exception. As I have seen both brasses and necks cut so badly as to be worthless within an hour, by cinders getting into them, by worthless grease, by hard spots in the brass starting a neck, by the chippings from the neck tearing the brass to pieces, and by the carelessness of the roller, I know what the bearings have to stand.

I will describe the three most important trials made with the bronze bearings. I placed a set of trial bearings under the necks of a pair of finishing rolls, in a ten inch mill, on November 25, 1872. On November 23, 1873, they were taken out and examined, when it was found that they had not worn one thirty-second of an inch on the bearing proper; and they were only discarded because the collars were worn out on account of the excessive end wear, caused by forcing the bearings against the ends of the rolls by set screws, to keep the grooves over each other. The second test was a much severer one. A set of bronze bearings were placed under and over the middle roughing roll of an eight inch train on December 2, 1872, and were used just one year before they were worn out, though the necks of the rolls had been previously badly scored by cinders. In the roughing rolls of any mill a large amount of cinder is thrown into the bearings, thus making such tests as the above very severe. In the first test, a careful roller was in charge of the mill; in the second test, a careless one. The third test was the most severe of all. One of the E bronze plates was put under the upright shaft of a thirty-five ton rotary squeezer, and a set of A bronze plates under the horizontal shaft. Every rolling mill man knows that it is an impossibility to keep all the cinder from the bearings of the horizontal shaft, cover it as you will. The one mentioned had four covers, owing to the fact that, as water is used on the squeezer to keep it cool, it will wash fine particles of cinder into the journals. After using it from August 1, 1873, to August 1, 1874, having made about seven millions of revolutions and turned out over ten thousand tuns of iron, the upright bearing had worn but one sixteenth of an inch, and the horizontal about one tenth of an inch, a result far ahead of any other I have ever been able to hear of.

Six or seven grades of this alloy are now made, being marked by letters, the Sligo, or A, being used principally for journal bearings. The E brand is almost as hard as steel. I send you a sample of the A, and also a chart of its tensile strength compared with other alloys. I have never had anything to approximate it for rolling mill use, except a composition of nine parts tin to one of copper; but this is not often available, on account of its low melting point.

I am induced to send you these lines, as I have not noticed any actual trials reported by any of your correspondents, and for the reason that I have received so many good things from the table you spread that I cannot refrain from adding my mite.

JOHN A. BRASHEAR.

Pittsburgh, Pa

Steam Boiler Explosions.

To the Editor of the Scientific American:

The frightful results of the bursting of steam boilers, entailing (it may safely be assumed, in three cases out of four) the loss of life or maiming of one or more persons, have led to many inquiries as to the probable cause of these catastrophes. The almost invariable verdict is rendered, however, by the coroner's jury that "Mr. ——, the engineer, came to his death by the explosion of a steam boiler in the factory of Messrs. Smith & Jones, to whom no blame is to be attached, the cause of said explosion being unknown, reliable witnesses having sworn that five minutes prior to the explosion the water stood at 3 inches over the flues and the steam gage indicated only 90 pounds pressure to the square inch." In some cases, a stoker testifies that he observed a trifling leak in the lower part of the boiler a day or two previously, but did not mention it, as it appeared so insignificant. Let us, however, examine into the subsequent effects of this insignificant leak.

The nature of the effects of one of these apparently spontaneous explosions, the demolition of the entire building in which the boiler was, the shattering of all the windows for some distance around, and the deafening report, all preclude the possibility of our assuming a steadily increasing force as their cause. A sudden and violent force, such as caused by the explosion of gunpowder, has evidently here been at work. Witness the bursting of the Westfield's boiler, of which two pieces, smashing through bulkheads and machinery, traversed the entire length of the ferry boat and lodged respectively in her stem and stern. I need not recall, to the recollection of your New York readers who visited the scene of the disaster, the appearance of the buildings near the excavation on the New York and New Haven railroad one year ago, occasioned by the explosion of the boiler of (if my memory serves me) but a six horse power engine. Since such effects as these could only be the result of some sudden and violent force, where must we look for it?

It is obvious that no steadily increasing power could produce the too well known effects of bursting boilers, as is shown by the manner in which they do occasionally burst while being subjected to the water test. Then, as a rule, a line of rivets gives way, or a seam tears open; but in no case is a fragment torn completely away, as is almost invariably the case when they burst while in use.

The reason is simply this: Let us assume that a boiler containing 1,000 pounds of water generates steam to a pressure of 90 pounds to the square inch. According to Régnault, the temperature of the water in the boiler would be 318° Fah., or about 106° above the boiling point under the ordinary atmospheric pressure. Now suppose the boiler to burst from weakness of a plate or corrosion of a line of rivets. The pressure is instantly relieved, *but the water in the boiler is* 106° *above its natural boiling point.* Now the heat required to raise 1,000 pounds of water through 106° would raise about 586 pounds of water through 180°, or, according to Lavoisier, would convert about $\frac{3}{11}$ as much water into steam at the ordinary atmospheric pressure. What is the consequence? *About* 207 *pounds of water are instantly concerted into steam,* occupying about 2,890 cubic feet: in other words, producing an explosive effect just about twice as great as an equal bulk of gunpowder. Imagine exploding 3 cubic feet of gunpowder in a steam boiler!

The figures here given are rather an under than an over estimate, as no account has been taken of the evaporating power of the enormous amount of heat made sensible by the condensation of the superheated steam in the boiler at the moment of explosion.

R. D. WILLIAMS.

Maryland Agricultural College, Md.

Bridging the Niagara River.

To the Editor of the Scientific American:

Is it impossible to erect a bridge across the Niagara river at Lewiston, to consist of one or more arches of some enduring material, such as stone, bronze, or iron? Will some engineer answer this question, or give an opinion?

Such a work, if practicable, and built about 100 feet wide, would be better for the interests of the people of this continent than the results of the late war. It might be built as a monument to Washington, and be dedicated to his memory. If such an enterprise can be inaugurated and completed in twenty years, I will give $500 toward it, and $500 to create a trust fund of $100,000 for the engineer and the family of the engineer whose skill shall be used to this end.

We have a monument of the war system in our colossal debt; now let us have one for a better purpose—one that shall interlock the friendship of two great and growing nations, Canada and the United States, and put them on good behavior and progress in the arts of peace. I make this proposition in the highest hope for results to industrial progress.

C. A. H.

[The suggestion of our correspondent is a good one. We think it probable that such a bridge could be built, and that Captain James B. Eads, of St. Louis, Mo., is the man to execute the work.—EDS.]

A New Light.

Considerable attention is now being given in Paris to a new lamp, the invention of Messrs. B. Delachanal and A. Mermet, and intended for photographic and other purposes where a brilliant light is required.

The media employed are carbon sulphide and binoxide of nitrogen. Ignition of binoxide of nitrogen containing vapor of carbon sulphide produces a brilliant flame of a violet blue tint, peculiarly rich in chemical rays. The carbon sulphide lamp by which this flame is produced continuously is constructed simply of a flask with two tubulures, the vessel having about 30·5 cubic inches capacity. The flask is filled with spongy fragments of coke, or, better, of dried pumice, which imbibes the carbon sulphide. Through the central tubulure passes a tube to within a short distance of the bottom; in the other mouth or tubulure is fixed a tube of larger diameter, about 7·85 inches in length. The latter tube is of glass or metal, and contains an arrangement acting as a safety valve as well as impeding return of the gas and preventing explosion. Binoxide of nitrogen is passed by this tube into the flask, and the gaseous mixture is conducted by a caoutchouc tube to a kind of Bunsen burner, from which has been removed the air port and the cone regulating the supply of gas. The binoxide of nitrogen is produced by a St. Claire Deville apparatus; but instead of decomposing nitric acid by copper, which would be too expensive, a mixture of nitric and sulphuric acid is caused to act upon iron.

The flame, which is about 10 inches in hight, possesses high photogenic properties, and is much superior to the light obtained from the magnesium ribbon. The apparatus is nearly as portable, the mixed acid being contained in one vessel which communicates by a tube with a vessel containing fragments of iron. Supply is regulated by a cock. The flame is constant, unlike that of the electric light, and is not subject to spontaneous extinctions like the magnesium lamp. Photographs of human subjects are obtained in a less exposure than fourteen seconds. Photometric tests show (flame for flame, per measure) about twice the power of the oxyhydrogen light.

The inventors are studying the question of development of the green coloring matter of plants by means of this light. The experiments are being made in M. Dumas' laboratory at the Central School of Paris, and the result will shortly be made public.

Jaw-Wrenching Chemical Nomenclature.

Is it not about time that something was done to simplify the chemical names of organic compounds? It seems to us that some of the new cognomens trench closely upon the bounds of absurdity; and while they may be clear enough to the older chemists, accustomed to words which would stagger the best of orthographists, we submit that they tend to heap up a mountain of technicality as unnecessary as it is discouraging to the coming student, and thoroughly unintelligible to the general reader.

A recent number of the *Deutsche Chemische Gesellschaft* informs us that a certain chemist has studied *orthoamidocresylparasulphurous* acid, and that by the aid of hydrochloric acid and chlorate of potash he has transformed it into *trichlororthotolaquinone.* Further on the author discourses on *nitrorthocresylolparasulphurous* acid, and finally some other chemist hurls at us the fearful jaw-breaker of nitrate of *ethenyldenitrophenyldiamine.* There are plenty more examples of this kind before us, but we spare the reader. These names are of German origin, and hence the German chemists are responsible for them. Goethe, in his "Aphorisms on the Natural Sciences," says: "The Germans have the gift of rendering the sciences inaccessible," a sharp criticism which finds an apt illustration in the present instance.

PRACTICAL MECHANISM.

NUMBER XV.

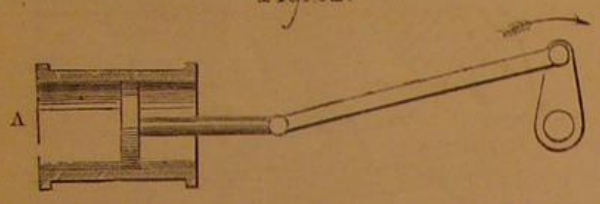
BY JOSHUA ROSE.

MOVEMENTS OF PISTON AND CRANK.

The variation in the supply of steam, when considered in proportion to the amount of piston movement, to which reference has already been made, arises from the irregularity of speed in feet per minute at which the piston travels at different parts of the stroke: which irregularity is due to the varying angles of the connecting and slide valve rods during the stroke, but mainly to those of the connecting rod. The amount of this irregularity will vary with the length of the connecting rod; the longer the connecting rod is, the less will be its variation.

The fly wheel, acting as an equalizer of the power of the engine throughout the stroke, travels at a comparatively uniform speed; and nearly the whole of the variation of speed (caused by the unequal admission of steam during one stroke, as compared to the other stroke, necessary to complete a revolution of the engine) falls upon the piston. In an engine of 12 nches stroke, the connecting rod being, say, 23 inches from center to center of its journals, the piston will have moved 6¾ inches of its stroke when the crank has performed the first quarter of its revolution, and stands at or near its point of full power, as shown in Fig. 52, which

Fig. 52.



represents a cylinder, piston, piston rod, connecting rod, and crank in the positions referred to, the piston having moved from the end, A, of the cylinder. While the crank is moving the next quarter of its revolution, the piston will move 5¼ inches only, thus completing its stroke of 12 inches. Moving the crank the third quarter of its revolution, we find the piston to have moved back 5¼ inches, standing in the same position as it did at the end of its first movement of a quarter revolution. During the last quarter revolution of the crank, the piston moves 6¾ inches, both piston and crank returning to the respective positions from which they started.

STEAM SUPPLY.

The inequality of the comparative piston and crank movements here disclosed causes the supply, expansion, and exhaust of the steam (in common or simple slide valve engines) to be irregular and unequal at one end of the cylinder as compared to the other, as shown by the following example, taken from a working engine of 12 inches stroke, the eccentric and connecting rods being each 23½ inches long, the steam ports ⅞ inch wide, the width between the steam ports being 3 inches and the valve having ⅝ steam lap, with neither lap nor clearance on the exhaust side. The stroke of the valve was 2½ inches, or just sufficient to permit the steam ports to open to their full extent. Commencing, then, when the piston is at the front end of the cylinder, that is to say, at the end farthest from the crank, we find the following respective movements.

TABLE 1.—FRONT STROKE.

Piston moved inches	Port open inch
1	9/16
2	¾ barely
3	13/16
4	⅞
5	⅞
6	⅞ barely
7	¾
8	11/16
9	9/16
10	⅜
11	¼
11¼	closed, and expansion begins.
11¾	" " " ends.
12	exhaust open ⅛ inch

TABLE 2.—THE RETURN OR BACK STROKE

Piston moved Inches	Port open inch
1	11/16 full
2	⅞
3	⅞
4	⅞
5	⅞
6	13/16 full
7	¾
8	⅝
9	7/16
10	3/16 full
10¾	closed, and expansion begins.
11¼	" " " ends.
12	exhaust open ⅛ inch.

It will be at once observed that the supply of steam to the piston is much greater, from the very first inch of piston movement, in the back stroke as compared with that of the front stroke; but this inequality is somewhat compensated for by the fact that the cubic contents of the steam space in the cylinder is greater in the case of the stroke tabulated in No. 1 than it is in No. 2, because of the space occupied during the latter by the piston rod.

The expansion commences earlier in the stroke, and ends earlier; and the distance moved by the piston under expansive steam is ¼ inch more in the back than in the front stroke. The effect of the irregularity will, however, be more correctly understood by comparing the movements, as shown in the following table

TABLE 3.

Movement of crank	Movement of piston	Average port opening
1st. quarter	6¾ inches	125/160
2d "	5¼ "	86/160
3d. "	5¼ "	134/160
4th "	6¾ "	64/160

A comparison of the first and third quarter revolutions of the crank: during each of which it moved from a dead center into about full power, and during each of which the piston moved from one end towards the middle of the cylinder: shows that, while the piston moved the greatest distance in the first, it received the least amount of average port opening, and hence the least supply of steam. A comparison of the second and fourth quarter revolutions of the crank, during each of which the piston moved from near the middle of the cylinder towards one end, discloses that, while the piston traveled the least distance in the second, it received the most steam during the fourth quarter revolution. Now let us compare the second and third quarter movements of the crank with the piston movement and steam supply. During each of these movements, the piston traveled an equal distance; but we find the average opening of port for the admission of steam to be 5/16 of an (inch nearly one third) greater in one case than in the other. So likewise a comparison of the first and fourth quarter revolutions of the crank shows that, while the piston and crank moved an equal distance in both cases (namely, the crank a quarter revolution and the piston 6¾ inches of the stroke), the average port opening for the supply of steam was very nearly double in the first quarter of what it was in the fourth. So far, then as we have considered these movements, the steam supply has been (in consequence of the area of the port opening) in each case the least, in proportion to the distance moved by the piston, where it should have been the most, and *vice versa*.

The first quarter movement, considered in relation to the second, shows the steam supply to be the greatest when the piston movement is the greatest; but the third quarter movement, as compared with the fourth, discloses the greatest discrepancy of all, since not only was the port opening more than double in one case of what it was in the other, but the greatest amount of port opening was given to the least amount of piston movement.

Considering the port opening with reference to the crank movement only, it would seem to be desirable to have an equal average of opening for each quarter movement; but when considered with reference to the piston movement (that is, with reference to the amount of steam which is required to pass through the port in a given time), it becomes self-evident that the area of the port should be greater when the piston is traveling fast than when it is traveling slowly.

We must, however, consider that, during the second and fourth quarter revolutions, the piston is at that end of its stroke where the exhaust takes place; so that the piston is not under steam (during each respective quarter movement) for the whole of the movement. Hence the smallness of the opening of steam port is not so disproportionate (considering each quarter movement of itself, and not comparatively with another) as it would at first sight appear to be.

It must also be remembered that, since the ports are of rather larger area than they would be if employed as steam ports only, instead of as steam and exhaust ports alternately, the inequality of port area during the movement, shown in the above tables, is not experienced to so serious an extent as it otherwise would be. It is, however, felt by the engine to a sufficient extent to render it of great advantage to give to the valve (when it has not more steam lap than one half the width of the steam port) more travel than is absolutely necessary to open the ports to their full width; because not only does a small amount of increased valve travel more nearly equalize the average steam port area, but it gives to the engine a much better and quicker supply of steam. It may thus be accepted as a positive rule that such a valve should always have this increase of travel, as will be hereafter shown, there being advantages due to this increase on the exhaust as well as on the steam side of the piston.

Testing and Mounting of Lenses.

Mr. E. L. Wilson, describing a visit to the establishment of Ross & Co., London, says, in the Philadelphia *Photographer*: "The number of tools or curves in this establishment is very great, consisting of upwards of two thousand, all of them being ground with such accuracy that the curvature of each is known to the fourth place of decimals, their respective radii extending from 30 feet down to 0·1 inch (a hundredth of an inch). The curvature to which any particular lens is to be ground is calculated mathematically to suit the refractive and dispersive ratios of the glass of which it is to be formed; and after the lens is finished, if, on examination, it fails to come up to the standard of sharpness, the particular surface which exercises control over the shortcoming is reground in a tool one degree deeper or shallower in curvature, to suit the requirements of the case. The most intense sharpness is insisted upon as a *sine qua non* in this establishment, no portrait lens being allowed to pass into stock unless it can produce a picture with open aperture sufficiently sharp to bear a large degree of magnifying. Such an idea as diffusion of focus is not recognized, the reason assigned being that, if once a lens is made that will produce absolute sharpness, perfection of definition can at will be destroyed in any special case by the mere interposition of a transparent pellicle, or even a sheet of homogeneous paper, between the negative and the print, the latter of which will thus possess that quality known as diffusion, although from the very same negative may be obtained an enlargement of the greatest sharpness and perfection. One large shop in this factory is devoted to brass turning and fitting, and numerous workmen are here engaged in making the new small symmetrical lenses. In this kind of lens the Messrs. Ross have effected a reformation that has, for a long time, been much desired by photographers, namely, the reduction of the diameter of the lenses to the smallest possible size, and the causing of the whole series of twelve to screw into one flange, one cap also fitting all of them. This series of lenses consists of twelve separate combinations, all, as I have said, of the same diameter in mount, which, by the way, is very small, owing to every superfluous portion of glass being removed from the lenses, which are thus reduced to scarcely more than the size of the stop. Their foci range from 3 inches to 21 inches, a lens of the latter focus covering a plate 21 x 25 inches. So small and light are they that a photographer may without any inconvenience carry several of them in his pocket, and screw into his camera any one of them which, from its focus, is best adapted for the representation of any special view. It would be well if this system of having one standard flange for all lenses up to a certain size were more prevalent, for it would prove a boon of inestimable value to photographers. The system of universality of screw has for many years been in use in connection with the object glasses of microscopes; and no matter now in what countries either microscopes or objectives may have been made, all are fitted to one gage. The varying diameters of photographic objectives will ever, of course, prevent the adoption of one individual flange for all purposes; but what can and ought to be done is the adoption throughout the world of a series of flanges, as few as possible, of recognized and standard sizes. Notwithstanding the small dimensions of the symmetrical lenses, they work with greater rapidity than those of large size, when used under similar circumstances of lighting and aperture.

The racks used for portrait lenses are toothed in the solid, so to speak, and are sawn asunder afterwards, three dozen being made at a time.

The cutting of screws, in the tubes, cells, and flanges, is effected both by hand and by mechanism attached to the turning lathe, the special mode to be adopted in each case being determined by the size of the article. The screwing of the tube of a lens of ten or eleven inches in diameter would never be undertaken by hand alone; while on the other hand the services of the lathe screwing machine would never be had recourse to in the case of a small symmetrical lens.

When two achromatic lenses are to be mounted, they are first of all placed in a trial mount, so adapted as to permit of an approximation or separation of the lenses. The test object is a watch dial placed at the extreme end of the testing room, and the image of this dial is examined through a powerful eyepiece. Unless it can divide the closest lines upon this dial, the lens is rejected. In this trial both the central and oblique pencils are examined, and the exact amount of separation of the lenses from each other is now determined by experiment and marked upon each pair, as the instructions for the workman to whom is intrusted the duty of the final adjustment of the length of tube, an operation which influences materially the performance of the lens, when it is considered that so nicely poised are the qualities, in some of the combinations of more recent production, that a deviation of a fortieth part of an inch from the exact distance, required and determined in the way described, will affect its performance and be detected by the manager in course of the final trial, which is made after the lenses have been finished.

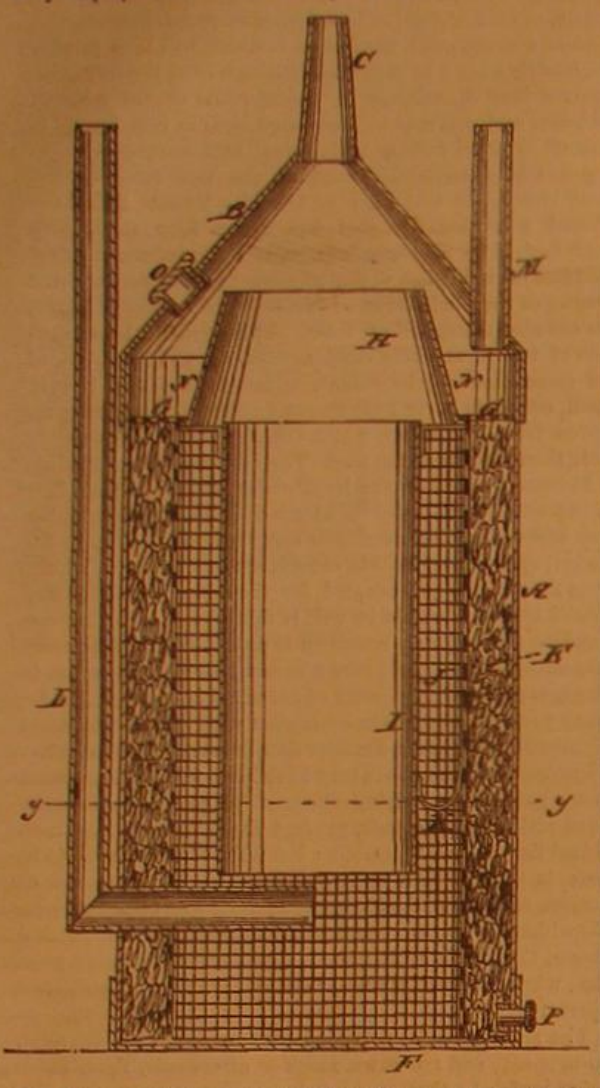
The consulting engineer of the firm of Ross & Co. is Mr. F. H. Wenham, who has apartments upon the premises. Most of the modern improvements in the microscope owe their existence to the genius and executive skill of this gentleman, who, by his invention of the binocular microscope, his simplification and improvements of the object glasses, which throughout the world are all now made upon his principle, his parabolic condenser, and other inventions, has acquired a name which will ever be associated with the highest department of optical science, both mathematical and applied.

Turkish Steam Engineering.

Some ironclad ships were recently built in England for the Turkish government, and sent out under the care of English engineers. On arriving at their destination these were discharged, and Turkish mechanics substituted. Like all other persons who undertake matters which they have no fitness for or knowledge of, these persons came to grief at once. Being required to start the engines of the Mahmoudeh, much delay ensued; the engines did not start, they were pronounced "all wrong," and one officious party, growing impatient after having moved every movable lever, spied some cocks, which he thought must be the right thing to work, and went for them at once. He was scalded by receiving a jet of steam full in the face, which precipitated not only matters, but himself and several other Turkish gentlemen backward down a pair of iron stairs leading to the fire room.

A NEW GAS CARBURETTER.

The novel features in the device represented in the annexed diagram consist in arrangements whereby a part of the gas is allowed to pass through fibrous material saturated with a carburetting liquid. This increases the illuminating power of the gas while economizing the hydrocarbon. The appliance may be made of any size and shape, and be profitably employed, it is claimed, in gas works.



The fibrous substance is packed in the space between the outer casing, A, and an inner wire cloth cylinder, the annular chamber between being covered with a perforated plate, G. L is a central cylinder within the wire gauze, suspended and held out from the latter by springs, K. Above this cylinder is a truncated cone, H, which opens above just below the discharge tube, C.

The carburetting liquid is poured into pipe, M, the orifice, O, being previously opened. It then flows into the annular trough, N, and filters through plate, G, into the packed material. The gas is admitted through the pipe, L, under cylinder, I, a portion rising through said cylinder and combining in the upper part of the apparatus with another portion which passes up through the saturated substance and thus absorbs the hydrocarbon vapor.

This invention was patented Nov. 3, 1874, through the Scientific American Patent Agency, to Messrs. H. Venners and G. H. Judy, of Cumberland, Md.

THE TOMPKINS UPRIGHT ROTARY KNITTING MACHINE.

The claims which this machine has upon present public favor cannot be more forcibly pointed out than in stating at the outset that it is a standard apparatus—if we may so term one which has been in successful use for nearly twenty years—remodeled, made from entirely new patterns, and provided with all the improvements which its long trial has suggested to the original patentee. For an idea of its simplicity, and at the same time beauty, of design, we refer the reader to the annexed engraving, in connection with the following detailed description:

The table is of iron, paneled; the shaft bearings long and well Babbitted, and the counter pulleys are large in diameter and narrow faced, so as to allow of ready shifting of the belt by the stop motion.

The cylinder has a long, large bearing, and the principal wear is at the lower end of the hub. The metal is thick where the cap screw enters, and there are three arms, which enables the attendant to reach the burr adjuster without the necessity of cutting a hole in the cloth. The cap screws are turned out of solid seamless iron.

The slotted circle which supports the feed stands is firmly bolted, and allows the attendant to nicely adjust his stands to any sized cylinder. The bedplate and tube are cast together, instead of separate, securing perfect rigidity. The center shaft is held up to its place by a single set screw, which, when loosened, allows the shaft to drop down, and so gives room without disturbing the take-up to take off the cylinder with needles in their places. The sinker and presser wheel stands have been made heavier, and an excellent stop motion is provided, which does not allow the needles to load up. By means of a new inside plate and burr adjuster, after the burr is set for angle, radial position, and depth, which can be done before the cloth is put on, the burr may be raised or lowered to a nicety without losing the other positions. For this purpose a two sized double-threaded set screw is employed, cut right and left hand, and so placed as to be regulated from under the cylinder without cutting the cloth, and so connected as to have no lost motion in its thread; it is so cut that the burr may be varied or depressed any number of hundredths of an inch.

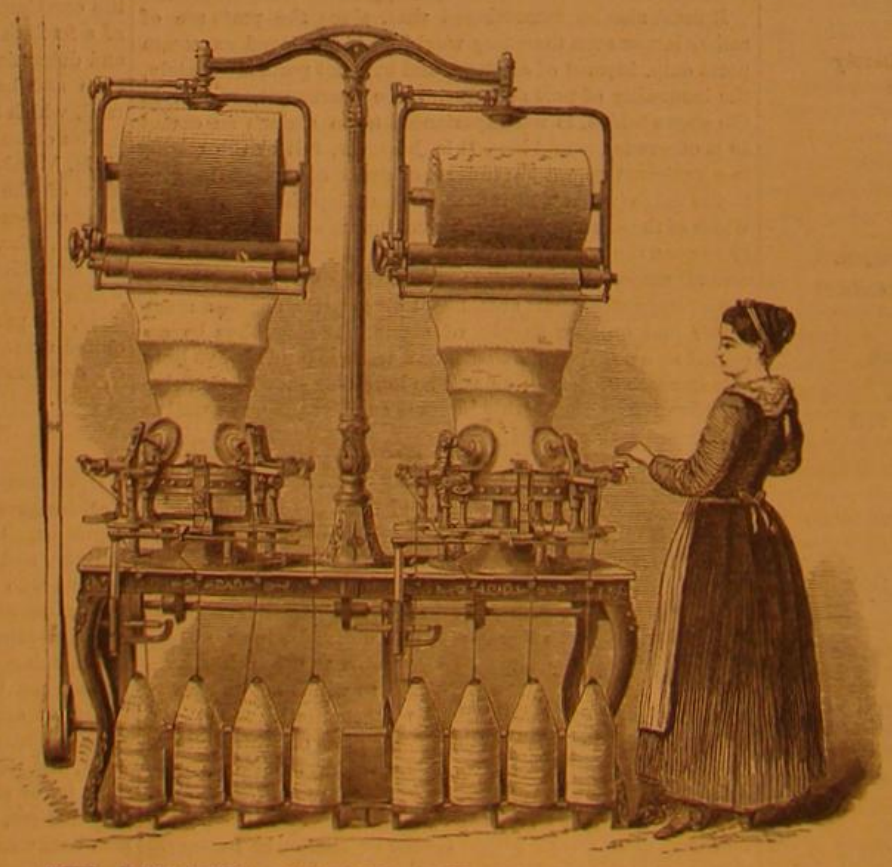
The take-up is a light iron frame, and hangs and turns on a hardened steel step, so shaped as to form of itself a self oiler. It is driven by a gear motion instead of the usual cam; said gear has a hunting tooth, which gives to the taking motion an ever changing movement, which, contrary to the cam, tends to keep the cylinder true and steady. The emery rolls are not geared together, but are so placed as to get the same result. The swing rod is squared at each end where it enters the sustaining arms to equalize the strain on the cloth, in case one of the long spiral springs is drawn out more than its mate. The arrangement to raise the dogs and loosen the cloth is instant in its effect. In changing from a sleeve cylinder to body size, a new take-up is not required.

A machine or table complete has two cylinders or heads, each head generally knits four threads at once, and each thread, or the machinery necessary to knit it, is called a feed. The machines are finished ready to belt except the needles. The same table does nicely for a single cylinder. One girl can attend to six cylinders. The table occupies a space of 6 feet 6 inches in length by 2 feet 4 inches in width; total hight over all is about 9 feet; weight, all told, is 1,340 lbs.

The needles used are the spring beard, and, for convenience, preparatory to putting them in the cylinder, are placed in a mold in pairs, and leaded by having a composition, resembling solder, poured around them while so held. The gage is determined by measuring the needles, and counting the leads when set in the cylinder. For instance, 14 gage has 14 leads, or 28 needles in 3 inches in length, measured on the circumference. To change from plain to rib requires only four new presser burrs. In regard to the proper speed of the needles for the different sized cylinders, needles, and yarn, some believe a quick speed to be best, and others consider it policy to use more machinery and run it more slowly.

As examples of the capabilities of the machine, the manufacturer informs us that a single cylinder apparatus of 22 inches diameter, 20 gage, 4 feeds, knitting common hosiery yarn, cotton and wool mixed, running 45 revolutions, has 920 needles, thus making 165,600 stitches per minute. A 16 inch cylinder, 20 gage, 4 feeds cotton yarn, is running 79 revolutions, and making 212,352 stitches per minute; the same cylinder has been run as high as 85 revolutions on the same yarn, at which speed it made, per minute, 228,480 stitches. Another cylinder, 19 inch, 30 gage cotton yarn, is running 38 revolutions, has 1,193 needles and is making 181,374 stitches per minute. Usually an 18 inch cylinder, 15 gage, is run 45 revolutions, and a table of 2 heads, which turns off, per day of 11 hours, 160 lbs. of knit cloth, averaging 15 dozen goods, exclusive of waste, is considered as doing fair. The machine is so geared within itself that 113 revolutions of the receiving shaft will give 45 revolutions of the cylinder. The receiving pulley is 10 inches in diameter, and is made for a 2½ inch belt.

For further particulars address the manufacturer, Mr. C. Tompkins, Troy, N. Y.



THE TOMPKINS UPRIGHT ROTARY KNITTING MACHINE.

To move a tight glass stopper, hold the neck of the bottle to a flame, or take two turns of a string and seesaw it. The heat engendered expands the neck of the bottle before the expansion reaches the stopper.

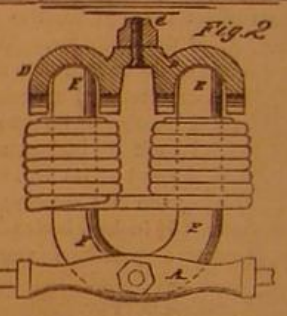
A NEW ELECTRO-MAGNETIC MOTOR.

The novel electro-magnetic engine illustrated in the annexed diagram is adapted for driving sewing machines or other light apparatus. The inventor claims that it is so constructed that the magnets and armatures are held in contact for a sufficiently long time for the magnets to exert their full power between the opening and closing of the circuit, even when the armature wheel is revolving rapidly.

The armatures, D, are secured to the rim of wheel, C, which rotates the shaft, B, from which motion is imparted to

Fig. 1

Fig. 2



the machinery to be driven by the pulley, E. F are the magnets, from each of which a wire, *f*, leads to a clamp, G, to which a wire connecting with the battery is secured. The other battery wire is fastened to clamp, H, so that the frame, A, forms part of the circuit.

From each magnet a wire leads to adjustable bolts, I, which are arranged in an arched slotted plate, J. These bolts carry springs, which in turn support wheels, L, the peripheries of which are in contact with the rim of the wooden disk, M, on shaft, B. The edge of this disk is covered with wide and narrow strips of metal, ranged alternately and insulated from each other, which strips are connected by wires with shaft, B, so that when one of the wheels, L, passes upon the narrow pieces the circuit will be closed; or when a wheel reaches a wide strip, the circuit will be broken.

The parts already described are also so arranged that the circuit will be closed as each armature passes upon each magnet, and will be broken when the reverse takes place. The armatures are made in the form of a double U, and are so secured to the wheel as to overlay the sides of the rounded ends of the magnets. The magnetic force on all sides of the poles, it is claimed, is thus utilized.

Patented through the Scientific American Patent Agency, Nov. 17, 1874, to Mr. C. J. B. Gaume, of Brooklyn, N. Y.

Making Coffee.

Les Causeries Scientifiques states that M. Doyen has been investigating this subject, and has proposed the following method, which is simple and can be easily tried by any housekeeper:

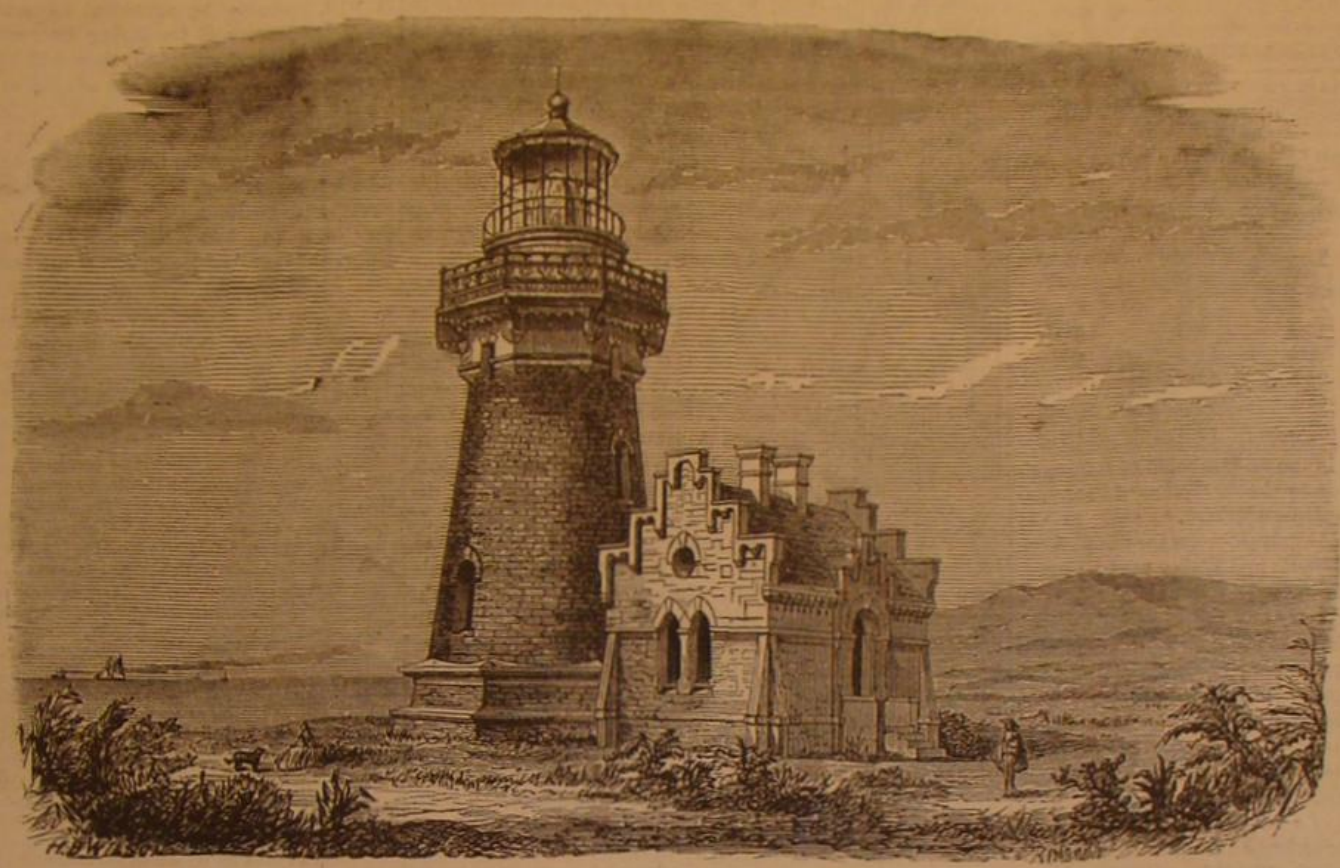
He uses 15 grammes (about half an ounce avoirdupois) for two cups. The berries are to be powdered just before they are used. Three fourths of the powder is thrown into cold water, which is made to boil, and kept boiling for ten minutes. Then the remaining fourth of the powder is cast in; the pot is removed from the fire, covered up, and allowed to remain five minutes. The liquid is now ready; but it may, if desired, be passed through linen. So prepared it is brownish, not black, and slightly turbid from the fatty matter, of which coffee contains 12 per cent. When coffee has to be carried on a journey, as by an army on the march, M. Doyen has the roasted berries ground into an impalpable powder, which is then slightly moistened, combined with twice its weight of sugar, and pressed into tablets like chocolate. These are dried and wrapped in tinfoil, and the coffee ration thus prepared may be used very speedily; for if cast into boiling water, the coffee is ready. Precious time and the necessity of having coffee mills is thus saved.

THE LIGHTHOUSES OF THE UNITED STATES.

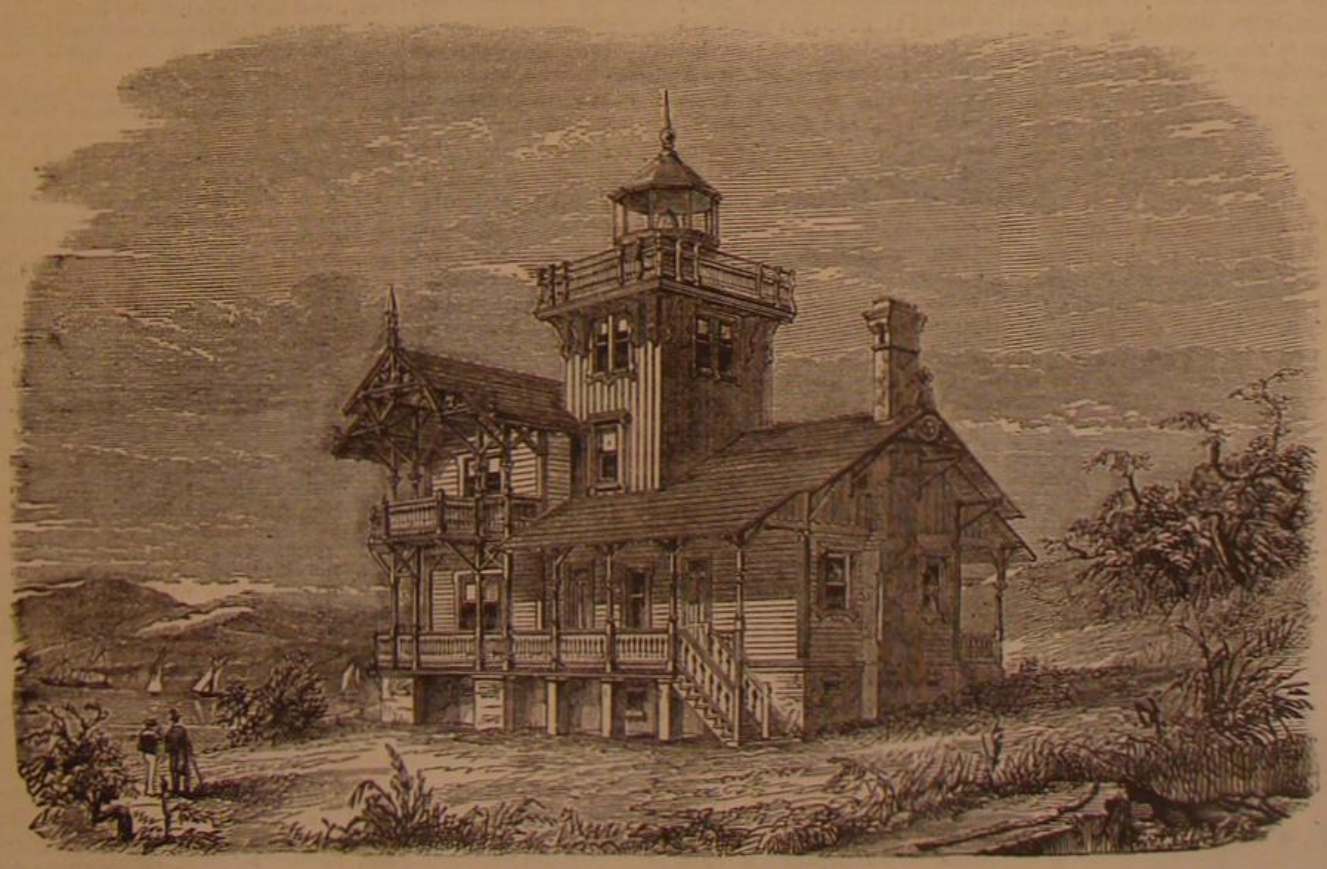
We have heretofore called attention to the efficient system of beacons which is being completed along our Atlantic and Pacific coasts, as well as on the shores of the great lakes. Most of the lighthouses are modern structures, and are commendable for their thorough efficiency and the engineering skill shown in their construction; and many of them possess considerable architectural merit.

We publish this week two more examples of American lighthouses, both on the coast of California. The first of these is at Piedras Blancas, a point about midway between the lighthouses on Points Conception and Pinos, and is distant about 150 miles from each. An appropriation of $75,000 was made for this work, which has a first-order light and fog signal.

The second illustration shows the lighthouse for the Straits of Karquines, California. An appropriation of $20,000 was made for this structure, which is to mark the entrance of the Straits of Karquines. A location on the southern shore, just opposite Mare Island, was recommended; but as none suitable was found, the final selection of site was made on the southern end of Mare Island.



LIGHTHOUSE AT PIEDRAS BLANCAS CALIFORNIA.



LIGHTHOUSE AT THE ENTRANCE OF KARQUINES, CALIFORNIA.

The French Meter.

Sir Edmund Beckett is a true Englishman, and does not love the French measure. He says:

"The polar axis is estimated at 7,899½ miles, or 500 millions of inches a thousandth part longer than our present standard inch, which probably only came by accident to be what it was when the standard was taken, and might just as well be a thousandth more. True, the other European nations have inches too, and some of them are rather longer than ours. The French meter, 39·371 inches, is the worst measure in the world, because it is inconsistent with any natural one: whereas our yard is the long stride of a man of good hight, and the natural length of his walking stick, and half his hight or half the stretch of his arms; and the meter is not even what it pretends to be, the 40-millionth of a meridian of the earth, for the measure taken was erroneous; and if it were, such a standard is of no more real value than the distance of the moon. Yet there are people who have engaged in the crusade of trying to force on us this bad, erroneous, arbitrary, and revolutionary measure of a nation which tried also to abolish the week and make a new one of ten days, and whose language is declining over the world, while ours already prevails over more regions of the world than any other, and is evidently destined to advance more and more."

Sir Edward, we think, is about right. The good old yard stick is a better measure than the meter.

Giant Beaver.

Drawings and specimens of the remains of the great extinct beaver, *castoroides Ohioensis*, an animal closely allied to the beaver of modern times, but of giant size, being about five or six feet in length, and weighing probably from 200 to 400 pounds, have been exhibited before the Lyceum of Natural History in this city. This specimen was found at Nashport, on the Ohio canal, in a bed of peat, which was buried under strata of clay and sand, and apparently belonged to the same age as the forest bed found in the middle portions of the drift deposits of Ohio.

Rapid Transit.

Mr. Ebenezer Hawkins, of Islip, N. Y., has recently obtained letters patent for a railroad for taking and leaving passengers without stopping the train, a desideratum which, if it could be effected, is of great importance in city and suburban railways, as a large share of the time of traveling on such roads is lost by stopping and the previous and subsequent slow travel. Mr. Hawkins' plan consists in starting from each depot an auxiliary train on a side track, to be coupled to the main line through train as soon as the former has attained a similar speed. Passengers can step from the main line train to the auxiliary, and the latter will be uncoupled in time for stoppage at the next depot, and the process will be continuous.

A REMARKABLE result has recently been obtained by Messrs. Brown & Co., of Sheffield, Eng., with a disk made from a rail saw and rotated at 3,000 revolutions per minute. As the disk was 9·6 feet in diameter, the velocity of its circumference was in the neighborhood of 86,400 feet per minute. Steel rails were cut with astonishing rapidity, and even melted. Millions of sparks were thrown off, but no heating of the disk could be detected after the cutting.

Society of Telegraph Engineers.

At a recent soirée of this Society, London, the greatest features of the evening were the electro-motograph exhibited by Mr. R. S. Culley, Engineer-in-Chief to the Post Office Telegraphs, and some specimens of boring worms exhibited by Mr. Browning under his microscopes.

The electro-motograph was discovered by Mr. Thomas A. Edison, of Newark, N. J., who, in a letter published a few weeks ago in the SCIENTIFIC AMERICAN, described his experiments in chemical telegraphy, wherein he met with the peculiar force he obtained; from that letter and the ideas contained in it, the instrument exhibited was made. It has been known for years that marks could be made on chemically prepared paper by passing currents of electricity through a style resting on the paper, which passed over a metal drum, these marks being produced by chemical decomposition. In his experiments Edison noticed that with certain compositions motion was produced in the lever holding the stylus, which was caused apparently by the sudden decrease of friction of the paper. It was found that paper prepared with caustic potash and a stylus tipped with tin gave the most favorable results. In the electro-motograph exhibited by Mr. Culley, the stylus was of tin, but held in a peculiar form of clip, which brought a very great amount of friction on the paper, so much so that, when the instrument was started, the great friction carried the stylus forward. Immediately a current was passed through it, decomposing the paper, all friction seemed to cease, the clip, by the strong force of its springs, was drawn back; and this occurred each time the current passed, and so long as the current existed the clip remained in its normal position. Immediately, however, the current ceased, the friction of the paper showed itself, and the stylus was drawn forward.

This motion was made audibly manifest by the position of a small bell which was struck loudly each time a current passed and destroyed the friction. So perfect was it that the Morse signals sent by the key were perfect and accurate as recorded on the bell. This little instrument attracted crowds all through the evening, and it may be fairly characterized as one of the most interesting scientific novelties produced for a long time.

Engineering says: "It may undoubtedly be termed a new discovery in Science."

The specimens of boring worms were found in the cable between Holyhead and Dublin belonging to the Post Office, and were picked up inside the cable not far from Holyhead. They were of three varieties, two of which are of somewhat large type, ranging from one inch to three inches long, and they appear to have strong proclivities in favor of hemp. Through the slightest opening they penetrate and enjoy themselves among the covering, which they utterly destroy. The third variety is small and apparently insignificant, but to submarine cables it is a dreadful enemy; passing straight through the hemp and boring at once into the gutta percha, it finally produces a fault. These specimens were sent by

Mr. Culley to Mr. Browning, who mounted them so as to show their leading peculiarities. Close to these microscopes were placed some specimens of gutta percha insulated wire freely marked by them.

Another novelty was an electrical gas-lighting apparatus exhibited by Mr. Thompson. This consisted of a very small portable apparatus, held easily in the hand. At the upper part was a curved rod with a bell cup to it, which was placed over the gas to be lighted; the lower part, near the handle, contains a small electrophorus, the upper plate of which was lifted by the thumb or finger of the hand holding the handle. The electric spark from this is arranged to pass across a small space where the gas has mixed with the atmosphere in such proportions as to become explosive. Immediately the spark passes, the gas is lighted. This instrument, though new in London, has been in use here for some three years.

OCEAN TELEGRAPHY.

BY GEORGE B. PRESCOTT.

Number II.

The working speed of ocean cables with the mirror system is as follows:

NUMBER OF WORDS PER MINUTE.

Weight of copper strands, lbs.	Knots, 1,000.	Knots, 1,500.	Knots, 2,000.	Knots, 2,500.
100	18·3	8·1	4·6	2·9
150	27·5	12·2	6·9	4·4
200	37·0	16·4	9·2	5·9
250	46·0	20·4	11·2	7·4
300	55·0	24·4	14·0	8·8
350	64·1	28·5	16·0	10·3
400	73·2	32·5	18·3	11·7

The apparatus employed in the transmission of communications through ocean cables is the invention of Professor Sir William Thomson. Ampère suggested, as early as the year 1820, the employment of a galvanometer for the purpose of telegraphing, and in 1833 Gauss and Weber used a reflecting galvanometer as an indicator upon a line about one mile in length, uniting the Observatory and the Physical Cabinet at Göttingen. Their alphabet was made up of combinations of right and left deflections. This apparatus, the first ever employed for practical telegraphy, has lately, in the hands of Professor Sir William Thomson, become the most sensitive of all telegraphic instruments. His reflecting galvanometer is the only instrument at present with which a cable 2,000 miles in length can be successfully worked by a battery of low tension. It consists of a needle formed of a piece of watch spring, three eighths of an inch in length. The needle is suspended by a thread of cocoon silk without torsion. The needle lies in the center of an exceedingly delicate galvanometer coil. A circular mirror of silvered glass is fixed to the needle, and reflects at right angles to it in the plane of its motion. It is so curved that, when the light of a lamp is thrown through a fine slit on it, the image of the slit is reflected on a scale about three feet off, placed a little above the front of the flame. Deflections to the extent of half an inch along any part of the scale are sufficient for one signal. In so delicate an instrument, the sluggish swing of the needle in finally settling into any position would destroy its usefulness. To rectify this, a strong magnet, about eight inches long and bent concave to the instrument, is made to slide up and down a rod placed in the line of the suspending thread above the instrument. This magnet can be easily shifted, as necessity may require. The oscillations of the needle due to itself are, by the aid of the strong magnet, made so sudden and short as only to broaden the spot of light.

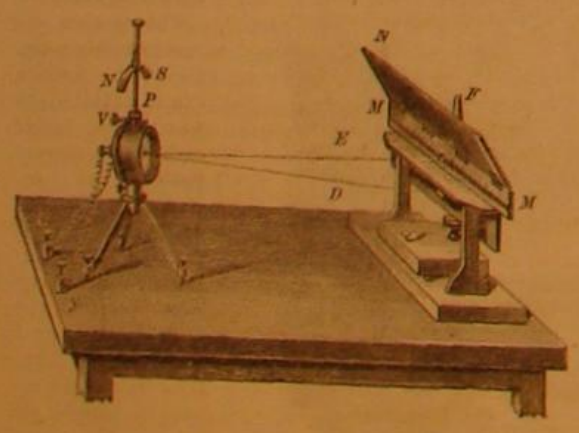


FIG. 6.

The above illustration (Fig. 6) shows the construction of the instrument. The galvanometer, P, contains the multiplication wire, divided into several layers and so arranged that it can be used for weak or strong currents, according to the requirements of the instrument. In the center of the coil the magnetic needle is suspended, to which is attached the tiny mirror, and close before it is to be found a small collective lens, whereof the focal point lies almost in the mirror, in order to produce a sharp figure of the prism on the scale.

The magnetic needle has a length of only $\frac{1}{8}$ of an inch, a breadth of $\frac{1}{12}$ of an inch, and a thickness of $\frac{1}{2}$ of an inch. The mirror connected with the needle has a thickness of only $\frac{1}{250}$ of an inch. The magnetic needle is made from a small piece of a very fine watch spring, and the little mirror, from one of the thinnest microscopic cover glasses. The magnetic needle and mirror used for signaling across the Atlantic weigh only 1½ grains.

The entire box which encloses these parts is hermetically closed. The ends of the multiplicator wires are soldered inside the box to two screw posts, *x y*, wherewith the instrument is connected with the cable.

A curved steel magnet, N S, is fixed to a brass bar, P, in such a way that, by turning the micrometer screw, V, any required removal, upwards or downwards or to the right or left, can be given to it; and by this means the magnetic needle, when in a state of rest, is kept in such a position that the picture of the slit, D, which is reflected from the middle of the mirror, and likewise returns through the lens, appears upon the zero mark of the scale, M M.

Opposite the galvanometer, the scale, M M, and the lamp, F, are to be seen. The light from the lamp penetrates through the slit, D, in an oblique direction to the looking glass, and is thrown back from it to the scale somewhat upwards, in the direction, F, where the picture of the slit is to be seen as a fine light line. The screen, N, can be turned up and serves to keep the lamp light from the scale. The instrument is necessarily used in a darkened room.

The transmitting key is shown in Fig. 7. It consists of two separate levers, L and E, moving on axes at the upper end in the figure. They are kept, by springs, pressing against the cross plate, C, which is in connection with one of the poles of the battery. L is connected with the cable and E to the earth. When either key is pressed down, it falls on the plate, Z, in connection with the other pole of the battery. In the normal position of the key, the cable is connected, through L, C, and E, to earth, and Z is insulated; and it is easy to see how a positive or negative current is put to line according as L or E is depressed.

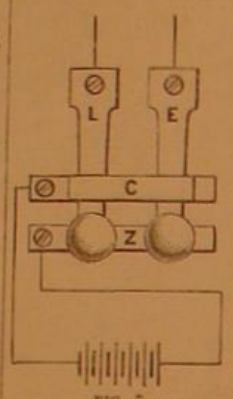


FIG. 7.

The alphabet is made by opposite movements produced by one or other of the keys. The signals need not be made from zero as a starting point. The eye can easily distinguish, at any point in the scale to which the spot of light may be deflected, the beginning and the end of a signal, and when its motion is caused by the proper action of the needle or by currents. It is thus that the mirror galvanometer is adapted to cable signaling, not only by its extreme delicacy, but also by its quickness. The deflections of the spot of light have been aptly compared to a handwriting, no one letter of which is distinctly formed, but yet is quite intelligible to the practised eye. Signals in this way follow each other with wonderful rapidity. A low speed of from twelve to sixteen words per minute is adopted for public messages; but when the operators communicate with each other, a speed of twenty-four words per minute is sometimes attained.

Condensers are used at both ends of the Atlantic cables, by means of which the speed is very considerably increased. The term condenser has long been used among electricians to denote an arrangement, in a moderate compass, equivalent to a Leyden jar of enormous capacity. It is composed of alternate layers of mica or parafined paper and tinfoil. One coating of this Leyden jar is put in direct communication with the conductor of the cable, and the other is joined to the sending key. At the other end of the cable one coating of the condenser is connected with the cable and the other coating with the receiving instrument. The condensers are each equal to about 70 miles of the cable. The condenser serves two purposes: it lessens the delay caused by induction, and prevents the disturbance of the signals by earth currents. The cable and condenser being insulated, there is no voltaic circuit, and no way whereby earth currents can enter and leave the line.

The question is often asked: "What is the velocity of electricity?" or "how long does electricity take to go across the Atlantic Ocean?" Electricity cannot properly be said to have a velocity, but differs with the circumstances under which it travels. For about two tenths of a second after contact is made with the conductor of an Atlantic cable, no effect is perceptible on the opposite side of the ocean, even by the most delicate instrument. After four tenths of a second, the received current is about 7 per cent of the maximum permanent current which the battery could produce in the circuit. One second after the first contact, the current will reach about half its final strength, and after about three seconds its full strength. The current does not arrive all at once, like a bullet, but grows gradually from a minimum to a maximum.

The Direct United States Cable, which is now being laid between Ireland and Nova Scotia, and thence to Rye Beach, New Hampshire, is 3,060 nautical miles in length. The core is composed of a thick copper wire encircled by eleven very fine copper wires, weighing 480 pounds per mile, and is served with four coatings of gutta percha, measuring about three eighths of an inch in diameter. After the serving with gutta percha comes a serving with manilla hemp, which brings the core up to a thickness of three fourths of an inch; and then follows the sheathing with iron wire, which forms the outer covering of all. Ten iron wires are employed for this purpose: but before being applied to the cable, they are each wound with five strings of manilla hemp, so as to impart greater strength, and protect them from the action of water. The hemp covered wires are served with a species of black compound resembling tar or pitch; and after being twisted around the core, they are again served in this manner, and finally whipped with Italian hemp, which, however, can scarcely be said to do more than hold the strands in their places until the whole becomes hard and dry. This is the deep sea portion of the cable. The shore ends are of varying sizes, graduating from about 2½ inches down to ⅞ of an inch.

The Direct United States Company expect to obtain a speed of about nine words per minute, or about one half that of the present Newfoundland and Ireland cables.

The French Atlantic Cable, laid in 1869 between Brest and St. Pierre, has 400 pounds of copper per mile, is 2,584 knots in length, and has a working speed of fifteen words per minute.

The contract price of the Direct United States Cable, laid down, is $6,055,000. The cost of the Anglo-American Cable —between Ireland and Newfoundland—laid down, was $1,500 per mile.

The Direct United States Cable has been laid from Ireland to within a distance of about 200 miles of Nova Scotia; but owing to unfavorable weather it had to be cut and buoyed. It will probably be recovered again as soon as favorable weather ensues, and its laying be successfully completed. When this is accomplished, there will be five working cables across the North Atlantic and one across the South Atlantic oceans.

Submarine telegraph cables now extend across the North and South Atlantic, Indian, and German Oceans; the Mediterranean, Red, North, Baltic, Chinese, Oriental, Japan, Java, and Caribbean Seas; the Gulfs of Biscay, Bengal, Mexico, and St. Lawrence, and the straits of Bass and Malacca: thus placing North and South America, the West Indies, Europe, India, Java, Australia, Tasmania, and Siberia in constant and instantaneous telegraphic communication, as well as affording communication with the most important ports in China and Japan.

The following is a list of the more important cables which are in working order at the present time:

Date.	From	Length in Miles.
1851.	Dover, England, to Calais, France	25
1852.	Holyhead, Wales, to Howth, Ireland	65
	Port Patrick, Scotland, to Donaghadee, Ireland	25
	Prince Edward Island to New Brunswick	12
1853.	Denmark, across the Belt	18
	Dover, England, to Ostend, Belgium	80½
	Port Patrick, Scotland, to Donaghadee, Ireland	25
1854.	Port Patrick, Scotland, to Whitehead, Ireland	27
	Sweden to Denmark	12
	Holyhead, Wales, to Howth, Ireland	65
1856.	Prince Edward Island to New Brunswick	1
	Crete or Candia to Syra, Greece	170
	St. Petersburgh to Cronstadt, Russia	10
	Across the Amazon	105
1857.	Ceylon to Hindostan	30
	Norway across the Fiords	49
1858.	England to Holland	140
1859.	Denmark to Heligoland	46
	Isle of Man to Whitehaven, England	36
	Sweden to Gottland	64
	Folkestone, England, to Boulogne, France	24
	Malta to Sicily	60
	Jersey to Pirou, France	21
1860.	Great Belt, Denmark (two cables)	14
	Cape St. Martin, Spain, to Iviza	76
	Iviza to Majorca	74
1861.	Corfu to Otranto, Italy	90
	Dieppe, France, to Newhaven, England	80
1862.	Wexford, Ireland, to Aberman, Wales	63
	Lowestoft, England, to Zandvoort, Holland	125
1864.	Fao, Persia, to Bushire, Persia	204
	Bushire, Persia, to Masandam, Persia	450
	Masandam, Persia, to Gwadar, Beloochistan	447
	Gwadar, Beloochistan, to Kurrachee, British India	346
	Otranto, Italy, to Avlona, Turkey	50
1865.	Trelleborg to Rugen, Germany	55
	South Foreland, England, to Cape Grisnez, France	25
1866.	Ireland to Newfoundland	1,896
	Lyall's Bay to White's Bay	41
	Crimea to Circassia	40
	Colonia to Buenos Ayres	30
	England to Hanover	224
	Cape Ray, Newfoundland, to Aspee Bay, Cape Breton	91
	Leghorn, Italy, to Corsica	65
	Persian Gulf	100
1867.	South Foreland, England, to La Panne, France	47
	Malta to Alexandria, Egypt	925
	Placentia, Newfoundland, to St. Pierre	118
	St. Pierre to Sydney, Cape Breton	126
	Arendal, Norway, to Hirtshals, Denmark	68
1868.	Italy to Sicily	5
	Havana to Key West, Florida	125
1869.	Peterhead, Scotland, to Egursand, Norway	250
	Grisselhamm, Sweden, to Nystadt, Russia	96
	Newbiggin to Sondervig	334
	Malta to Sicily	54
	Tasmania to Australia	176
	Scilly Isles to Land's End, England	27
	Ithaca to Cephalonia	7
	Bushire, Persia, to Jask, Beloochistan	505
	Brest, France, to St. Pierre	2,584
	St. Pierre to Duxbury, U. S.	749
	Moen to Bornholm, Sweden	80
	Bornholm, Sweden, to Libau	230
1870.	Scotland to Orkney Isles	37
	Salcombe, England, to Brignogan, France	101
	Beachy Head, England, to Cape Antifee, France	70
	Suez, Egypt, to Aden, Arabia	1,460
	Aden, Arabia, to Bombay, India	1,818
	Porthcurno, England, to Lisbon, Portugal	823
	Lisbon to Gibraltar	831
	Gibraltar to Malta	1,120
	Marseilles, France, to Bona, Africa	447
	Bona, Africa, to Malta	386
	Madras to Penang	1,408
	Penang to Singapore	400
	Singapore to Batavia	557
	Malta to Alexandria, Egypt	904
	Batabano, Cuba, to Santiago, Cuba	520
	Jersey to Guernsey, Channel Islands	16
	Guernsey to Alderney, " "	18
	Santa Maura to Ithaca	7
	Zante to Trepito	11
	Sunium to Thermia	25
	Patras, Greece, to Lepanto	2
	Dartmouth, England, to Guernsey	66
	Guernsey to Jersey	15

Date.	From	Length in miles.
	Porto Rico to St. Thomas	110
	Santiago, Cuba, to Jamaica	140
	Port Patrick, Scotland, to Donaghadee, Ireland	25
	Anjer, Java, to Telok Betong, Sumatra	55
	Banjoewangie, Java, to Port Darwin, Australia	1,082
	St. Thomas to St. Kitts	133
	St. Kitts to Antigua	90
1871.	Javea to Iviza, Balearic Islands	53
	Majorca to Minorca	35
	Villa Real to Gibraltar	155
	Marseilles, France, to Algiers, Africa	447
	Singapore to Saigon, Cochin China	620
	Key West to Punta Rassa	120
	Saigon to Hong Kong	975
	Hong Kong to Shanghai	1,100
	Shanghai, China, to Nagasaki, Japan, thence to Wladiwostock, Siberia	1,200
	Rhodes to Marmarice	22
	Latakia to Cyprus	86
	Samos to Scala Nuova	11
	Mytelene to Aivali	13
	Khania to Retimo	32
	Rhetimo to Candia	41
	Candia to Rhodes	201
	Chios to Chesmeh	6
	Zante to Corfu	150
	Zante to Cephalonia	18
	Lowestoft, England, to Greitseil, Germany	223
	Antigua to Demarara, connecting the West India Windward Islands	1,028
	Porto Rico to Jamaica	582
1872.	Lizard, England, to Bilbao, Spain	460
	British Columbia to Vancouver Island	18
1873.	Falmouth England, to Lisbon, Portugal	1,150
	Caithness to Orkney	8
	Valencia to Newfoundland	1,900
	Key West to Havana	100
	Placentia, Newfoundland, to Sydney, Cape Breton	300
	Heligoland to Cuxhaven, Germany	40
	England to Denmark	450
	France to Denmark	550
	Denmark to Sweden	10
	Pernambuco, Brazil, to Para, Brazil	1,382
	Alexandria, Egypt, to Candia or Crete	300
	Candia to Zante	240
	Zante to Otranto, Italy	190
	Alexandria, Egypt, to Brindisi, Italy	930
1874.	Lisbon, Portugal, to Madeira, Madeira Islands	633
	Madeira to St. Vincent, Cape de Verde Islands	1,360
	St. Vincent to Pernambuco, Brazil	1,953
	Jamaica to Colon, South America	600
	Pernambuco, Brazil, to Bahia, Brazil	450
	Bahia, Brazil, to Rio Janeiro	1,240
	Italy to Sicily	7
	Jamaica to Porto Rico	582
	Rio Janeiro to Rio Grande do Sul	840
	Rye Beach, U. S., to Tarr Bay, Nova Scotia	550
	Barcelona, Spain, to Marseilles, France	200
	Shetland to Orkney	60
	Valencia to Newfoundland	1,900

The following is a list of the principal submarine telegraph companies, with the amount of their capital:

Anglo-American Telegraph Company: Ireland to Newfoundland; Newfoundland to Cape Breton; Brest to St. Pierre; St. Pierre to Duxbury, U. S. (five cables)—$35,000,000.

Brazilian Submarine Telegraph Company: Portugal to Brazil—$6,500,000.

Cuba Submarine Telegraph Company: Santiago to Havana—$800,000.

Direct Spanish Submarine Telegraph Company: England to Bilbao, Spain—$650,000.

Direct United States Submarine Telegraph Company: Ireland to Nova Scotia; Nova Scotia to the United States—$6,500,000.

Eastern Submarine Telegraph Company: England to Bombay *via* Mediterranean and Red Sea—$15,000,000.

Eastern Extension, Australian and China Submarine Telegraph Company: Madras to China and Japan; Java to Australia—$8,315,500.

Great Northern of Copenhagen Telegraph Company: England to Denmark, Norway, Sweden, and Russia—$2,000,000.

Great Northern China and Japan Extension: Siberia to Hong Kong and Japan—$3,000,000.

International Ocean Telegraph Company: Florida to Havana—$1,500,000.

Mediterranean Extension Telegraph Company: Sicily to Malta and Corfu—$760,000.

Montevidean and Brazilian Telegraph Company: Montevideo to Brazilian Frontier—$675,000.

Platino-Brazilian Telegraph Company Rio Janeiro to Uruguay—$2,000,000.

Submarine Telegraph Company: England to France, to Belgium, and to Holland—$2,093,200.

Western and Brazilian Telegraph Company: Coast of Brazil—$6,750,000.

West India and Panama Telegraph Company: Cuba to West India Islands and South America—$9,590,000.

Sanitary Sense.

Dr. W. W. Hall, in his *Journal of Health*, says a great many truthful things in his peculiar way. These are, and certainly should be, extensively read; for they include so much excellent advice that their influence can be for nothing else but good. The last number of the *Journal* is before us now, opened with the intention of clipping an article here and there; but after reading it all through, we really cannot decide that any one subject is better treated than the rest. Consequently, we have culled a few ideas which strike us as especially good and interesting, and these we give below:

Dyspepsia—says the opening paragraph of a short sermon on that wretched malady—means a difficulty in preparing the food eaten so that the nutriment can be extracted from it to supply the wants of the system. Eating too fast and too much are prolific causes; the first because the food, being swallowed in too large pieces, begins to ferment before it can digest, and the second because the stomach cannot cope with the quantity forced upon it. A limited supply of gastric juice is another cause, and this implies bad blood. Out of door life, moderate exercise until hungry, and simple food are the best remedies.

Bitters, the names of the multitudinous varieties of which disfigure the fences and scenery of the country, come in for severe handling, on account of their alcoholic composition. A list of thirty-four of these mixtures is given, including all we ever heard of and a great many which we did not know existed; and in every instance they are shown to contain alcohol. In brief, while persons are using bitters as a medicine, they are often drinking, three times a day, a more concentrated form of alcohol than is found in the purest whiskies and brandies. It should be set down as a settled rule that bitters in any form is alcohol in disguise.

Localities of life should be high. Elevated stations are generally exempt from the ravages of consumptive disease. The air is lighter and contains less oxygen; but as the lungs live on oxygen, as it is the oxygen which they bring in contact with the blood at every breath, it is that which purifies and gives it its life-giving power. If each breath of air does not give a sufficient amount of oxygen, instinct prompts a fuller breath; this distends the lungs more fully, and thus develops and strengthens them. A statement is given of the elevation of several American cities: New Orleans is relatively given as 10, New York and Philadelphia 35, Boston 40, Chicago 585, Nebraska City 1,000, and Winona, Miss., 1,500.

Many a family mansion, says the editor, speaking of healthy houses, has been built with the accumulations of the savings of half a lifetime to make the graves of half the household in a few months, from neglect of the precautions for thorough drainage and a proper water supply for drinking and cooking. Never select a house over a filling; prefer sandy soil or the top of a hill.

In Munich, the bodies of the dead are kept for forty-eight hours before burial, and the fingers are connected with a wire so that, in case the person should revive, his least movement will ring a bell and so give warning. This is not applied to babies; but it is suggested that, if the plan be adopted here, the wire should be attached to the child's toes, as all babies begin to kick as soon as awake.

With reference to winter garments, sufficient clothing, it is said, should be worn to keep off a feeling of chilliness when about usual avocations. Less than that subjects one to an attack of dangerous pneumonia at any day or hour. More than that oppresses. Steadily aim, by all possible ways and means, to keep off a feeling of chilliness, which always indicates that a cold has been taken.

Instinct teaches that less exertive power is required to keep moving than, after coming to a standstill, to set the body in motion again. The frequent stoppages of stages and street cars kill off the horses. Instinct also teaches the requisite expenditure of strength according to the circumstances of the season. No one walks as fast in summer as in winter. We get up in the morning with a certain amount of strength, and much may be gained by economizing during the day.

Spectacles become necessary when you first notice yourself going to the window instinctively for a better light, or when your eye gets tired by looking at any small thing near at hand, or a dimness or watering is manifested, so as to cause indistinctness. First purchase No. 20; and as you observe the symptoms above named, get No. 18, and so on. The glasses should be near enough to the eye almost to touch the lashes; they should be washed every morning in cold water and carried in a pocket by themselves. Brazilian pebble makes the best lenses. Avoid reading before sunrise and after sunset. Read as little as possible before breakfast, or by artificial light; do not sew on dark material at night, and use no other eyewash than pure, tepid, soft water. Babies' eyes are often injured by allowing the glaring sunlight to fall upon them.

Exercise is worth more than all the medicines in maintaining health. If it rains, take an umbrella and let it rain on; if it is cold, walk or work faster; if it is windy, turn around and go the other way; if it rains, hails, snows, and blows, all at once, so that you have to stay indoors, then live on bread and water that day, not an atom else, and you will need no exercise to work it up.

It should always be borne in mind that a large share of our little aches and pains would pass off about as soon by letting them alone as by doing or taking something; and the more we "take," the greater is the necessity for "taking."

The best way to enjoy things is to use them, and thus get the worth of our money out of them. There is no sense in gorgeous parlors kept in darkness.

Sometimes the reading of a single sentiment in a newspaper makes an impression on the mind which tinges the whole subsequent life *for* good.

The Musconetcong Tunnel.

The tunnel through Musconetcong Mountain, New Jersey, for the line of the Easton and Perth Amboy railroad, was opened on the 16th of December. The work was begun on April 10, 1872, from which date to August of the same year labor was devoted to making an open cut on the west side of the mountain. Tunneling was then started at both ends through formations of limestone and syenitic gneiss. Considerable trouble was experienced during the progress of the boring by irruptions of water from a subterranean lake. The tunnel is almost exactly one mile in length.

ERRATUM.—In our article on the hydrocarbons produced on iron and steel, published in our last week's issue, it is stated that the least volatile portions of the bromated product were "set aside to be treated with an alcoholic solution," "of potassa" should be added to complete the sense.

(For the Scientific American.)

THE ARITHMETICAL OPERATIONS OF MULTIPLICATION AND DIVISION.

We think that most of our readers will agree with the assertion that there is less probability of mistakes, on the part of the ordinary calculator, in making additions and subtractions of numbers than in multiplying and dividing. The reason is that the latter operations are more complex, requiring the use of all the fundamental rules of arithmetic. There is a simple artifice, employed by many in multiplying and dividing, which reduces these operations to cases requiring the application of the rules of division and subtraction only. The method referred to is tolerably well known, but not as generally as it should be; and we think that there are many of our readers who will be interested in receiving an explanation. The method finds its principal application in cases where different numbers are to be multiplied or divided by the same number, as, for instance, in the preparation of tables. We can best illustrate it by giving an example.

According to our observation, a question frequently arising with those who are engaged in mechanical pursuits is the determination of the circumference of a circle when the diameter is known. It is not always convenient or practicable to consult a book in which the properties of circles are given, but one can nearly always carry a few cards upon which useful numbers are written. Let us suppose that one of these cards contains the following:

CIRCUMFERENCE OF CIRCLE.

Diameter.	Multiplied by	Diameter.	Multiplied by
1 =	3·1416	6 =	18·8496
2 =	6·2832	7 =	21·9912
3 =	9·4248	8 =	25·1328
4 =	12·5664	9 =	28·2744
5 =	15·7080		

and that the circumference of a circle whose diameter is 130·0402 feet is required. Below is the solution:

3·1416
130·0402

62832
1256640
9424800
31416

408·53429232

It will be observed that the multiplier is placed beneath the multiplicand, as in the ordinary method; but that instead of actually performing the operation of multiplying the multiplicand by each term of the multiplier, the several products are taken at once from the card and placed in their proper positions, so that we have only to add them to get the whole product. It will be advisable, in following this plan, to use small cards, with only one set of numbers on one side of each, to avoid confusion; and in preparing a card for a given number, it is well to form the several multiples by adding the number first to itself and then to each successive sum, repeating this operation nine times, so as to check the accuracy of the work. Below is given an illustration:

Areas of circles.	Square of diameter multiplied by
	0·7854 = 1
add 0·7854	1·5708 = 2
" "	2·3562 = 3
" "	3·1416 = 4
"	3·9270 = 5
" "	4·7124 = 6
" "	5·4978 = 7
" "	6·2832 = 8
" "	7·0686 = 9
" "	7·8540 = 10

It is evident, from simple inspection, that the last quantity is ten times the first, and this affords a strong presumption that the intermediate calculations are also correctly made.

An example is appended, showing the application of this method to division:

REDUCTION OF CUBIC INCHES TO CUBIC FEET.

Cubic in.	Divided by	Cubic in.	Divided by
1 =	1,728	6 =	10,368
2 =	3,456	7 =	12,096
3 =	5,184	8 =	13,824
4 =	6,912	9 =	15,552
5 =	8,640		

Question: How many cubic feet are there in 901,314,564·268 cubic inches?

1,728) 901,314,564·268 (521,594·076 +
8640

3731
3456

2754
1728

10265
8640

16256
15552

7044
6912

13226
12096

11308
10368

940

A simple inspection of the card shows the successive figures of the dividend, and gives the products of the divisor by these figures, so that the operation is reduced to a series

of subtractions. It takes very little practice to render any one expert in this method, which combines the advantages of quickness and accuracy. By preparing cards from time to time, as occasion requires, one will find that he has, ere long, a pretty good stock of numbers, which, if carefully indexed, will prove very serviceable. The values of a few useful factors are appended:

Reduction of pounds to kilogrammes: Pounds × 0·454.

Reduction of kilogrammes to pounds: Kilogrammes × 2·205.

Reduction of inches to meters: Inches × 0·0254.

Reduction of meters to inches: Meters × 39·37.

Reduction of square feet to square meters: Square feet × 0·0929.

Reduction of square meters to square feet: Square meters × 10·76.

Reduction of cubic feet to cubic meters: Cubic feet × 0·028.

Reduction of cubic meters to cubic feet: Cubic meters × 35·32.

Reduction of U. S. gallons to cubic feet: U. S. gallons × 0·134.

Reduction of cubic feet to U. S. gallons: Cubic feet × 7·48.

Reduction of imperial gallons to cubic feet: Imperial gallons × 0·1604.

Reduction of cubic feet to imperial gallons: Cubic feet × 6·25.

Reduction of U. S. gallons to imperial gallons: U. S. gallons × 0·834.

Reduction of imperial gallons to U. S. gallons: Imperial gallons × 1·2.

ABOUT two thirds of the New State Capitol at Albany, N. Y., is now completed. The building thus far has cost $3,000,000, and it is estimated that about $7,000,000 more will be required to finish it entirely. If the State Legislature appropriate funds promptly, there is a prospect of the roof being in place by May, 1876.

Recent American and Foreign Patents.

Improved Safety Lock for Elevators.

Henry Carille, Steubenville, Ohio.—This invention consists in providing an elevator with a pair of clamping jaws, which are actuated by the weight of the cage to seize the guides and arrest the downward movement of the carriage whenever the lift rope slacks or breaks. By the novel means employed in effecting this purpose, all chance of accident is removed, while the carriage may be held automatically at different elevations and stories. It seems admirably calculated for use in connection with the elevators employed by hotels, warehouses, and stores.

Improved Feed Water Heater and Filter.

George F. Jasper, Freeburgh, Ill.—The supply pipe passes downward through and beneath the filtering material, and the water discharged therefrom passes upward through the said material, and flows over into a series of sediment troughs or pans, and thence into the heating tank proper, from which it is conveyed to the boiler. The arrangement of the filter below the tank increases the surface available for application of heat in the furnace, when desired or necessary, as well as gives easy access to it for removal of the sediment when the furnace is fired up.

Improved Seed Planter.

Jacob R. Sample, Liberty, Miss.—This invention relates to the simultaneous distribution of comminuted manures and cotton or other seed, and consists in a peculiar shape of the opening and covering plows, together with the standards by which they are attached to the frame. This insures great uniformity and accuracy in the application both of seed and manure to the soil.

Improved Rotary Harrow and Roller.

Louis Belly, St. Anne, Ill.—This is an improvement in cultivating machines wherein rotary harrows are employed. The novel feature consists in an arrangement of parts whereby the harrows are supported entirely by the rollers and front wheels of the frame, and the revolution of the harrows arrested when raised from the ground.

Improved Stereoscope.

Absalom H. McClintock and Henry J. W. Barker, Fort Scott, Kan.—This is an improved stereoscopic apparatus designed especially for use in object teaching in classes, so constructed that a copy of the picture may be before each pupil. All the pictures may thus be exhibited, replaced by others, and moved to bring them into focus at the same time and by the same operation. Several pairs of lenses are arranged in a box, and the pictures are raised and held before the former by suitable devices. The supporting frame moves transversely to bring each picture into focus.

Improved Bale Tie.

Sewall J. Leach, Tuscaloosa, Ala.—A plate with a right-angled flange at each end is attached to one end of the hoop, and is a little narrower than the breadth of the latter. The flange is notched transeversely on the inner faces to lock the free end of the hoop, which is correspondingly notched on its edges to fit the notches of the flanges. The latter are inclined in the direction to cause the hoop to draw to the bottom of the space between the flanges, and thus insure the holding of it so as not to work loose. There is also a loop on one end of the tie for the free end of the hoop to pass through, to be kept in position at the time of fastening until secured by the notches.

Locomotive Attachment for Towing Canal Boats.

Charles Howard, New York city.—The driving wheels of the locomotive are constructed with a V-shaped groove in the periphery, so as to bring the bearing diagonally on the sides of rails without touching the tops. This adds to the traction in proportion to the angle or sharpness of the groove. The towing bars are applied on the bottom of the frame, are pivoted equidistant from the wheels near the center of the frame, and are of curved shape, extending beyond the wheels. They are bent at their ends into upward and slightly forward turned hooks, and swing toward the canal, allowing thereby a free adjustment to the different positions of the towing line. Suitable guide pieces applied to the bottom of the frame control the swing of the tow bars, and a spring forces the latter sideways, when there is no strain on them, preventing the obstruction of the track by the slackened tow line.

Improved Corn Coverer and Cultivator.

James Copeland, Bloomingdale, Ohio.—The vertical arm of a standard is slotted to receive a wheel that supports the forward part of the machine when adjusted as a coverer or double shovel plow. When the machine is to be used as a cultivator, the standard may be removed and replaced by a similar standard, the lower arm of which is without a slot, is curved slightly forward, and has a hole formed through it to receive a bolt for holding a cultivator plow.

Improvement in Manufacturing Shoes.

Charles F. Hill, Baltimore, Md.—This invention consists in a shoe in which an insole, receiving the lasting nails, is covered by another insole, and the whole united by a line of stitching passing through the outer sole, upper, and the two soles.

Improved Office Door Plate.

Thomas S. Kennard, Exeter, N. H.—This invention consists in the application of time-indicating wheels and an inscribed slide to a slotted recessed plate, in such a manner that, when said slide is in a certain position, the device will indicate that the occupant of the office is out, and also the time of his return: and when in another position, that he is in, the name of the day of the week being indicated and the wheels locked in position in each case.

Improved Hydraulic Safety Valve.

John F. Taylor, Charleston, S. C.—This invention relates to certain improvements in hydraulic safety valves, whereby the valve is weighted with great convenience and facility by the fluid employed. It consists in a valve chamber provided with openings in its seat connecting with the escape pipe, in combination with a valve having different areas of pressure upon its opposite sides, the chambers upon the opposite sides of the valve being connected by a channel through the valve, so that the unit of pressure upon the valve is the difference between the opposite areas of pressure.

Improved Combined Hoe and Chopper.

Charles H. Gaylord, Osceola, Ark.—This invention consists in a tool by which the workman may cut up the soil on each side of a row of plants as he passes along, and then, giving it a half revolution, cut the weeds or surplus plants in the front and rear; the first operation being effected by a chop toward himself, while the second is produced by a chop from himself. The construction of the tool is such that the two effects are secured without changing the position of the workman, consequently with much less labor and fatigue, as well as with a great saving of time.

Improved Extension Table Slide.

James Plenkharp, Columbus, Ohio.—The grooved slides are connected by castings of angular form, with a dovetailed base. The lower half of each casting is provided with a projection or shoulder at its angle, the same being notched to receive a fastening screw or nail. Thus the castings are secured to the slides without being weakened and hence rendered liable to break at their angle, under the strain put upon them by the weight or pressure supported by the table top.

Improved Car Coupling.

Henry C. Chapman, Port Jervis, N. Y.—The outer end of the coupling link is raised or lowered by a looped rod, in which the link rests, and by which the said link may be elevated or depressed to suit the various hights of drawheads on different cars. By having a recess made in the face of the drawhead, into which the looped rod which supports the link may recede when the cars bump together, the said rod is prevented from being injured in the collision. The loop rod is suspended from a U crank of a long rod which extends across the end of the car, and which is readily turned from the side of the latter.

Improved Clamping Attachment for Tinners' Machines.

William H. Burnett, Stanfordville, N. Y.—A standard is cast with a ribbed socket-shaped top part and clamp screw for supporting firmly the operating machine parts, and with an enlarged base. For the purpose of dispensing with the permanent attachment of the standards, and for making them detachable, a strong clamping device, with circular top part fitting closely around the base of the standard, is applied by a clamping screw. The standard may be secured to any part of the bench, and also turned readily into any direction over and beyond the latter.

Improved Blind Bridle.

Francis Schwalm, Clarksville, Cal.—This invention consists in forming the cheek pieces of the bridle so that they operate as cranks on the blinds, which blinds are attached to their upper ends. By means of this improvement, the blinds may, at the will of the driver, be drawn tightly over, and so as to close the horse's eye, and held in that position until the danger is passed.

Improved Exhaust Regulator.

Charles C. Gregory, Fredericton, Can.—As the steam enters a receiver it forces up a spring piston. It then expands until the pressure is equal to that at the nozzle, when the spring will begin to react on the steam, and, while steam remains in the receiver to be forced out, will maintain a continuous uniform blast at the nozzle. A valve in the nozzle is provided for opening and closing it, to regulate the escape by opening the passage wider when the greatest pressure exists in the receiver, and closing it when the pressure decreases. This valve is operated by the piston. In case the steam should, at any time, enter the receiver in excess of the means of escape by this apparatus, the excess will be automatically allowed to escape through a pipe by the opening of a valve lifted by the piston, when the last arrives at a certain predetermined hight.

Improved Gas Heater and Condenser.

Sylvanus Warren, New York city.—This is an improved apparatus, to be placed between the exhauster and the purifier of a gas-making mechanism, for heating or scrubbing the gas, and condensing from it the tar and ammonia. By suitable construction, while the gas is passing through the central compartment of a drum, cold, tepid, or warm water or air may be forced through the end compartments and small connecting pipes, to regulate the temperature of the gas as it passes to the purifier.

Improved Shingle Bolting Machine.

William A. Fletcher, Beaumont, Texas.—The pivoted rest for the bolt is provided with two clamps, operated by a single shaft, having right and left screw threads. Said clamps are worked by a single crank for opening and closing them.

Improved Steak Tenderer.

Daniel J. Shults, Mount Union, Pa.—This is a device by which steaks may be easily and rapidly made tender. It consists of two toothed plates, which are hinged at one end, to be adjustable to greater or less thickness of steak, and closed by means of a lever with sectional pinion pivoted to the inner plate, and gearing with a toothed stationary arm of the lower plate. Both plates are carried toward each other by swinging the lever to the front, and act with considerable power on the steak placed between them.

Improved Target and Toy Pistol.

Warren Lyon, Mamaroneck, N. Y.—The first invention is a toy, for use with pea shooters and the like, for the amusement of children. It consists of two or more self-adjusting targets of equal weight, arranged on the ends of radial arms of equal length secured to a rotary shaft. The target is self-righting, and may include several grotesque figures. The same inventor has also devised a toy pistol which may be used in connection with the toy target just described. A piston is arranged in the barrel, and its rod connected at the rear end with a lever. The rod has a coiled spring on it to throw the piston forward. The lever is arranged in a vertical slot in the breech, above which it projects. The lower end has a notch below the pivot, in which a spring catch drops to hold the piston spring, and to be used for tripping it by the trigger. A stop is combined with the spring catch and trigger, to prevent damage to the catch by pulling the trigger too hard.

Improved Grain Separator.

John Gordon, St. Catherine's, Can.—The novel feature in this invention is a hinged valve which may be arranged to connect at will the carrier board leading to the discharge with the carrier board leading to the suction channel. This is useful in case the separation of the wheat into lighter and heavier grades is not desired.

Improved Pump.

J. C. Chambers and S. Chambers, Dallas, Texas.—This invention consists in combining, with three bottom-valved cylinders, three valved connecting pipes, and a single discharge pipe, three differential pistons, of which one is always forcing water into the discharge pipe. This produces a continuous and uniform flow of water, and not only greatly lessens the time usually required, but also very considerably diminishes the labor.

Improved Sack Scale.

Pascal P. Parker, Parkersburgh, Iowa, assignor to himself and Milton I. Powers, same place.—To the inner edge of the scale pan are attached two standards, to which is secured an oval band having an inwardly projecting flange formed upon its lower edge, and which is provided with an open spring ring for supporting a bag, and holding the mouth open while being filled.

Improved Land Roller.

Benjamin S. Healy, Cohocton, N. Y.—The new feature in this invention is an arrangement of the double tree and draft bars whereby the draft will always be applied to the front part of the frame in whatever position the tongue may assume.

DECISIONS OF THE COURTS.

United States Circuit Court.—District of Massachusetts.

PAPER BOX PATENT.—UNION PAPER BAG MACHINE COMPANY *vs.* LUTHER CRANE *et al.*

[Before Clifford and Lowell, J. J.—May Term, A.D. 1874—to wit: October 6, 1874.]

Lowell, J.:

The bill is brought under section 58 of the consolidated Patent Act of 1870, 16 Stat., 207, alleging that the plaintiffs own a patent granted to them December 24, 1872, as assignees of Lorenzo D. Benner, for an improvement in paper bags, of which said Benner was the original and first inventor; that the defendants hold a patent dated February 20, 1872, for an improvement alleged to have been invented by Luther C. Crowell; that the patents interfere, and the plaintiffs pray that the patent of the defendants may be declared void.

The answer denies that Benner was the original and first inventor of the improvement patented to the plaintiffs; insists that Crowell was the inventor of that held by the defendants; does not explicitly confess or deny the interference between the two, and concludes with a prayer that the plaintiffs patent may be adjudged void.

It appears to us, on a comparison of the specifications, that they describe and claim the same invention, and the evidence proves that the plaintiffs intended that their patent should cover the same ground as the defendants. The Patent Office decided in favor of the plaintiffs, after an interference had been regularly declared with Crowell's patent, which had already issued; upon the hearing, Crowell produced no evidence excepting his own statement, and Benner examined several witnesses, and both parties were heard in argument.

Two points of law are taken by the plaintiffs: First, that the decision of the Patent Office is final between these parties; second, that the defendants are estopped by the statement made by their assignor Crowell to the Patent Office respecting the date of his invention to introduce evidence in this cause carrying his invention back to an earlier time than that which he specified in that statement.

1. The decision of the Patent Office is never final upon the question of the novelty or priority of an invention. The rule may have been adopted at first from a consideration of the *ex-parte* character of the proceedings at Washington, but it has never been confined, as is now maintained by the plaintiffs, in cases in which no contest was had; and it is obvious that it cannot be so limited, because, if one party to an interference is concluded as against the other party, the result may be that the patent is valid as against him, which is void against all the rest of the world. If, for instance, Crowell's invention was, in fact, earlier than that patented to the plaintiffs, the latter patent is conceded to be void as against every one who had no hearing before the Patent Office, while the defendants' patent would be void as against the plaintiffs, and all persons claiming under them; so that the only person who could not practice the invention would be he who had made it, and his assignees.

The statute is not ambiguous. It gives a court of equity power to decide between interfering patents without any exception or limitation. This is substantially a re-enactment of section 16 of the act of 1836, under which Mr. Justice Nelson is said to have decided the very point. Atkinson *vs.* Boardman; Laws's Dig., title, Construction of Statutes 13. See, also, section 30 of the act of 1870.

By the act of 1793, interfering applications were to be passed upon by three arbitrators, and upon this act Mr. Justice Story said:

The award or decision of the arbitrators would have been final between the parties only so far as respected the granting of the patent.

The sole object of such an award is to ascertain who is *prima facie* entitled to the patent. But, when once obtained, it is liable to be repealed or destroyed by precisely the same process as if it was issued without opposition. Stearns *vs.* Barrett, 1 Mason, 173, 4.

Upon reasoning and authority, then, the new patent granted after a hearing merely makes out a *prima facie* case for the plaintiffs, shifting the presumption that would otherwise exist from the earlier date of the defendants' deed.

2. There is no ground for holding the statement of Crowell an estoppel. It was not made to the plaintiffs, nor intended to influence their action, and the evidence is clear that they did not act upon it.

We have examined, with great care, the evidence concerning priority of invention, and are of opinion that Crowell was the true and first inventor. He neglected his case before the Patent Office, and the examiners were led to believe that he might have obtained hints or suggestions from the drawings of Benner for a patent that was issued to him a short time before that of Crowell. It is true, those drawings were left with Mr. Coffin, one of the persons interested in Crowell's invention, and in the shop where Crowell was at work on his machines; but the evidence in this case does not prove that any use was made of them, but tends to prove the contrary. But a wholly decisive consideration, as to which the course of proceedings before the Patent Office led the examiners into error, is that those drawings do not contain the invention, and, if they had been seen and studied by Crowell, would be no answer to his claim of priority. This is now admitted by the plaintiffs, and was well known to them while the interference was going on, as appears by a letter from their counsel to the president of the company, which they have printed on page 41 of the record. As their argument before the Patent Office is not given, we do not know whether the admission was made at that time; but the fact that the decision was very largely influenced by this mistake is shown by the record, and must detract much from the weight of the adjudication.

Upon the principal point of fact we are well satisfied, not only that Crowell's invention was actually made by him, but that it was completed in 1867. The plaintiffs, not denying that Crowell made the invention, insist that he was not the first inventor, and have introduced evidence which they rely upon to prove that Benner made it in 1868, and that Crowell was not earlier than 1871. The defendants, on the other hand, insist that they have thrown doubt upon the claim of Benner to have made the invention at all, though he may have approached it. As we are satisfied that Crowell really made the invention before Benner or any of his witnesses say that Benner made it, we have not examined the question whether Benner ever made it at all.

Decree for defendants.

United States Circuit Court.—District of New Jersey.

FLUTING MACHINE PATENT.—SUSAN R. KNOX *et al. vs.* ARTHUR H. LOWREE *et al.*

[In equity.]

Nixon, J.:

The bill filed in this case charges the defendants with infringing four different patents belonging to the complainants—to wit:

1. Patent issued to Susan R. Knox and W. D. Corrister, April 5, 1866, and reissued to Susan R. Knox, assignee, April 1, 1870, No. 3,661.

2. Patent issued to Susan R. Knox, November 20, 1866, and reissued to her April 26, 1870, No. 3,938.

3. Patent issued to Samuel G. Cabell, July 17, 1866, and reissued to Flora B. Cabell, assignee, March 1, 1870, No. 3,856.

4. Patent issued to Flora B. Cabell, assignee, November 10, 1868, No. 83,924, and reissued to Flora B. Cabell and Susan R. Knox, assignees, November 28, 1871, No. 4,653.

The defendants, in their answer, deny the validity of these patents on various grounds. They allege that the complainants were not the original and first inventors of the said inventions or of any material or essential parts thereof; that there was a prior knowledge, use, and public sale, in many parts of the United States, of machines embodying all the principles and combinations claimed as new by the complainants; that the invention had been mentioned and described in certain printed publications; that there had been an abandonment by the inventor to the public; and that there had been no infringement by the defendants of the rights and privileges alleged in the bill to be secured to the complainants by their several letters patent.

Held by the Court:

A patentee held to have made his invention when he had a machine embodying it completed and in operation and actual use, though the use was private.

Delay in filing an application is no ground for charging the inventor with abandonment if he was residing in the insurrectionary States during the war.

Making the lower roll in a fluting machine adjustable is an infringement of a patent for making the upper roll adjustable by similar means and for the same purposes.

Making the roll adjustable by means of a rack and pinion instead of a screw is also an infringement.

Decree for the complainants against the defendants for the infringement of the first and third claims of the reissued patent No. 3,856, and of the first and second claims of the reissue No. 4,653; but without costs.

[*J. J. Coombs* and *F. W. Leonard*, for complainants.
N. Perry, Jr., for defendants.]

Rochester, N. Y., 8th Dec. 1874.
MR. G. W. HARROLD.
DEAR SIR:—THE PROUTY STEAM TRAP that you put in for us works to our entire satisfaction; you may now remove the other trap, as it is no longer of any use to us. We consider your Trap in every respect superior; it saves a great amount of constant labor in drawing off water, which we had to do almost constantly when heating on different floors with the other Trap. Yours respectfully,
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Portable Engines, new and rebuilt 2d hand, a specialty. Engines, Boilers, Pumps, and Machinist's Tools. I. H. Shearman, 45 Cortlandt St., New York.

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

Notes & Queries

M. J. will find the recipe for diamond cement on p. 90, vol. 30 (cementing whalebone to wood).—W. H. H. and T. E. C. will find directions for bronzing iron on p. 283, vol. 31, and for tinning iron on p. 302, vol. 31.—W. L. D. can make a magnet by following the directions on p. 218, vol. 31.—J. G. M. & Co. will find a recipe for paste for use on tin on p. 253, vol. 30.—J. E. H. can nickel plate steel by following the instructions on p. 174, vol. 30.—L. T. can repair his rubber boots by following the directions on p. 203, vol. 30.—C. McE. can make a carmine red ink by the recipe given on p. 200, vol. 30.—F. M. H. and many others will find directions for nickel plating on pp. 43, 90, 346, vol. 31.

(1) E. C. asks: 1. In the present Atlantic telegraph cable is, there a floating battery, or has there been one at any time since it was laid, in mid-ocean? A. No. 2. What is the size of the batteries used at the shore ends of the cable? A. Quart cells. 3. How small a battery is it possible to use and send a communication over the cable? How small a battery has been tried, which showed indications at the other end? A. A battery composed of a single percussion cap, in each case. 4. Would it be possible in taking up the cable, beginning in mid-ocean, to communicate with the shore, unless they first separated the cable or outer coating? A. It would not.

(2) N. N. asks: What is the best battery for running a revolving armature? A. A large size Daniell, battery or the modification of it known as the gravity or Callaud battery.

(3) S. E. T. says: 1. I wish to convey water from a stream to a tank 1,000 feet distant and 30 feet higher than the stream. Will I get as good a supply of water with the same power if I lay a 3 inch pipe over the first 300 feet, a 2 inch pipe over the next 200 feet, and an 1½ inch pipe over the remainder, as with a 2 inch pipe over the whole distance? A. The data are not complete, but it would be better to have the pipe the same size throughout. 2. Will chestnut sticks, with a 2½ inch hole bored through them lengthwise, united with iron couplings, answer the purpose for pipe? A. Yes. 3. How many horse power will it require to give a supply of 10 gallons per minute? A. From 2 to 2½ times the power required to lift the water, neglecting friction.

(4) N. N.—A very pretty magnified view of an aquarium or other object is obtained through a telescope when the objective and eyepiece are very far apart, in a tube of extra length.

(5) I. F. J. asks: How can I repair an opera glass of which the plating is discolored and the ivory broken? A. Nickel plate the metal surface, and cover with morocco leather attached with marine or other glue.

(6) S. D. E. says: 1. Eight months of labor and patience have rewarded me with a splendid reflector. I used Draper's method of silvering on glass, as described in your answers to correspondents. Any one who follows the formula must succeed. My reflector is 12 inches in the clear, with 10 feet focus. I want to set the reflector at an angle, so that I can view direct instead of using an angle mirror; and I wish to leave the tube 2 feet longer than the focus, so that my head will not be in the way of the light. Will this answer? A. If your mirror gives sharp definitions, mount it as a Newtonian; if not, mount it as an aerial, as figured by Dick. 2. Please tell me what the focal distances and diameters of the two eyepieces should be (the focus spot by the sun covers about half an inch). A. To construct a battery of eyepieces, take the highest power, say 600, and divide it by 1·5=400, the next power; 400+1·5=266+1·5=177, +1·5=59; or begin with the lowest, say 60, and make each power ½ greater than the one below it. 3. How far should the first glass (next to reflector) be beyond the focus? Should it be plano-convex or double convex? A. Focus is within the Huyghenian eyepiece. See No. 48, October 17, 1874. A Ramsden or positive eyepiece, for micrometer or reticule, is constructed thus: The focus of the field lens=twice the focus of objective divided by the power required. Focus of eye lens is 0·555 or $\frac{5}{9}$ that of field lens. Distance apart is $\frac{4}{9}$ or 0·444 of focus of field lens. Equivalent single lens is ⅓ focus of field lens. Apertures are ⅙ of focal length. Image is $\frac{1}{10}$ of focus of field lens in front of it. Both lenses are plano-convex, the convex sides facing each other.

(7) Z. T. R. says: I wish to convey the water of a spring to my dwelling, which is at a distance of 600 yards; the pipe will have to cross a creek and swamp, making the lowest point of the pipe 40 or 50 feet below the fountain head. The spring affords water enough to fill a 2 inch auger hole through a weir with a 6 inch head. What size of pipe will be required for the work, the discharge being 15 or 20 feet below the receiving point, and consequently at a head of 15 or 20 feet at the house all the time? A. A one inch iron pipe will serve your purpose, and, notwithstanding the friction of so long a line, give water enough for a family's use. The salts in the water will very likely coat it so as to prevent the rusting of the iron. The usual thickness of a one inch wrought iron pipe will be strong enough for the pressure at the lowest point. The exterior may be covered with a wash of coal tar. 2. Who makes the best pipes, to keep water free from all poisons and rust? A. Tin-lined lead pipe is supposed to be the best pipe for the purpose. All pipe should be laid below the reach of frost. The power of a water wheel is best ascertained by experiment.

(8) J. G. H. says: I have a sawmill boiler in which the distance from the bottom of the boiler to the top of the arch is 8 inches from the arch. The brickwork is gradually sloped. We fire with sawdust, but have to use some dry slabs to get steam enough. An engineer tells me that if I make the arch 10 or 12 inches from the boiler, and leave the space from the arch to the brick wall empty instead of filling it up, I will be able to burn more sawdust and refuse and keep up steam, without using slabs. I want to burn all the sawdust and refuse I can, and at the same time have steam enough. Which is the better way? A. We do not think that the change will produce any decided advantage, unless you make a combustion chamber, by admitting air into the space back of the bridge wall.

(9) D. N. B. asks: 1. Is it economy of fuel to buy a 10 horse power engine and work it up to 15 horse power rather than work a 15 horse engine at its nominal capacity? How much work could a well made nominal 10 horse engine be made to do without over working or straining? A. We cannot tell you anything about nominal horse power, as it varies with different makers; nor is it possible to give general rules for the most economical manner in which to run all engines, as it depends upon a number of variable quantities. 2. How might the relative value of coke and Illinois bituminous coal be stated for making steam? A. It can readily be determined by experiment. Keep account of the fuel consumed and word done. 3. What power of engine would you advise putting in, to run machines requiring (according to manufacturer's representations) an aggregate of 10 horse? A. An engine of 10 effective horse power.

(10) H. L. says: 1. I wish to construct a two inch achromatic telescope and use it both as a terrestrial and astronomical one. What would be the best object glass, and what length of focus should it have? A. See answer No. 27, October 24, 1874. 2. How should I construct the eyepiece to match? A. Put the smaller plano-convex lens next the eye. 3. What are the names, distances, magnitudes, and masses of about ten of the nearest fixed stars whose distance has been roughly ascertained? A. 61 *Cygni* has a parallax of 0·45″, distance 44 millions of millions of miles; diameter of orbit 17 times that of the earth; light period 7 years. Sirius and *α Lyræ* have each a parallax of ¼ second; they are about 800,000 times as distant as the sun. 4. Please give the rates at which they appear to travel in their orbits, and towards what star they appear to travel, as well as the rate at which others move away. A. Stars approaching us are: Arcturus, 55 miles per second, Vega 44, *α Cygni* 30, Pollux 40, *α Ursæ Majoris* 46 to 60. Stars receding are: Sirius 18 to 22 miles per second, Betelgeux 22, Rigel 15, Castor 23 to 28, Regulus 12 to 17. The two fourth magnitude components of *γ Virginis* revolve round their center of gravity in 169 years; major axis, 7″. *Xi Ursæ Majoris* fourth and fifth magnitudes, 61 years, 5″. *ζ Herculis* third and sixth magnitudes, period 36 years; major axis 2½″. 5. What time does it take Sirius's companion to go round him? A. Four hundred years, 10th magnitude; mass of satellite=half mass of Sirius. Sirius is over three million miles in diameter. 6. What are the diameters of Saturn's moons? A. Titan is larger than Mercury. It can be seen with 1 inch aperture, Japetus with a two inch. 7. In what constellations can I find five of the largest nebulæ that have been found to be gaseous? A. Great nebula of *Orion*: Right ascension, 5h. 29m., declination S. 5° 29′. Nebula in *Andromeda*: 4° long, 2½° broad, R. A. 0h. 30m., D. N. 40° 30′. Dumb bell nebula, R. A. 19h. 54m., D. N. 22° 22′. Annular nebula in *Lyra*: R. A. 18h. 49m., D. N. 32° 52′. Horseshoe nebula, R. A. 18h. 13m., D. S. 16° 15′. Two copies of SCIENTIFIC AMERICAN for 1 year and two of *Science Record* will cost $10.

(11) J. McD. asks: 1. Is there any place in America or Europe where crude petroleum is used for making gas? A. There have been many attempts to employ it, some of which are still in progress. 2. Does such process pay economically, in comparison with coal? A. As yet, the various inventors have not succeeded in perfectly overcoming the practical difficulties.

(12) A. A. N. asks: Is there any way of preparing the sympathetic inks which are visible only when heated, such as solutions of Co $(NO_3)_2$, $CoCl_2$, etc., so that they can be used for printing or stamping? A. We do not know of any such method.

(13) J. G. S. asks: How can I make a cheap paste for putting up paper exposed out of doors, making it impervious to any kind of weather? I should like it to form some kind of hard surface similar to varnish. A. We know of no material that will answer all these requirements.

(14) C. W. asks: 1. Are the saltpeter deposits in the Big Bone Cave, Tenn., extensive? A. It is probable that saltpeter has been obtained by lixiviation of the earth in the cave. 2. Is it true that large quantities were obtained here for the rebel army? A. The amount, though considerable, would not cause this source of supply to supersede others.

How can I preserve guns with least trouble? A. Cover the iron with a mixture of tallow and white lead.

How must I treat brier root to prevent splitting, and how can I color it for a pipe bowl? A. Boil the wood for an hour or two in water, and dry slowly. To color, hold near the fire so as to gently warm, and by means of a feather coat the surface with dilute aquafortis; oil and polish.

How can I dye hair switches dark brown? A. To a saturated solution of sulphate of copper (blue vitriol) add ammonia until the precipitate which falls is redissolved. For a mordant, to be first applied, use a saturated solution of ferrocyanide of potassium.

(15) J. B., of Wells, England, says: On removing a sheet of tin which had been placed immediately behind a looking glass plate (exposed to the sun) I discovered several circular spots, varying from two to four inches in diameter, with a dull silvery appearance and very smooth. If this was a coating of silver, can you explain how it was conducted from the plate to the tin, as the mercury on the plate did not come in contact with the tin, except at the edge of the plate? A. They were probably spots produced by a small amount of mercury volatilized from the back of the mirror, acting upon the tin.

I have two small pine trees (which I brought from America last winter) and wish to preserve. One especially is looking sickly, although both have grown a little. They were planted in a rich red soil in a low situation. Can you tell me what locality or soil would be most congenial to their growth? A. In this country, pine trees do not grow in rich moist bottom lands, but upon arid, sandy soils.

(16) S. asks: What is a solvent of oxidized linseed oil? A. Turpentine.

(17) J. H. asks: What is a durable cement, for cementing burlaps to the edges of a frame made of building paper? A. Edmond Davy prepares a cement, which is well spoken of, by melting in an iron vessel equal parts of common pitch and gutta percha. It is kept liquid under water, or solid to be melted when wanted. It is not attacked by water; and it adheres strongly to wood, stone, glass, porcelain, ivory, leather, paper, feathers, wool, hemp, and linen fabrics, and even to varnish.

(18) H. W. asks: What is the best preparation to put upon the wood floor of a public building which is daily much used? A. In cases of this kind, the general practice is to use some cheap durable paint.

(19) J. H. A. asks: 1. Will oil in which steel is repeatedly hardened lose its hardening property? A. No. 2. Which is the best kind of oil for hardening steel? A. Common machine oil may be used; but for fine work, olive or cotton seed oil will be more satisfactory.

(20) J. W. asks: What materials are used to make amber-colored glass, beside manganese? A. Different shades of yellow may be imparted to the glass by the addition of the oxides of silver and antimony, and by finely divided charcoal; also by the presence of peroxide of iron in quantities not exceeding one per cent. The tints may be tempered by the addition of minute quantities of the purple of Cassius.

(21) J. K. asks: If a mixture of steam and air, after passing through red hot pipes, were admitted, by means of the draft, to a coal fire, would it insure a more complete burning of the smoke than if air alone were so used? A. It would be a dangerous experiment, as such a mixture (if a sufficient amount of heated iron were presented to the steam to liberate a part of the hydrogen) might be rendered explosive.

Why do the rays of the sun warm the air more in the valleys than they do on the top of high mountains? A. The air receives its warmth by contact with the earth; as the valley offers to the lower strata of air greater surface, the contact is more frequent and intimate. Something is also due to evaporation.

(22) H. A. G. asks: 1. Are glass tumblers made in molds? A. Yes. Many forms of glass ware are made by blowing into molds. 2. How is window glass made? A. In the manufacture of common window glass, the workman dips an iron tube into the melted mass, a portion of which adheres to it. This is blown into a pear shape, which becomes elongated by swinging like a pendulum. By reheating, blowing, and rolling, it is worked into the form of a cylinder, which is cut off around the top and bottom and split down the side. After again softening in the furnace, it is opened and spread out into a flat plate. 3. There is a recipe for crystal glass which states: White sand 15, red lead 10, refined ashes 4, and niter 1, parts. What are these parts? A. Parts by weight.

(23) D. H. R. asks: How can I relieve canaries from the attacks of a very small red parasite? A. Allow the birds to bathe frequently, and keep the cage very clean, with plenty of sand at the bottom.

(24) H. E. B. asks: 1. In re-sharpening files will any other kind of battery answer the same purpose as the Bunsen? A. Yes. 2. Will a zinc and porous cup battery, excited by nitric and sulphuric acids, be sufficient, and how many cups are needed? A. No doubt any kind of battery will answer the purpose, provided the electromotive force be equal to that of twelve Bunsen cells, the number employed by Mr. Werdermann in his experiments. 3. Are the files placed horizontally or in a perpendicular position? Should the positive pole connect with every file separately in the bath, or do they project above the bath and make a dry connection with the positive pole? A. Perpendicularly. The handle end of the file should project above the liquid, and connection may be made by means of a binding screw with the positive pole (copper or carbon) of the battery. 4. Will a small battery of medium strength be sufficient to sharpen a few files at a time, or even one, with a longer period of immersion? A. Possibly. The experiment is easily made.

(25) J. J. B. asks: I have been making some magneto-electric apparatus, and to insulate the wire I wrapped it with silk thread. Is there not a cheap silk thread made especially for this purpose? A. Yes. The wire is covered with raw silk floss, called untwisted silk for covering telegraph wire.

(26) I. J. S. asks: 1. Is there any way which will effectually destroy magnetism in the steel parts of watches, except passing them through the fire? A. There is no practicable method of destroying it. 2. Why do watchmaker's small tools get magnetized when there is no magnet about the shop? A. It is possible but not probable that the tools may have become magnetized by friction. It is more likely that your tools have accidentally got in contact with a magnet.

(27) M. D. says: Will you give me the simplest process of nickel-plating small objects like surgical instruments? A. Use chloride of nickel for a solution with a nickel positive electrode, and proceed as in silver plating.

(28) J. M. D. asks: Do you know of anything that will cut off the attraction of a magnet? A. Place a brass plate between the poles of the magnet and the armature.

(29) W. T. B. says: I have learned from several that there is a mode of increasing negative electrical attraction, relative to the positive, in other words, of having a great attraction and slight repulsion. Is this so? A. It is probably erroneous.

(30) S. D. asks: What is the explanation of the term squaring the circle? A. Calculating the exact superficies of a circle whose diameter or radius is given, so that the side of a square of the same area may be known.

(31) C. W. says: Please state the composition and properties of croton chloral. A. Ordinary chloral is an aldehyd; it is the hydride of trichloracetyl, C_2Cl_3OH. Croton chloral is the hydride of trichlorocrotonyl, $C_4H_3Cl_3H$, or the aldehyd of crotonic acid, C_4H_5OH, in the radical of which three atoms of hydrogen have been replaced by three atoms of chlorine. Anhydrous croton chloral is a colorless, oleaginous liquid, having a peculiar odor, recalling that of ordinary chloral. It is insoluble in water, but, like ordinary chloral, it combines with water to form a crystallized hydrate. The hydrate of croton chloral crystalizes in white nacreous spangles. It is slightly soluble in cold water, more freely soluble in warm water, and extremely soluble in alcohol. It dissolves more readily in glycerin than in water.

(32) F. M. H. asks: Will five Callaud batteries be enough to plate with? A. Yes.

(33) N. B.—If the moon's node be less than 9° 3′ from the center of the earth's shadow, there will certainly be an eclipse of the moon. If the sun be more than 12° 4′ from the node, there cannot be an eclipse. The moon crosses the ecliptic 19° further west each year.

(34) W. M. D. asks: 1. In what manner are the connections usually made or attached to the pendulum of a regulator beating seconds, to convey a current of electricity to another clock? In other words, how can I make and break connections at each second, and at the same time take no power that would disturb the pendulum as regards its rate? A. The pendulum in swinging passes through a small cup of mercury. 2. What form of battery will convey a weak current for a year without attention? A. The Leclanché or the gravity battery.

Has mercury any effect on platinum when brought in contact with it? A. It will adhere to the platinum, but will cause no injury.

(35) W. T. H. asks: Is it darkest just before daylight? A. No.

What is a good cement to stick rubber coat seams together with? A. Dissolve a small quantity of pure rubber in hot naphtha.

(36) W. E. S. says: I think my eyes are getting weak, but am not sure. Will you please tell me how I can test them? A. By comparing with some one whose eyes are undoubtedly good.

(37) F. H. W. asks: 1. How can I make a soft iron core for a magnet? A. Bend a rod of iron into the shape of a horseshoe. 2. Should the wire be wrapped tight around the soft iron? A. Yes. 3. Would a battery made of a common tin can lined with lead, with zinc hung in the top, make a battery of any strength? A. Yes. 4. What fluid should I use for such battery? A. Put crystals of sulphate of copper in the bottom of the can, and fill with water.

(38) S. H. B. asks: Will the Leclanché battery answer for an electrical clock in which the impulse is to be given to the pendulum at each return to one side, the pendulum beating in half seconds? A. Yes.

(39) W. H. M. asks: Is electricity a substance? A. That question still remains to be solved. The present opinion seems to be rather inclined to regard it as a force.

(40) T. C. H. asks: Will you please give me a good recipe for separating silver and gold when melted together? A. Melt the alloy, and while in a fused state pour it from some hight into a vessel of water to which a rapid rotary motion is given. By this means the metal may be obtained in a finely granulated state. Add to the metal thus obtained a quantity of chemically pure nitric acid, and heat gently. When the solution ceases, which may be known by the discontinuance of effervescence, the liquid may be poured off. If any grains appear entire, more acid must be added until the silver is all dissolved. The remaining gold will have the appearance of black mud or powder, which must be thoroughly washed and melted. The silver is recovered by precipitation with muriatic acid and reduction. The precipitate of silver must be well washed with boiling water, and may be fused with niter or tested off with lead.

(41) C. L. W. asks: What will restore the color of a book slate which has turned white? B. Try a thin coat of lampblack in alcohol.

(42) I. F. M. asks: Would not the attractive force between two magnets with the opposite poles in contact be greater than that with which both magnets, with like poles adjacent, would attract an armature? In other words, would one magnet attract another of the same power with more than twice the force that it would the armature? A. No.

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

C. L.—They are iron pyrites.—J. W. W.'s specimen did not come to hand.—I. S. H.—It is a fine sand, consisting mostly of silex and alumina. It can be used for grinding and polishing powder. It would not be easy to grind it finer, except by suitable steel rollers; but the finer particles could be separated from the coarser by suitable sieves and bolters, and then the coarser could be ground, if necessary.—L. G. D.—There is nothing peculiar about this earth, except that it is quite white from being unstained by iron, and that it is in a fine powder. It consists principally of silicate of alumina.—J. H.—Both the specimens contain sulphuret of iron.—J. T. T.—It is sulphuret of iron (iron pyrites).—J. H. M.—They are worms growing from germs in organic tissues, like the interior portion of feathers.—J. J. J.—Your specimen is fine sand with scales of mica. The powder marked P is a mixture of particles of metallic lead with oxide of lead, carbonate of lead, chloride of lead, and sulphate of lead.

C. F. A. asks: How can I construct the sliding or guiding parts of a self-supporting drawer, so that it may be drawn out its full depth, from under a bench?—E. J. Q. asks: 1. What is laminated steel? 2. A gunsmith in Boston says he can take any gun barrel and make a laminated steel barrel of it. Can it be done?—W. H. B. Jr. asks: How can I make artificial firebrick?—L. K. Y. asks: What is Vienna lime?—C. H. M. says: 1. It is observed that the putty used in stopping up the nail holes in boats where galvanized nails are used soon becomes soft and friable, and ceases to afford adequate protection. To what is the change due? 2. What can be used, in place of putty, that will remain hard and firm in covering galvanized nails while exposed to salt water? T. H. D. asks: 1. How can I get rid of the red spider which infests house plants? I have tried tobacco water and smoke, but without effect. 2. How can I get rid of moths in carpets?—J. C. asks: 1. How can I cause a quick fermentation, to prepare molasses for distillation? 2. How can I take the taste of molasses from the spirit after distillation?

COMMUNICATIONS RECEIVED.

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

On Lining Engine Cylinders. By F. G. W.

On Splicing Large Belts. By T. G. B.

On Hydrophobia. By J. R.

Also enquiries and answers from the following:

W. A. T.—J. S.—T. F. M.—W. H.—H. D. D.—C. G.—A. J. B.—H. E. B.—G. B.—G. W.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Where can illustrations of new designs for furniture be obtained? Who sells the best feed water heater and filter? Why do not makers of glue advertise in the SCIENTIFIC AMERICAN?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

Rochester, N. Y., Dec. 24th, 1874.

MR. GEO. W. HARROLD, Rochester:

DEAR SIR:—The "PROUTY'S AUTOMATIC STEAM TRAP," fitted by you to our heating apparatus, has, after due trial, proved in every way satisfactory, and its working has surpassed our expectations. We now experience a considerable gain of heat from the same steam coils and at low pressure. It is a valuable saver of fuel, steam, and pumping, and its use results in less work for the Engineer. For economy in steam heating we can cheerfully testify to its great value. Yours truly,

STEWART RUBBER CO.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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Granted in the Week ending

December 15, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Cultivator, W. P. Munger	157,721
Cultivator, S. Reed	157,761
Cultivator, W. M. Watson	157,895
Curtain fixture, R. A. Thompson	157,771
Dental compound, C. Kellnitz	157,838
Digger, etc., cane stubble, Von Phul & Mallon	157,893
Dish drainer, S. R. Abbe	157,774
Door plate, transparent, W. Sharrock, Jr	157,724
Dryer, stereotype matrix, Mayall & Hartnett	157,853
Egg carrier, W. Weis	157,896
Elevator, hay, L. B. Sprout (r)	7,175
Elevator, stump and rock, B. H. Davis	157,739
Elevator, stop mechanism for, J. H. Paine	157,722
Engine, rock drill, Brandon & Trankle	157,674
Engine, rock drilling, E. Edwards	157,805
Engine crank and piston, S. P. Ruggles	157,705
Explosive compounds, I. M. Millbank	157,856, 157,857
Feed rack, portable, J. X. Mills	157,692
Firearm, breech-loading, H. Berdan	157,783
Firearm, revolving, D. Moore	157,860
Fire extinguisher, J. S. Tibbets	157,729
Fireplace, T. Whitwell	157,709
Fires, extinguishing, W. Mullally (r)	6,173
Flanging machine, R. Garstang	157,810
Frog, C. C. Shelby	157,877
Fuel, manufacture of artificial, D. F. Packer	157,758
Gage, standard, Q. S. Backus	157,779
Gas and air, carbureter for, J. H. Bean	157,781
Gas apparatus, J. Hanlon	157,818
Gas cooking apparatus, T. and J. C. Peacock	157,865
Gas machine, air carbureting, J. H. Needles	157,861
Gas regulator, I. Simmons	157,879
Gas retort, J. Hanlon	157,820
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Gas pressure regulator, etc., S. I. Chapman	157,676
Gas, determining gravity of, W. W. Goodwin	157,749
Glass tampering furnace, F. B. A. R. De La Bastie	157,717
Glass, manufacture of, B. Britten	157,733
Grain, apparatus for steaming, C. R. Taylor	157,708
Grinding cylindrical surfaces, J. S. Elliott	157,744
Grooming apparatus, W. T. Davis	157,798
Guns, attaching the fore end to, W. M. Scott	157,699
Gutters, making wooden, H. A. Stone	157,703
Hame fastener, R. Gustin	157,750
Harrow, P. S. Carhart	157,792
Harrow, J. Shuck	157,878
Harrow, rotary, T. J. Hoover	157,827
Harrow, sulky, D. Salgeon	157,872
Harvester cutter, F. R. and W. O. Sutton	157,705
Harvester rake, J. Barnes	157,672
Hat measurer and stretcher, T. J. Levering	157,845
Hay loader, E. R. Whitney	157,899
Hinge, blind, Z. F. Bryant	157,711
Hoisting machine, H. Richmann	157,870
Horse checker, W. T. and J. B. Burton	157,712
Horseshoe nails, finishing, J. Mills	157,858
Horseshoe nails, pointing, Caryl & Lee	157,713
Hose coupling, J. W. Kennedy	157,840
Hose, making hydraulic, Dodge & Rice	157,741
Hosiery, stamping and striping, G. F. Salmon	157,766
Hydrant, A. Gudenoge	157,814
Ironing board, T. H. Eaton	157,680
Jack, lifting, L. M. Cutting	157,738
Jelly jar, W. C. King (r)	6,172
Knitting machine, O. F. Tripp (r)	6,177
Knob spindle fastener, Fisher & Ballou	157,746
Ladder, fire escape, C. Thompson	157,889
Lamp pendant, J. L. Washburn	157,630
Lamp wick, H. Halvorson	157,685
Lathe, spoke, J. Plummer	157,696
Leather-crimping machine, T. Barrett	157,780
Leather, etc., scouring, F. O. Lockwood	157,691
Leather-scalloping machine, I. P. Hall	157,815
Lock, alarm combination, H. W. Dilg	157,803
Loom, Crompton & Wyman	157,677
Loom shuttle guard, Hall & Newton	157,684
Lubricating compound, A. G. Mandel	157,848
Lubricator, steam cylinder, J. Kukelkorn	157,844
Match composition, safety, G. C. J. Schneider	157,873
Mechanical movement, windmill, G. Metcalf	157,845
Millstone bush, S. Bulver	157,797
Mine safety attachment, W. Walker	157,728
Mooring attachment for buoys, H. Brown	157,785
Motor, vehicle, Steel & Austin	157,884
Mowers, track cleaner for, J. E. Millice	157,756
Mowing machines, W. F. Cochrane	157,794, 157,795
Musical damper action, D. Imhof	157,754
Nail extractor, J. B. Guild	157,689
Necktie holder, L. B. Snow	157,768
Needle blanks, swaging, S. C. Kingman	157,698
Organ action, reed, G. B. Kelly	157,839
Organ, reed, M. J. Matthews	157,850
Organ attachment, reed, J. Van Doren	157,891
Overalls, C. Q. Wo	157,902
Paint, manufacture of, J. B. Orr	157,864
Paper ruling machine, T. F. & F. H. Collins	157,715
Pencil case, J. Holland	157,826
Pencil, lead, D. M. Somers	157,881
Photograph burnisher, E. R. Weston	157,898
Pianoforte attachment, W. R. Miller (r)	6,176
Pipe joint, J. Hoskin	157,828
Pipes, ascertaining leakage in, J. M. Atkinson	157,710
Pitman box, F. L. Bailey	157,870
Planing machine, Carey & Harris (r)	6 171
Planter, corn, C. A. Haskell	157,752
Planter, corn, S. C. Minear	157,859
Planter, check row, M. J. Stevens	157,885
Plow, F. Stridde	157,887
Plow, C. M. Van Every	157,892
Plow point, Calvin & Wallace	157,790
Plow, shovel, J. R. Glover	157,681
Plow, sulky, J. A. Kneedler	157,842
Press, B. J. Day	157,799
Press, piston, etc., hydraulic, J. F. Taylor	157,888
Propeller, screw, A. C. Fletcher	157,809
Propeller wheel, Dowler & Birdseye	157,742
Pulley, stop, J. Pollitt (r)	6,174
Pump, T. J. Reamy	157,760
Pump, plunger for oil, F. C. Wilson	157,901
Pump valve, G. H. Nye	157,863
Punch, railway ticket, Spaulding & Dyer	157,770
Railway axle box, C. A. Hussey	157,822
Rake, horse hay, J. Evered	157,808
Range, E. O. Brinckerhoff	157,784
Rein holder, H. G. Tyson	157,772
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Roofs, jointing boards for, B. W. Sears	157,767
Rope molding, cutting, E. C. Austin (r)	6,170
Rope socket, Buckley & Forker	157,675
Sash fastener, Allen & Schultz	157,668
Sash fastener, W. S. How	157,830
Sash holder, J. Rollo	157,871
Saw mill, J. L. Knowlton	157,843
Saw mill, muley, T. E. Chandler	157,794
Saw mills, set work for, R. Durkee	157,679
Sawing machine, G. W. Bell	157,782
Sawing machine, scroll, Ale & Snyder	157,775
Scales, beam, L. G. Spencer	157,882
Screw caps, forming, J. L. Mason	157,720
Screw cap, chuck, Smith & Perry	157,726
Scriber, H. King	157,841
Sewing machine threader, H. A. Ellis	157,745
Sewing machine clutch, R. W. Whitney	157,731
Sheet metal, sheathing, F. Pollard	157,867
Shirt bosom, F. A. Tormey	157,890
Shoe pegs, making wire, Charnley & Cushman	157,714
Sifter, coal, C. F. Saul	157,698
Skelping die, E. Gordon	157,682
Sled, W. H. Helmbold	157,823
Socket bending machine, B. Murphy	157,693
Spring head blank bar, J. Evans	157,807
Stirrup, J. Bull	157,786
Stone, artificial, A. Berard	157,903
Stone, etc., grinding and polishing, H. Quigg	157,759
Stoves, cooking, E. Bussey	157,788, 157,789
Stove for burning kerosene, Dethman & Claussen	157,740
Strainer, Lipman & Friedberg	157,847
Stump extractor and stone puller, L. J. Howse	157,829
Switch, C. C. Shelby	157,876
Telegraph, printing, S. J. Burrell	157,787
Telegraph, printing, J. E. Smith	157,880
Telegraph relay and sounder, W. S. Rose	157,764
Tin plate, making, T. H. Johns	157,687
Tube expander, boiler, W. S. Sharpneck	157,875
Type setting machine, J. W. Paige	157,694
Tyre upsetter, Q. C. Tebbs	157,728
Valve, compound, A. S. Cameron	157,791
Valve for steam vacuum pumps, G. H. Nye	157,862
Valve, steam cut-off, J. Bailey	157,671
Valve, stop, J. Demarest	157,800
Vehicle motor, Steel & Austin	157,884
Vehicle seat, E. L. Bradley	157,673
Vehicle seats, back for, M. Halfpenny	157,816
Vehicle wheel, J. A. Geer	157,748
Vehicle wheel, W. M. Hoffmann	157,825
Vehicle wheel hub, Clarke & Lvcke	157,735
Vehicle wheel tyre, J. T. Brayton	157,732
Vehicle wheel tyre, F. Corsa	157,796
Velocipede for picking cotton, C. & G. E. Hess	157,824
Vessels, sail for, J. C. Nichols	157,862
Wagon and carriage safety guard, T. Joyce	157,837
Wagon axle, J. Skeen	157,708
Wagon spring seat, J. Griffith	157,815
Wall paper striping machine, J. J. Janeway	157,834
Wash stand, W. Schwarz	157,874
Washing machine, boiler, J. S. Anderson	157,669
Washing machine, Goodnough, Worden, & Luce	157,812
Weather strip, N. Johnson	157,836
Welt trimmer, I. A. Dunham	157,678
Whiffletree attachment, R. Mansfield	157,849
Windmill, T. J. & M. F. Ingels	151,833
Windmill, W. C. Nelson	157,757

DESIGNS PATENTED.

7,922.—COFFIN HANDLE TIP.—A. B. Bailey, Cobalt, Conn.

7,923 & 7,924.—JEWELRY DROP.—L. S. Beals, Astoria, N. Y.

7,925 to 7,928.—BREASTPIN.—L. S. Beals, Astoria, N. Y.

7,929.—BRACELET.—L. S. Beals, Astoria, N. Y.

7,930.—SOAP.—D. S. Brown, New York city.

7,931.—GAS GLOBE GALLERY.—T. Trudeau, Ottawa, Ca.

7,932.—BUTTONS.—L. S. Davis, Waterbury, Conn.

7,933.—REVOLVING FIRE ARMS.—C. B. Richards, Hartford, Conn.

7,934.—INKSTANDS.—L. Rosenfeld, New York city.

7,935.—ADVERTISING WAGONS.—O. F. Sage, Boston, Mass

7,936.—TYPES.—G. W. Witham, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,113.—CIGARS, ETC.—F. Dufour, New York city.

2,114.—MEDICAL COMPOUND.—J. X. Quigley, Shippensberg, Pa.

2,115.—WHISKY.—G. P. Simonson, Jersey city, N. J.

2,116.—CHAIRS.—Delaware Chair Company, Ohio.

2,117.—CANNED GOODS.—Evans & Co., Baltimore, Md.

2,118.—BAKING POWDERS.—H. F. Griswold & Co., Chicago, Ill.

2,119.—MUSTARD.—H. F. Griswold & Co., Chicago, Ill.

2,120 & 2,121.—TOBACCO.—Liggett *et al.*, St. Louis, Miss.

2,122.—CORSETS.—S. A. Moody, New York city.

2,123.—STARCH.—C. Morningstar & Co., New York city.

2,124.—STATIONERY.—Rowland & Co., Washington, D. C.

2,125.—CIGARS.—J. Schroeder & Co., Baltimore, Md.

2,126.—SOAP.—N. Sheldon, Providence, R. I.

2,127.—COCOANUT PREPARATIONS.—California C. N. Co., San Francisco, Cal.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
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On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, DECEMBER 11 to DECEMBER 17, 1874.

4,166.—J. O. Grove, Bluffton, Wells county, Ind., U. S. Improvements in differential pulleys, called "Grove's Differential Pulley." Dec. 11, 1875.

4,167.—S. White, Belleville, Ont. Improvements on a machine for attaching horses to plows, harrows, etc., called "White's Suspended Whiffletree." Dec. 11, 1874.

4,168.—E. L. Fenerty, Halifax, Nova Scotia. Extension of Patent No. 180, called "An Improved Method of Making, Adjusting, and Fastening Skates." Dec. 11 1874.

69.—G. Fournier, Ste. Julie, Megantic county, P. Q. Améliorations aux boutons pour les habillements, dit 'Bouton de l'Industrie et des Familles de Fournier." (Improvements in buttons for coats, etc.) Dec. 15, 1874.

70.—S. C. Redgrave, Lyons, Wayne county, N. Y., U. S. Improvement on liquid measure, called "Redgrave's Transparent Liquid Measure." Dec. 15, 1874.

171.—H. Hollingshead, Howick Township, Huron county, Ont. Improvement in land roller, called "Hollingshead's Improved Land Roller." Dec. 15, 1874.

172.—E. O. Brinckerhoff, New York city, U.S. Improvement on steam condensers, called "Brinckerhoff's Steam Condenser," Dec. 15, 1874.

4,173.—F. W. Tuerk, Jr., Berlin, Ont. Improvements in water wheels, called "Tuerk's Inverted Overshot." Dec. 15, 1874.

4,174.—D. Jones, Millburn Inverness, Inverness county, Scotland. Improvements in lubricators, called "Jones' Lubricator." Dec. 15, 1874.

175.—C. C. Roe, Hamilton, Ont. Steam man or steam walking wachine, called "Roe's Steam Man or Steam Walking Machine." Dec. 16, 1874.

4,176.—R. Thomas, Toronto, Ont. Improvement on cooking stoves, called "Ladies' Aid," or "Thomas' Improved Cooking Stove." Dec. 15, 1874.

4,177.—J. Campbell, Almonte, Lanark county, Ont. Improvements on churns, called "Campbell's Oscillating Combination Churn." Dec. 15, 1874.

4,178.—G. A. Keene, Lynn, Essex county, Mass., U. S., and F. A. Sawyer, Boston, Suffolk county, Mass., U. S. Improvements on carriage and car steps, and threads for stairs, etc, called "The Rubber Safety Step." Dec. 15, 1874.

4,179.—W. B. Laberge, Montreal, P. Q. Improvements on ironing tables, called "Indispensable Ironing Table." Dec. 15, 1874.

180.—D. Bissell, Detroit, Wayne county, Mich., U. S. Improvemenja on arm splints, called "Bissell's Arm Splint." Dec. 17, 1874.

4,181.—C. Parham, Valleyfield, Parish of Ste. Cecile, Beauharnois county, P. Q. Improvement in suction and force pumps, called "The Valleyfield Improved Pump." Dec. 17, 1874.

4,182.—F. Moses, Toronto, P. Q. Improvement on heating apparatus, called "The Coal and Wood Economizer," Dec. 17, 1874.

4,183.—C. Cluthe, Hamilton, Wentworth county, Ont. Improvements on truss pads, called "Charles Cluthe's Self-Adjusting Spiral Spring Truss Pad." Dec. 17, 1874.

184.—H. E. Rowe, Brockville, Leeds and Grenville counties, Ont. Improvements on feather renovators, called "Rowe's Improved Feather Renovator." Dec. 17, 1874.

4,185.—A. D. Griswold, New York city, U. S. Improvement on feather dusting brushes, called "Griswold's Improved Feather Duster." Dec. 17, 1874.

4,186.—M. Thibault, Hull, Ottawa county, Can. Améliorations aux cabestans, dits "Le Cabestan Amélioré de M. Thibault." (Improvements on capstans and windlasses.) Dec. 17, 1874.

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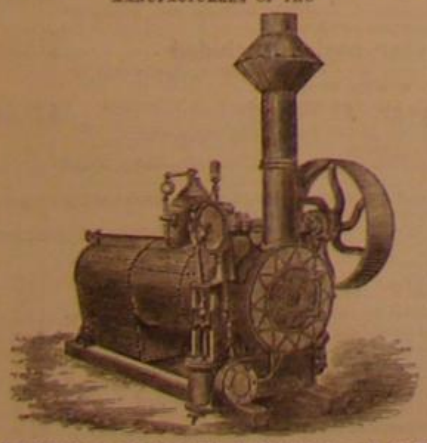

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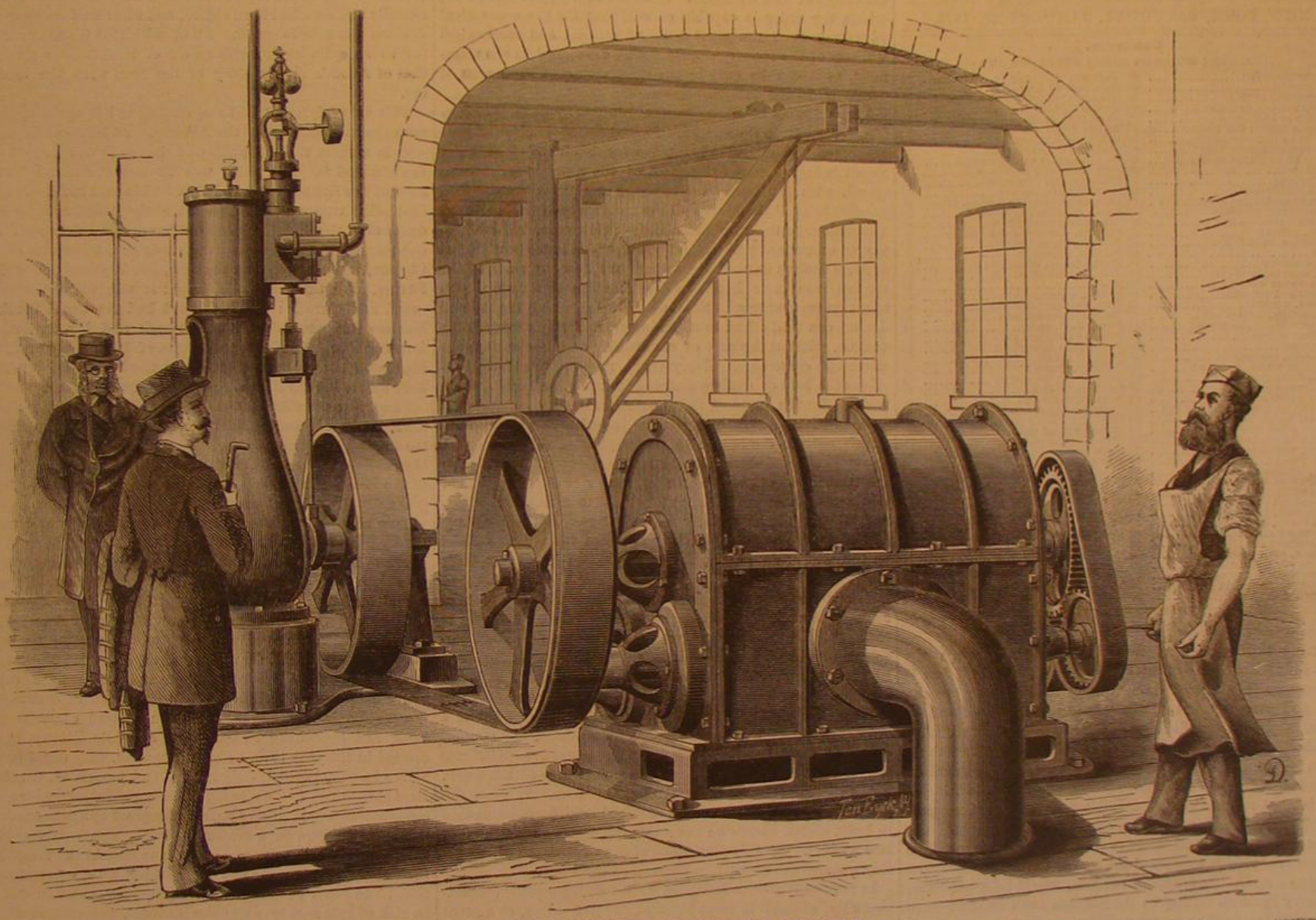
IMPROVED ROTARY PRESSURE BLOWER.

We present herewith engravings of a new rotary pressure blower. The machine produces a forced blast, in such a manner and by such means as to include a variety of advantages worthy of careful consideration. Of these perhaps the first to attract attention are fewness of parts and the strong construction of the entire mechanism. Another point of importance is comparative freedom from friction, there being no portions in actual contact, although in certain localities very close working is necessary. The machine is well adapted for mine use, since it is not liable to injury either by dust or weather; it runs continuously without stopping to be oiled or needing any careful attention.

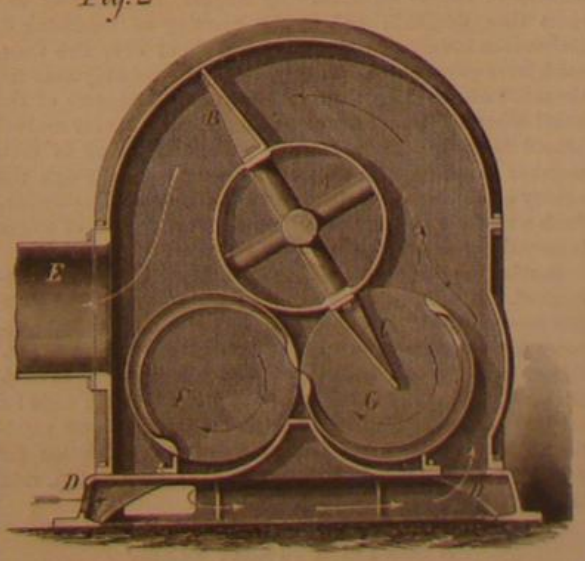


BAKER'S ROTARY PRESSURE BLOWER.

The large illustration affords an exterior view, and Fig. 2 gives a sectional representation of the interior. The external case is made of light boiler iron, formed up very truly and inserted into the heads of the machine, said heads being of cast iron, firmly secured to a bedplate of similar material. They are also bolted together longitudinally by outside iron rods. Within the chest, and concentric therewith, is a cylinder, A (a single iron casting), which is provided with two vanes, B and C. The shaft of the cylinder, A, is rotated by the driving pulley shown outside. The air enters at D, from underneath, and is forced by the vanes out through the outlet, E, in the direction of the arrows. In order to prevent any direct communication between inlet and outlet, two slotted cylinders, F and G, are arranged on separate shafts, the latter actuated by gearing on the main shaft (partially concealed by the figure on the extreme right of the large engraving) so that said cylinders revolve twice as fast as the central drum. As the cylinder, A, therefore turns in the direction of the arrow, Fig. 2, the vane, B, is almost in contact with the upper part of the casing, and is compressing the air before it, driving the blast out of the pipe, E. This compressed air is prevented from returning to the inlet by the cylinder, F, which above is close against the cylinder, A, and below meets the abutments formed on the bottom. The vane, C, at the same time has entered the slot of cylinder, G. A moment's consideration, supposing the auxiliary cylinders to revolve in the direction of the arrows drawn within them, will show that, whatever the position of the vanes may be, one or the other or both of these cylinders will prevent communication between inlet and outlet; while their slots will always be presented to the vanes so that the latter may, at the proper time, enter and so pursue the uninterrupted course necessary to drive a steady blast. In the construction of the machine, nice workmanship is of course required in order to bring adjacent parts just as near to each other as not to touch, and yet to avoid leakage as much as possible. The slight unavoidable leakage, it is believed, is much more than compensated for by the freedom of the moving parts from frictional contact with each other and with the chest.

The speed of this blower, to produce a steady current,

Fig. 2



need not exceed 100 revolutions per minute, and it is stated that a large machine runs with the same amount of power as a small one, when each is delivering the same number of cubic feet per minute. For exhausting air or gases, as in gas works, the capability of working at slow speed and without pulsation is a useful advantage. Similarly, for forcing heated air for drying lumber, grain, etc., or for warming buildings, the machine, owing to its metal construction throughout and nonrequirement of internal lubrication, is excellently adapted. Other utilizations, notably in foundries, will readily suggest themselves.

The inventor, Mr. John G. Baker, of Philadelphia, Pa., sends us a very excellent report, made upon the machine by a committee of judges at the recent Franklin Institute Fair, in which the results of elaborate comparative tests are given, showing the blower to be of a superior degree of efficiency.

Patented December 9, 1873. For further particulars address the manufacturers, Messrs. T. Wilbraham & Brothers, 2,316 Frankford avenue, Philadelphia, Pa.

Nitroglycerin as a Motor.

M. Champion, a French chemist, states that the heat developed by a given quantity of nitroglycerin when exploded is capable of exerting, when converted into motion, a maximum energy fully five times that produced by the explosion of the same amount of gunpowder, and three thousand times more than that caused through the combustion of an equal quantity of coal. A single quart of nitroglycerin, it is asserted, has the potential energy of 5,500 horse power, working during 10 hours. It remains to invent a machine in which the gigantic force can be harnessed and controlled.

A Novel Business.

A correspondent writes to know if it will be possible for him to secure by letters patent the exclusive right of selling pocket-knife blades, without handles. He thinks the idea original with himself, and, like Colonel Sellers, has reasons to believe "there's millions in it." Our correspondent's idea is certainly novel, but unfortunately the Patent Office laws contain no provision for the patenting of a new business merely.

WE are all living too fast. The man who is always in a hurry generally has his own work to do over again, besides being more liable to trip up and find himself sprawling in the mud.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

Club Rates:

Ten copies, one year, each $2 70, postage included.....$27 00
Over ten copies, same rate each, postage included..... 2 70

☞ By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 187.. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXII., No. 4. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, JANUARY 23, 1875.

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THE SOVEREIGNS OF INDUSTRY.

During these times of financial depression, when the great industries of the country are languishing and labor is everywhere out of employment, diminished incomes are the rule, and economy the virtue most in demand. To those whose incomes are still liberal, though never so much less than heretofore, the problem of adapting expenditures to receipts is comparatively simple. They have merely to cut off a few luxuries more or less, to pinch their pride a trifle, it may be, but with no risk of trenching on the actual necessaries of life, either for themselves or their families.

For the great mass of working men, however—men whose wages never greatly surpassed the cost of living—the problem is not so simple. To strike off luxuries would help but little, not many luxuries falling to their share even in the best of times. To lessen the amount of their purchases means to eat poorer food, or less of it, wear cheaper clothing and live in poorer houses; in short, to submit to evils, not to practise economy.

The usual door of escape from the ills of poverty, hard work and more of it, is closed by the general stagnation of industry. Men are fortunate if they get any work, at reduced prices at that. How then can they manage to live? There is but one way, and that is by increasing somehow the purchasing power of money, so that the little they now have may go as far as the larger sums they have been used to: a hopeless undertaking, it might seem, for men without capital and with no influence in financial circles: but so it did not seem to the working men of New England, spurred on by that most efficient sharpener of the wits, necessity. The problem was to make two dollars buy as much as three, prices remaining the same. A glance at the conditions of trade will suffice to make plain the efficiency of the means adopted. During the flush times, before the collapse of 1873, money was plentiful, business brisk, and profits large. Consequently the race of middle men multiplied enormously. Between the miller and the mechanic, the price of a barrel of flour increased fifty per cent or more by passing through half a dozen hands, each charging roundly for the nominal and, for the most part, uncalled-for service rendered. In like manner, the cost of nearly every other article of food or clothing was similarly advanced. With high wages and plenty of work, the consumer was able to pay the extra charges: but when the easy times were past, his lessened wages left small margin for the support of go-betweens. The machinery of trade had become so cumbrous and costly that it was a burden rather than a convenience. Its excrescences had to be cut away; and this the working men of the East have set out to do, holding it suicidal as well as foolish to pay half a dozen large profits on each article they buy, when they can be served as well for a single small advance on prime cost. For example: A hundred laborers want each a barrel of flour. By going to the retail grocer they can get such an article as they desire at the rate of ten or twelve dollars a barrel. On the other hand, by clubbing their funds and buying a car load at the mill, the same grades of flour can be got for seven or eight dollars a barrel, transportation and delivery included. So likewise with nearly every other standard article; by jumping the needless middlemen and buying for cash at first hand, the purchasing power of wages may be immensely augmented, without doing injustice to any one.

It is but a short and natural step from temporary combinations for mutual benefit to permanent organization. This step has been taken; and under the somewhat grandiloquent title of "Sovereigns of Industry," the new organization is drawing together the working men of the Eastern States with a rapidity rivaling the development of the Grange throughout the West.

Thus far the Sovereigns have stuck to their original idea of mutual helpfulness in supplying the necessaries of life to the members of their several councils. It is to be hoped that they will continue to do so, avoiding strenuously the political follies of the Grangers. It would be a pity if the power which the order is capable of wielding for the economical advancement of the great army of manual and mechanical workers of the country should not be developed to the uttermost, as it can be only by the most stringent repression of demagogues and party schemers.

Various plans of operation are adopted by different councils, according to the number of members, their place of residence, and the local advantages for buying. The chief object being to make the most of the money they have to spend, with the least inconvenience or risk, it is a common practice to avail themselves of the machinery of trade already established in their neighborhood, taking care, however, to pay no exorbitant profits. An arrangement is made with one or more dealers in each department to throw the trade of the council into their hands in consideration of a special discount on regular retail prices, a concession which the favored dealers can well afford to make in return for an assured cash custom, without the cost of advertising or other outlays for attracting customers. Every three months the council receives the bids of dealers desiring its trade, and elects those which offer the greatest inducements, all things considered. Tickets of membership are then issued, the exhibition of which entitles the bearer to the stipulated discount on all goods purchased during the ensuing quarter. In all cases the council takes pains to secure trade circulars and lists of wholesale prices current, from which to estimate the justness of the charges of their local dealers. If the members can do better by ordering their supplies from the producer or the wholesale dealer, the local dealers lose their trade altogether.

In many cases large dealers undertake to fill the orders of councils at a slight advance on wholesale rates, delivering to the appointed purchasing agents the articles in separate parcels as required by the members, thus enabling the mechanics of the most out of the way village to command as favorable terms as the market will afford. Where the purchases are considerable and tolerably regular, it has been found a very satisfactory way to hire a cheap store room, and appoint one of the members storekeeper for the council, to distribute the purchases as called for, on certain evenings of the week. At the regular monthly meetings, the members elect the amounts of the several articles required, which are purchased in bulk, and of course on more favorable terms than in separate parcels. By this plan, most of the advantages of co-operative stores are secured, with none of the risks.

In several States, it has been found advantageous (experimentally, at least) to mass the trade of the order, or a great portion of it, by appointing a general purchasing agent, through whom the supplies for the councils are ordered, the superior advantages of such a buyer more than offsetting the cost of the increased machinery.

An idea of the rapid spread of the organization may be gained by the rate at which the order has grown in Connecticut. The first council, with seven members, was organized February 26, 1874. In May a State council met, with a membership of twelve hundred. By August, this number was more than doubled; and at the meeting of December 8, forty-seven councils, with a membership of over five thousand, were represented. To-day, there are probably near ten thousand of the more thrifty mechanics and laborers of the small State of Connecticut thus banded together for mutual benefit in trade. Thus far, the estimated saving to each member is thirty per cent of his purchases through the agency of the order—certainly an amount worth considering. Such a sensible and practical "strike" for increase of wages is something new in the annals of industry.

Besides the State councils, a national council has been organized. It will hold its session for 1875, probably before this reaches the eye of the reader. For what practical purposes the session will be held does not clearly appear to outsiders. We can only hope that it will take no action to complicate the objects of the order, or to divert its work from its original purpose. National councils are apt to be over ambitious, and the temptation to use a popular organization for political purposes is hard to be resisted: if indulged in, ruin is inevitable.

A BOX TRICK TO BEAT HARTZ.'

According to travelers' stories—the best of all evidence, as everybody knows—there used to be in India a school of vagabonds who got their living by dying. For a very modest sum they would emulate the frogs which are periodically discovered alive in solid rock—or in tree trunks, overlaid by innumerable rings of annual growth—and retire for a specified period from the cares of this life. They professed to have such control over their vital processes as to be able to die at will, and would allow themselves to be sealed up in coffins or tied up in blankets, and buried underground for a week or a month, or more.

A very circumstantial account of such an operation was given by Sir Claude Wade. When he was at the court of Runjeet Singh, in 1837, a fakir was thus buried for six weeks, a company of soldiers guarding the place of his interment to prevent untimely resurrection. At the end of the six weeks the seals were found intact; and on removing the lid of the box which served as a coffin, the white linen bag in which the fakir had been placed was found to be mildewed. When the bag was opened, the temporarily dead man's arms and legs were found to be shriveled and stiff; and his head reclined, corpse-like, on his shoulder. To all appearance he was as dead as an Egyptian mummy, no pulsation or other evidence of life being discoverable. He was then turned over to the manipulations of his servant, who made warm applications of various kinds, whereupon the arms and legs gradually returned to their normal state. He then removed the wax and cotton with which the fakir's nostrils and ears had been closed, and after half an hour the devotee was able to speak. All of which Sir Claude vouches for as an eye witness, with an air of truthfulness rivaling that of About's clever story of the man with the broken ear.

This art of dying at will and coming to life again appears not to be monopolized by the Hindoos. At least one Englishman in modern times, if human testimony is worth anything, has attained it. His name was Townsend, Colonel Townsend of the British army in India. This man could go into a death-like trance at will, so skillfully counterfeiting real death that the most critical observers were deceived. On one occasion the experiment was made in the presence of Dr. Cheyne, who reports upon the case, Dr. Baynard and a Mr. Skrine. All three felt his pulse: it was distinct, though small and thready: and his heart had its usual beating. He then composed himself on his back and lay motionless for some time. Gradually all signs of life disappeared, till there was no pulse, no beating of the heart, and a mirror held before his mouth gave no indication of breath.

The witnesses discussed this strange appearance for a long time, finally concluding that he had carried the experiment too far and was really dead. As they were about to leave him, a slight motion of his body was observed, and a beating of the heart. In a little while he began to breathe, and gradually life was fully restored.

This account has been accepted as trustworthy and credible by high medical authorities, and so likewise have those given of the fakirs who carried the experiment a degree further than Colonel Townsend, and submitted themselves to actual burial.

It is a pity the art has not been more widely cultivated; it would afford such a convenient refuge for geniuses born ahead of their time. On finding their generation too stupid to appreciate their grand discoveries and projects, they could retire for a season until in the regular course of events the masses should overtake them. Then instead of writing a book and depositing it, sealed, in a public library, to be opened in the year 1975, or such a matter, they could themselves be so deposited, duly labeled and preserved, till their time should come. We could name a good many whose acquaintances would gladly provide fireproof quarters for them and their projects for a century or two. The only fear that the fakirs had of protracted burial was that in the meantime their servants might die and there be left no one to resurrect them. In cases such as we have imagined, there would be no risk of this sort to deter the devotee, the community at large assuming the responsibility.

TESTING THE CORRECTNESS OF FIGURES BY WEIGHT.

We publish in another column a communication from our well known correspondent Dr. P. H. Vander Weyde, in which he suggests a rather novel and effectual method of testing the correctness of all calculations such as those pertaining to the squaring of the circle, and the contents of circular or other forms. His method is based on the practice, adopted sometime ago, of measuring the area of land by weight, in which the figure of the land is drawn to a scale on paper, and the figure cut out of the sheet. The figure of a square acre is also drawn to the same scale and cut from the paper sheet. The two are now weighed separately. The weight of the paper figure of the land, divided by the weight of the paper figure of the square acre, indicates with accuracy the number of acres contained in the land.

Applying this method to the squaring of the circle, Dr. Vander Weyde weighed the circle of paper and the proper squares, with the results given in his letter. It will be seen that the calculations of some of our prominent circle squarers, when thus weighed in the balance, are found wanting.

P'I-RYI.

Among the ways that are dark and tricks that are queer, for which the "heathen chinee" is peculiar, one of the cleverest bears the name p'i ryi. It fairly rivals the jaggery of our highly enlightened writing mediums, and is employed for the same useful purpose. When the pig-tailed earnest enquirer realizes the truth which the Widow Bedott versifies:

> "Poor short-sighted critters, we
> Kant calculate what's going to be
> And, like enough, never'll take place:"

he consults an oracle, much as pig-headed enquirers do with

us. The oracle does not put a slate under a table to be written on; he writes on the top of a table, previously dusted with sand or flour. The pen—that is to say the brush, for no other sort of pen or pencil is used in writing Chinese—is suspended by a string from the rim of an inverted wicker rice basket, which is balanced on the fingers of two persons sitting on opposite sides of the table. After the proper period of quiet waiting, the pen begins to move, writing out the answer to any question which may be put.

On one occasion, the Chinese teacher of the Rev. R. H. Cobbold, who is responsible for the story, consulted an oracle of this sort to discover certain names that were wanting to fill up an ancestral register. On being asked for a particular name, the oracle wrote: "Inquire of another branch of the family." It was done, and the "spirit" at once wrote down the name. The story reminds one of a great deal that passes for evidence outside of China, there being no proof that the names furnished by the "spirit" were correct. It is not surprising that the investigations made by the reverend gentleman were unable to discover the cheat.

Writing of p'i-kyi, in his chapters on China and the Chinese, the Rev. A. E. Moule says: "So great is the mystery, or, if you please, so clever is the trick, that some of the oldest and most wide-awake of the missionaries have been quite unable to explain it away, even when performed under their own eyes and on their own study tables." The chief difficulty seems to be the apparent impossibility of directing by muscular effort the formation of intricate Chinese characters by means of a pen suspended by a string.

LOSS OF A LARGE NEW YORK MAIL.

On the 7th of January the express train that left Washington for New York at 9.30 P. M., in consequence of a misplaced switch, went into collision with a freight train standing on a side track. One man was killed, and another badly injured. The coal oil in the lamps of the postal car was scattered and instantly burst into flames, soon destroying the mails and the contents of the adjoining express car. The mails lost were large, comprising upwards of one hundred thousand letters from the South, bound for New York and other places. The usual daily correspondence of the SCIENTIFIC AMERICAN office was consumed, and a large number of our correspondents will consequently fail to receive their expected replies. We hope they will promptly repeat their enquiries.

IMPROVEMENT IN CANAL NAVIGATION.

It will be remembered that some three years ago the State of New York offered a reward of one hundred thousand dollars for the invention of improved methods of navigating the Erie canal (400 miles in length), whereby merchandize could be transported with greater economy than by the present system of horse towage. A variety of experimental boats were made, all or nearly all propelled by steam. The ultimate result was that none of the competitors succeeded in complying with the peculiar conditions of the law, and they were finally modified, and under the modification an award was last year paid to the owner of the Baxter boat and to one other competitor. So ended the State reward project. But there is still a strong demand for improvement, and the subject is well worthy the attention of ingenious minds.

General Thayer, Canal Auditor of this State, takes up the subject in his recent report, and gives expression to the following eminently practical views:

"The Baxter Steam Canal Boat Company has been organized, and during the past season has constructed and operated seven boats, which, according to reports furnished this department, have proved successful, both in regard to increased speed and greater economy, as compared with boats moved by animal power. This company is really the first organized to employ steam as a motive power on a scale likely to prove a financial success. There can be no doubt that an organization with a sufficient number of steamers to ensure daily departures, and with convenient wharfage facilities at New York, will command business at remunerative rates. Such an enterprise can secure a large and profitable traffic in both directions on the line of the Erie canal, which of late years has been almost entirely abandoned to the railroad.

A PLAN FOR TOWAGE WANTED.

"One great need, however, has not yet been accomplished, that is, some plan for steam towage or propulsion adapted to the large number of boats now employed, five thousand to six thousand, and moved by animal power.

"Although I do not disapprove of the liberal bounty which the legislature granted to the Baxter boat, still, without intending in the least degree to disparage the merits of that boat, I am inclined to believe that, if the same liberal reward had been open to wider competition, we might possibly have secured a better result. When the law required that the motor should be adapted to the form of boat then in use, that restriction virtually prevented practical mechanical engineers from engaging in the contest. They knew that, as Mr. Baxter fully realized, a boat to be propelled by its own machinery must be of a different form and model from those that were simply towed, and hence were unwilling to assume the risk of being recognized by the commission or rewarded by the State when not adhering to the requirements of the law. Had the time for competition been extended, the mechanical genius of the country would have been enlisted; a greater number of plans would have been submitted, and might not the practical results have been more favorable?

SUCCESS OF CABLE TOWAGE

"The New York Steam Cable Towing Company was organized for the purpose of introducing upon our canals the cable system of towing. That company, during the season of 1872, laid a single cable between Buffalo and Lockport, and, with two steamers especially constructed for the purpose, has been operating the system, experimentally, during the past two seasons. It is claimed by the projectors of the enterprise that, during their experimental operations, 1,400 tuns of freight, with boats containing it, have been hauled in one train by a single cable steamer, against the strong current between Tonawanda and Buffalo, at the rate of three miles per hour, at as low a cost for steam power as any known steam canal boat carrying two hundred tuns, that is to say, doing seven times the work at the same cost for steam. The cable system ought not to be considered an experiment. It has been in successful operation on European canals and rivers for several years, and found to be the cheapest adaptation of steam for towing purposes yet devised. There is no reason why it should not be equally successful on our own canals, and certainly no more profitable field for the operation of the system can be found.

FURTHER IMPROVEMENTS DEMANDED.

"Before dismissing the subject, I cannot refrain from reminding the legislature that the State has made but one earnest effort to introduce steam on our canals. That effort should be continued, and not relaxed until success is assured. With steam successfully established on our canals, we shall command, without fear of diversion, our full share of western trade. The Lyons lock will be finished before the opening of navigation the coming spring. The completion of that structure will give us double locks the entire length of the Erie canal. Cheap and rapid transportation is the great problem of the day, and its solution interests producer and consumer alike. Railroads reaching from nearly all the principal cities upon the Atlantic coast to the great grain markets of the West are striving for supremacy in the carrying trade, and it is quite probable that active competition will have the effect to reduce rates, for a time at least, to a point below actual cost. But with our great lakes, on which a single vessel of modern build will carry one hundred thousand bushels of grain (equal to 300 car loads) from Chicago or Milwaukee to Buffalo, and with the Erie canal in good order, seven feet of water and double locks, together with steamboats and steam towage on the canal and river, through from Buffalo to New York, alongside of ship in five to six days, we can successfully compete with all the railroads in the country, even at the present rates of toll."

AMALGAM FILLINGS FOR THE TEETH.

We are indebted to Dr. J. W. Clowes for a copy of his very excellent essay on the above subject, as read before the Odontological Society of this city. Dr. Clowes has rendered a good service to the dental profession by his long-continued, sturdy support and practice of tin amalgam fillings. He has in times past been ridiculed for this by members of his own profession; but at last it begins to be perceived that, instead of ridicule, he was entitled to honor.

The use of tin amalgams as a filling for the teeth was begun many years ago, but the practice never became general among dentists. This was due to early prejudices against the material, engendered by lack of knowledge and skill in its use. Its employment is, however, being now judiciously revived.

The experience of some of our best dentists, throughout a period of thirty years, has conclusively shown that tin amalgam, properly prepared and applied, is a reliable preservative; while owing to the plastic nature of the amalgam, it may be inserted within sensitive or delicate teeth without pain to the patient, and under circumstances when the use of gold would be inadmissible. This amalgam when first applied is quite soft, and a gentle pressure therefore causes it to fill every interstice of the tooth with certainty. After a few hours' time the amalgam becomes permanently solid.

Complaint has been made that the tin amalgam fillings turn black and cause the teeth to decay. But this is not the case to any greater extent than when gold is used. Some of the worst looking and most badly decayed teeth we ever saw have been those filled with gold by a poor operator. The truth is that, if the dentist is an unskilled man, or if you neglect to keep your teeth scrupulously clean, they will decay and discolor, no matter what fillings are used.

When the decayed cavity in a tooth is properly excavated and filled with amalgam, it will preserve the tooth with certainty; while in general, it looks better in the mouth than gold. Dentists skilled in the use of the amalgam, and patients carrying this filling, will testify to the correctness of this statement.

Next to the breathing of pure air, exercise, and the use of suitable food, nothing more contributes to the preservation of health than the possession of good teeth. All the arts used for their preservation are therefore of the highest importance.

It should never be forgotten that the teeth will not ordinarily decay, either originally or after being properly filled, unless food or other foreign substances are allowed to remain between them long enough to acidify or decay, and thus act injuriously on the dental enamel. The importance of keeping the teeth clean, by brushing, by drawing silk threads between, by frequent rinsing, and other simple agencies, may thus be understood.

Captain E. B. Ward.

We note with regret the death of Captain Eben B. Ward, a well known citizen of Detroit, whose name for many years past has been closely identified with the remarkable growth and progress of our Northwestern industries. Mr. Ward was born in Canada, in 1811, and at the early age of 12 years was rendered dependent upon his own exertions for support. Entering upon the duties of cabin boy on a lake schooner, he speedily rose to command the largest vessels, and ultimately became himself an owner of a great number.

During late years Mr. Ward gradually withdrew from shipping interests, and devoted his talents and capital to the establishment of iron manufactures in his section of the country. He founded the Eureka Iron Works of Detroit, the North Chicago rolling mill, and the rolling mill at Milwaukee. He also made large investments in the Lake Superior iron mines and erected furnaces in the vicinity. He was for many years President of the American Iron and Steel Association, and, in this as well as in other prominent positions, labored to push forward the important industrial enterprises which he had initiated. Pecuniarily his ventures were highly successful, and he leaves an estate estimated at several million dollars. Mr. Ward's death was very sudden, owing to an apoplectic stroke, and occurred on the morning of January 2.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NOVEL SINGLE RAIL RAILWAY.

The Turkish government has recently commenced the construction of a railway, termed the Steam Caravan, between Alexandretta and Aleppo, Syria, a distance of 94·2 miles. A single rail is employed, following the conformation of the land, but raised on a wall 28 inches high and 17·5 inches broad. The vehicles are mounted and straddle, so to speak, both rail and wall. The locomotives are provided below with horizontal, leather-covered wheels, which rest against the sides of the masonry and serve as brakes, and the last vehicle of each train has similar arrangements. Each side of each carriage contains two persons, and the complete train is calculated to accommodate ninety-six.

A NEW WAY OF PRESERVING EGGS.

It is stated by the *Revue Industrielle* that the best method of preserving eggs is to soak them for half an hour in soluble glass of a thick, pasty consistency. The material forms a chemical compound with the carbonate of lime of which the shell is composed, which renders the latter impermeable to air. After immersion, the eggs should be carefully dried and kept in oats or on perforated trays in a dry locality.

SCARLATINA AN EPIDEMIC.

The views of Dr. Alfred Carpenter, published some three years since in the *Lancet*, upon the subject of scarlet fever, ascribing to that disease an epidemic character, are strongly endorsed in a recent issue of the *Medical and Surgical Reporter*. The editor maintains that not only is the disease infectious in the full sense of the term, but also that the malignity of the infection is something frightful. Articles of clothing worn by patients retain a dangerous character for over a year, as do walls, furniture, and in fact everything that has been in the vicinity of the disease and in its spread. The secretions of the body, epidermic scales, and excreta are active carriers of the pestilence.

Thorough ventilation and disinfection are the best means for destroying the poison. Clothing, bedding, etc., should be submitted to a dry heat of 220° Fah. for several hours, and then soaked in a mixture of 1 pound hyposulphite of soda, 2 ounces sulphuric acid, and 8 gallons of water. Rooms should be purified by burning sulphur, and the patient thoroughly cleansed before having intercourse with other people.

VENUS AS A LUMINOUS RING.

Professor C. S. Lyman published in the *American Journal* eight years ago a brief notice of some observations made on Venus when near her inferior conjunction in 1866. The planet was then (for the first time, so far as appears) seen as a very delicate luminous ring.

No opportunity has since occurred of repeating these observations until the day of the recent transit. On Tuesday, December 8, Venus was again in close proximity to the sun, and the author had the satisfaction of watching the delicate, silvery ring enclosing her disk, even when the planet was only the sun's semi-diameter from his limb. This was at 4 P. M. or less than five hours before the beginning of the transit. The ring was brightest on the side toward the sun—the crescent proper. On the opposite side the thread of light was duller and of a slightly yellowish tinge. On the northern limb of the planet, some 60° or 80° from the point opposite the sun, the ring for a small space was fainter, and apparently narrower, than elsewhere. A similar appearance, but more marked, was observed on the same limb, in 1866.

These observations were made with a five foot Clark telescope of 4¾ inches aperture, by so placing the instrument as to have the sun cut off by a distant building while the planet was still visible. The ring was distinctly seen when the aperture was reduced to 1¼ inches. The 9 inch equatorial could not be used, as there were no means of excluding the direct sunlight.

On the 10th the crescent, extending to more than three fourths of a circle, was seen with beautiful distinctness in the equatorial; and on this and two subsequent days, measurements were taken with the filar micrometer for the purpose of determining the extent of the cusps, and consequently the horizontal refraction of the atmosphere of the planet, on the assumption that the extension of the crescent and formation of the ring are due to this refraction.

VARNISH FOR WHITE WOODS.—Dissolve three pounds of bleached shellac in one gallon of spirit of wine; strain, and add one and one half more gallons of spirit. If the shellac is pure and white, this will make a beautifully clear covering for white wooden articles.

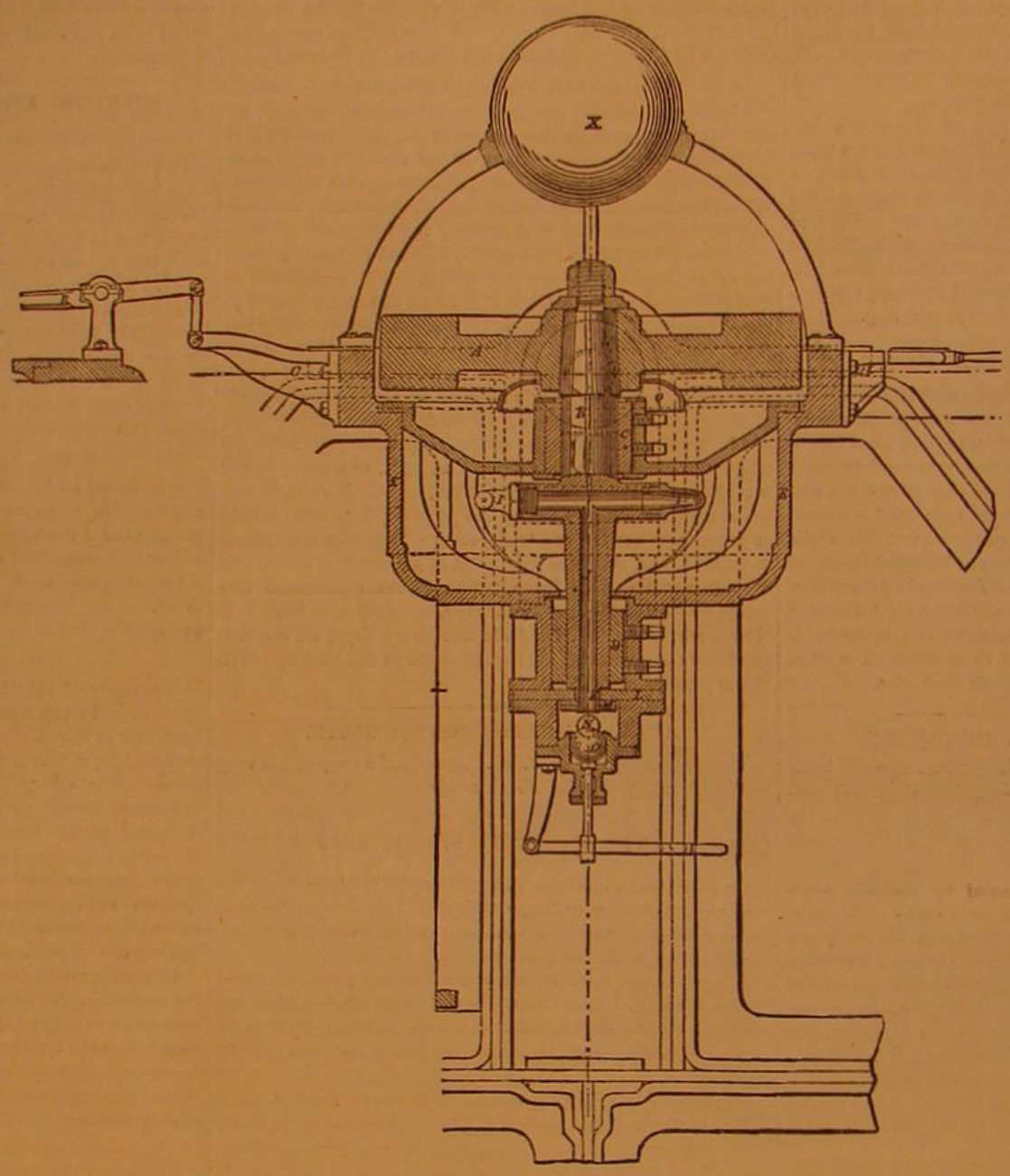
Cocoa nut husk is better than cotton waste and turpentine for taking temporary rust from iron or steel.

THE BESSEMER OSCILLATING SALOON.

As we shall probably soon hear that the oscillating saloon steamer Bessemer is running between England and France, conveying passengers over the uncomfortable and uncertain Straits of Dover, we present to our readers an engraving of the gyroscopic arrangement (by which the saloon is kept in a horizontal position, even under the greatest possible angles of variation of the ship), selected from *Engineering*.

The ordinary form of gyroscope (for an illustration of which see page 91, volume XXXI), is a heavy disk or wheel, made to revolve rapidly in any given plane, tending always to remain revolving in that plane; and it can only have the direction of its action of rotation changed by the application of considerable force, the amount of this force depending upon the weight of the revolving body and its speed of rotation. The manner in which Mr. Bessemer has availed himself of this gyroscopic action will be understood by reference to our engraving, which represents the controlling apparatus as constructed for the steamer. The gyroscope in this case consists of a steel disk wheel, A, 2 feet in diameter, and with a rim 4 inches square, this wheel being made of steel forged so as to make the mass as nearly homogeneous as possible, and carefully turned so as to insure its running perfectly true. As it may possibly be necessary under some circumstances to run the disk at as high a speed as 5,000 revolutions per minute, it is evident that great care is necessary to ensure perfect balancing. The boss of the disk is bored out conically to fit the conical upper end of the spindle, B, the spindle and disk being ground together to secure a perfect fit. A nut and washer at the top secure the disk in place, no keys or pins being used.

The spindle, B, which is also of steel, is steadied by two bearings, C and D, through which it passes, these bearings being capable of adjustment in one direction (that in which a disturbing force will be brought upon the spindle) by set screws as shown. The bearings are fitted to boxes formed by castings fixed to the top and bottom of the gun metal casing or frame, E, this casing being strengthened by internal ribs, and being slung on a pair of trunnions with which it is provided. The center line of these trunnions corresponds with the center line of the vessel, and the casing, E, can thus swing athwartships, but not in a fore and aft direction. The trunnion bearings are supported by wrought iron standards springing from the floor beams of the saloon; and thus, if the axis, B, be kept perpendicular by the gyroscopic action of the disk, A, the casing, E, must rock on its trunnions if the floor of the saloon departs from a horizontal position. The manner in which this movement of the casing, E, is made to control the action of the cabin we shall explain presently; meanwhile we must explain how the gyroscope is driven.



THE CONTROLLING GEAR OF THE BESSEMER SALOON.

It is evident that in such an arrangement, where the slightest interference with the gyroscopic action is to be avoided, the use of belts or other similar driving gear would be inadmissible, and Mr. Bessemer therefore decided to give motion to the gyroscope by means of a kind of reaction turbine, or Barker's mill, formed on the spindle of the gyroscope itself. For this purpose, the spindle, B, has, as will be seen, a pair of arms formed on it, these arms being bored out, and the hole through them communicating with another hole, J, bored up through the spindle from its lower end. Water under pressure enters through one of the trunnions of the casing, E, and passes down through a suitable pipe to a small casing, N, below the bottom of the spindle. Thence it passes up through the hole, J, in the spindle and through the radial arms, finally escaping through the lateral opening in the caps, I, with which the ends of the arms are provided. A small hole, forming a prolongation of J, conducts a supply of water to the upper bearing, C, and any water escaping at the upper end of that bearing is deflected downwards by the dished plate, Q, and thrown back into the casing, E. A flexible waste pipe, not shown in the illustration, conducts away the water from the casing, E, back again to the tank from which the pumps draw, this tank being fitted with screens so as to keep the water perfectly clear, and remove any particles which, if allowed to circulate through the apparatus, might cause a stoppage of the openings in the arms, I.

An exceedingly neat point in the design is the provision made for avoiding any frictional resistances due to the weight of the gyroscope. It will be seen that the lower end of the spindle, B, is considerably reduced in diameter, there being formed, at K, a square and carefully finished shoulder. Below this shoulder the reduced portion of the spindle passes through a phosphor bronze plate, L, the spindle being a free fit in this plate. Below the plate, L, are two metal disks, M, which also fit the spindle freely, and which are kept pressed lightly against the plate, by springs not shown in the engraving. These springs are only required to keep the disks, M, in place when the water is shut off from the apparatus; when in regular work, the pressure of the water tends to force them upwards. As a result of the free fit of the lower end of the spindle in the plate, L, there is always a slight leakage at that point when the apparatus is in use; and this leakage, besides lubricating the lower bearing, D, serves an important purpose, as we shall now explain. The upward pressure of the water on the area corresponding to the section of the lower end of the spindle suffices to balance the greater part of the gyroscope; but inasmuch as variations in the pressure of the water might otherwise create difficulties, the diameter of the lower part of the spindle is made such that, at the ordinary working pressure of the water, about fifty pounds of the weight of the revolving disk, spindle, etc., remains unbalanced. If no means were taken to prevent it, this weight would rest upon the square shoulder, at K, and a rapid abrasion of the plate, L, would result. But the leakage to which we have already referred prevents this. Thus the water leaking through the hole in the plate, L, around the lower end of the spindle comes against the shoulder formed on the spindle, at K, and it is thus brought to bear against an enlarged area, and is enabled to raise the spindle and its attachments. As soon as it has thus lifted the spindle, the leakage water can escape between the plate, L, and the square shoulder, at K; but it is evident that the amount by which the spindle is lifted is strictly limited by the amount of the leakage, and can never become excessive. It is also practically independent of moderate variations in the water pressure, an alteration in pressure merely producing a slight alteration in the thickness of the film of water flowing away between the plate, L, and the square shoulder, at K. Thus in all cases, when in action it is insured that the weight of the gyroscope is carried upon what may be called a water bearing, and one that it is consequently practically frictionless.

If while the apparatus was in action, the supply of water was shut off by means of a valve fitted to the supply pipe, the pressure of the water in the box, N, would at once cease, and the weight of the gyroscope, ceasing to be water-borne, would at once cause abrasion to commence between the square collar at K, and the plate, L. This result, however, Mr. Bessemer has ingeniously guarded against as follows: In a recess at the bottom of the box, N, is a gun metal ball, O, while at the lower end the hole, J, in the spindle, B, is countersunk so as to form a kind of valve seat. Under ordinary circumstances, the ball, O, rests in its recess at the bottom of the box, N; but when it is desired to stop the gyroscope, it is raised by means of the plunger and hand lever shown, until it is close to the lower end of the spindle. Immediately this is done, the pressure of the water carries it against the seat at the lower end of the spindle, and it then revolves with the latter, until, from the water being cut off from the arms, I, the gyroscope comes to rest. During this time, when the gyroscope is running down, as it may be called, the apparatus is still water-borne, as the pressure continues to be maintained on the box, N. When the gyroscope has come to rest, the water is shut off by a valve in the supply pipe; the leakage then reduces the pressure of the box, N, and the ball, O, falls into its normal position at the bottom of the box.

We have now to speak of the manner in which the gyroscope is made to actuate the valves by means of which the movements of the saloon are controlled. The saloon is hung on a longitudinal axis, and on either side of it are placed the hydraulic cylinders by which its movements in relation to the hull of the vessel are controlled. These cylinders are double acting, so that a pull upwards on one side of the saloon is always accompanied by a downward pull on the other, and *vice versa*, and the water has therefore to be admitted to, say, the top of the port and bottom of the starboard cylinder (or the reverse) simultaneously. The whole distribution of the water is effected by a cylindrical slide valve.

The connection between the valve and gyroscope will be readily understood. On the side next the valve the casing of the gyroscope carries an arm which is connected by a link with one end of a lever, the other end of the lever being connected to the valve spindle. Let us suppose that in our engraving we are looking towards the head of the vessel, and that the latter gives a roll over to port. The effect of this would be that, the gyroscope spindle remaining vertical, its lower end would be brought nearer to the valve casing, the arm raised in relation to that casing, the valve lowered, and water under pressure admitted to those ends of the hydraulic cylinders with which the pipe communicates; this admission of water to the hydraulic cylinders raising the port side of the cabin in relation to the hull of the vessel, and thus counteracting the list of the latter to port. On a roll taking place to starboard, the opposite action would, of course, take place.

It will be seen from this description that a slight movement of the saloon must take place before the gyroscope can actuate the controlling valve; but by adjusting the length of the lever in proportion to the length of the arm of the lever to which it is coupled, this movement, it is expected, will be brought within such small limits as to have no practical effect on the comfort of the passengers. This, however, is one of the points which of course can only be conclusively decided by actual trial.

Concrete Gravel Walks.

In Dick's *Encyclopedia of Practical Receipts* are the following directions for making concrete surfaces:

Dig away the earth to the depth of about 5 inches, then lay a bottom of pebbles, ramming them well down with a paving rammer. Sweep them off as clean as possible with a broom, and cover the surface thinly with hot coal tar. Now put on a coat of smaller gravel (the first bed of pebbles should be as large as goose eggs), previously dipped in hot coal tar, drained, and rolled in coal ashes, with an intermixture of fine gravel, and roll it down as thoroughly as possible. Let the roller run slowly, and let a boy follow it with a hoe to scrape off all adhering gravel. Next put on a coat of fine gravel or sand and coal tar, with some coal ashes, to complete the surface, and roll again as thoroughly as possible; the more rolling, the better. It will take some weeks to harden, but makes a splendid hard surface which sheds water like a roof. Do not use too much tar. It is only necessary to use enough to make the ingredients cohere under pressure, and a little is better than too much.

Nickel-Plated Screws.

In car building, nickel-plated screws are rapidly coming into general use. This grows out of the fact that, though their original cost may be a trifle more than silver-plated screws, yet, as nickel does not oxidize by exposure to air, the excess of cost is more than made up in the durability of the plating. Hence, in nearly all of the large car manufactories, nickel-plated screws are superseding silver-plated for use in joinery work. There is a steady increase in the use of nickel-plated screws in house joinery, which argues well for their final adoption for all such work in which silver-plated screws are now employed.

A Telegraphic Congress is to be held in St. Petersburg during the present year. The Russian telegraph department has set aside some $20,000 to pay the expenses.

TUBULAR FLOATING DOCKS.

It is quite unnecessary to insist at the present day on the general usefulness and merits of floating docks. The fact that they can be employed in deep water, and in situations where from the nature of the ground it would be impossible to cut docks on the ordinary system, and that, too, independently of the hight of the tide, is so manifest an advantage that it cannot be questioned that, at a time when increased dock accomodation is urgently required, their principle will be largely employed. The comparative cheapness of their construction also tells powerfully in their favor. To this must be added the consideration that floating docks are capable of being moved from place to place, so that if the demand for their use be diminished at one port they can readily, and at small expense, be moved to another where the demand is greater; while from their comparative cheapness they can at all times be more profitably employed than fixed stone docks which have been built at a large outlay. The story of the great Bermuda dock, safely towed across the Atlantic without accident or unusual difficulty, must be fresh in the memory of all who take an interest in shipping.

Floating docks of the ordinary type consist, as is well known, of parallel or nearly parallel walls terminating in a flat bottom, the space between being divided into a large number of watertight compartments, into and out of which water may be pumped by methods which need no description, and so be raised or lowered at pleasure; so that vessels of various sizes may be put on the dock, and raised by pumping the water out until the workmen can obtain access to the whole of the hull, and perform the requisite repairs, and can then be lowered by admitting the water until the vessel can be floated off. But the tubular dock of Messrs. Clark and Standfield, which we herewith illustrate, is of a totally different construction and is worked in a different manner. Both the bottom and the vertical sides of the dock consist of a number of circular wrought iron tubes, similar to egg-ended steam boilers. The bottom of the dock is formed of about eight circular tubes, which run the whole length of the vessel and extend some feet beyond its ends. These tubes are stiffened inside by angle irons every two or three feet, and are securely braced together by transverse beams of T and angle iron above and below, which are so united, by the tubes themselves and by gusset plates, as to form transverse girders of ample strength to support the vessel if its whole weight rests in the center. The whole forms a platform having sufficient buoyancy to support both the vertical sides of the dock and the vessel itself.

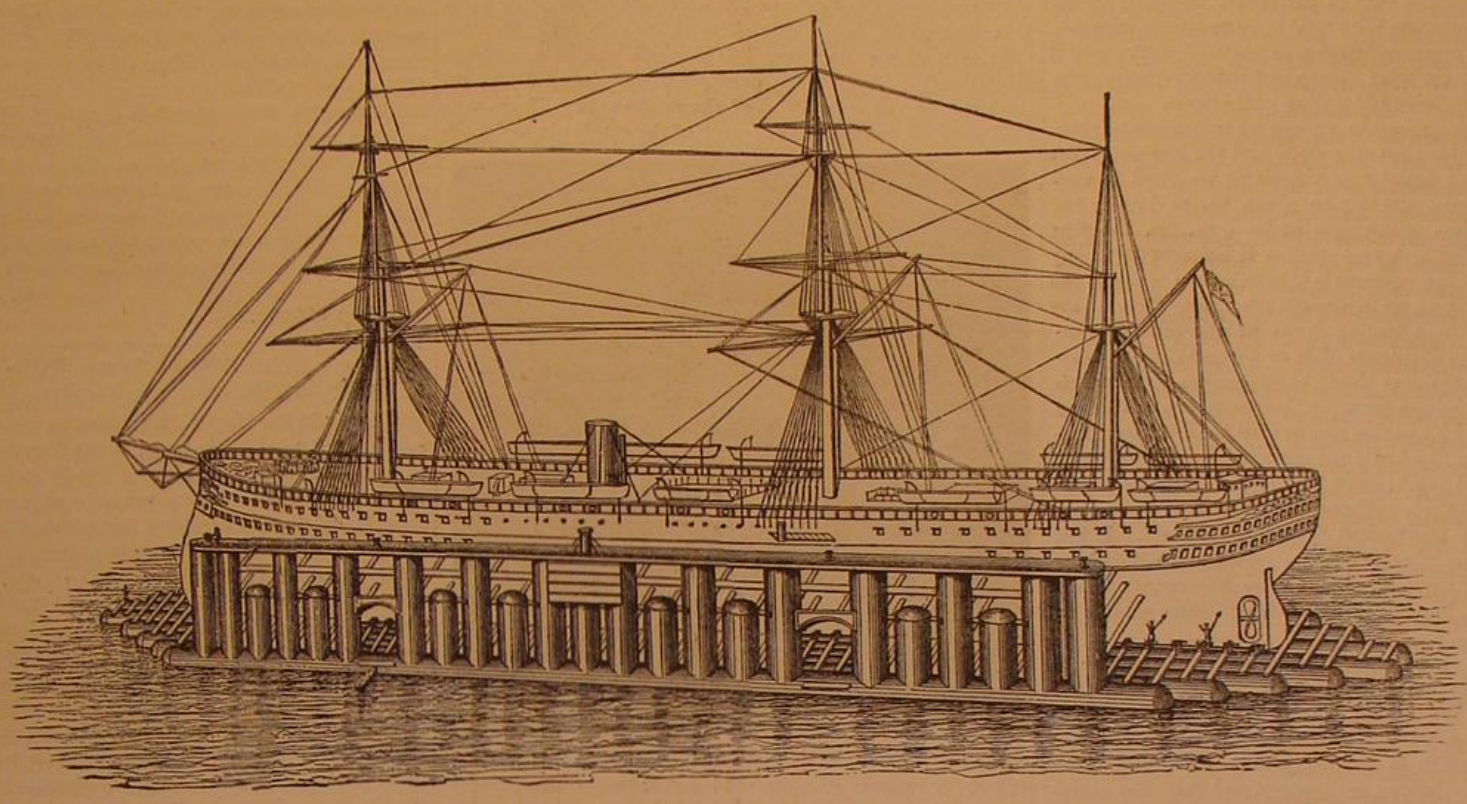
The sides of the dock are also formed of similar tubes which are fixed vertically. Each side is formed of from twelve to twenty-four of these vertical tubes, braced together and connected by a lattice work platform at the top running the whole length of the dock, forming a spacious gangway for the workmen. The longitudinal tubes are so connected with the iron platform at the top as to convert the whole dock into a beam or girder of great depth and of immense rigidity. The center longitudinal tubes are considerably larger than the side tubes, so that the general plan of the dock resembles somewhat that of an ordinary vessel. The two outer tubes are of larger diameter than the others, so as to give extra stability of flotation, and to afford convenient attachment for the side tubes.

The tubes are divided within into a great number of watertight compartments or chambers connected together by pipes; and the raising and submersion of the dock is effected by means of compressed air. The base of the dock is divided into about sixty airtight compartments, and the vertical sides form about forty additional chambers, and the whole of these last are hermetically sealed, so that the dock cannot under any circumstances sink. A certain number of the bottom chambers are so hermetically sealed; but the remainder are provided with valves at bottom, which can be opened or closed at pleasure, and with wrought iron pipes which are grouped together and are all brought to a valve house on the top platform of the dock, and are placed under the control of the valve engineer. When it is desired to sink the dock, the bottom valves are all opened and the air allowed to escape at the valve house until the dock settles down to its lowest level, ready for the reception of a vessel. When it is desired to raise the dock, air is forced into the tubes under compression, the water is expelled through the bottom valves, which are closed as soon as the dock and its vessel are fully raised; it then remains afloat with the vessel docked upon it, without any dependence on the air valves.

The engines are in two pairs, placed near the center of the dock within the vertical tubes, the main from these being led into the valve house. The whole of the watertight compartments in the bottom are divided into four equal groups corresponding with the four corners of the dock, by means of four corresponding valves in the valve house; air is admitted into or out of these respective groups in any desired proportions, so that the dock is maintained at all times perfectly level both in raising and lowering.

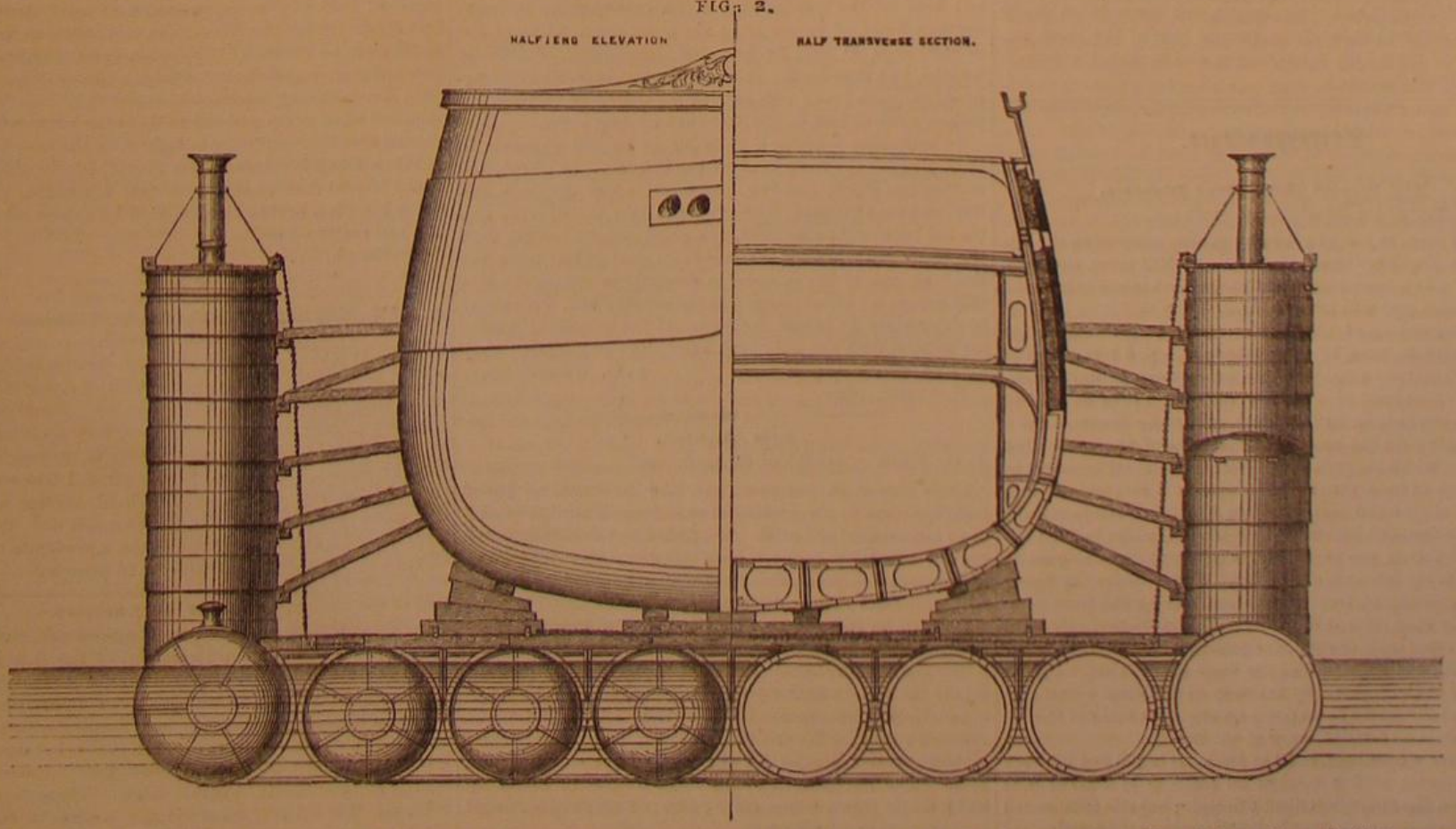
This novel form of dock has, to a great extent, the combined merits of the stone graving dock and of the ordinary hydraulic lift or pontoon dock, together with some advantages which are peculiar to itself. It has immense stability, owing to its great breadth, and to the great number of compartments into which it is divided, which prevent the tendency of the water to flow to the lower side —a tendency which may be, moreover, corrected at any time by allowing the compressed air (which is always kept stored in the vertical tubes) to act temporarily on any of the compartments. It is provided with sliding bilge blocks, similar to those used on hydraulic graving docks, which are drawn under the vessel by chains. The vertical tubes are also well provided with side frames, affording facilities for side shoring similar to those of stone graving docks, so that even loaded vessels may be readily blocked and shored up to any desired extent; this is a point of great importance in the lifting of heavy ironclads. Moreover, by admitting water into some compartments and expelling it from others, the lifting power can be to a great extent exerted directly under the load to be lifted. The vessel when lifted is high and dry above water, an advantage common to all floating docks; but owing to the vertical tubes in this dock being well separated from each other, there are great facilities of access to all parts of the

FIG. 1



CLARK AND STANDFIELD'S TUBULAR DOCK.

FIG. 2.



vessel. Two large gangways of extra width, provided with cranes, are also formed at each side for the landing of heavy timbers, plates, etc. The open sides admit of the air and light circulating freely round the work, so that paint dries and hardens much more quickly than in a sunken dock. From the same cause, repairs can be executed in a much more prompt and satisfactory manner than in a stone dock.

In exposed positions, it is proposed to submerge the dock entirely whenever it appears to be endangered by a cyclone or by stress of weather. The tubular sides afford great facilities for this operation; compressed air is pumped into them at leisure and kept stored up ready for use; after the dock is submerged, the opening of the valves will at any time allow it to expand and raise the dock to the surface. This use of stored-up power is also employed whenever it is desired to raise vessels rapidly—as, for example, in examining bottoms or screws; the power being stored up and ready for use, the docking of a vessel occupies but little time; by opening communication with the water in the tubes, the air expands and expels the water, and the vessel is immediately raised.

Fig. 1 shows a general elevation of the dock, with a vessel supported upon it by bilge blocks and shoring frames; Fig. 2 shows an end elevation and section of the same.

The floating dock appears to occupy an intermediate place between the old stone graving dock and the hydraulic lift dock. Where the number of vessels to be lifted is very great, preference will probably be given to the latter; but the floating dock has advantages of its own. In the first place, its greatly reduced cost renders it suitable for many positions in which the business is insufficient to warrant the cost of a stone dock or an hydraulic lift dock. There are several cases in which floating docks of the ordinary construction are paying dividends of 20 or 30 per cent, in positions in which stone docks would be impossible, or in which their cost would entirely preclude their adoption. It is not always easy to find a suitable position for an ordinary graving dock, and even the hydraulic lift system requires water of a certain limited depth; but a floating dock can be placed anywhere where there is sufficient depth for a vessel to approach, and can be transported from place to place. It has been stated that the tubular dock is raised and lowered by pneumatic means; there is, of course, no theoretical reason why it should not be worked by ordinary water pumps in the usual manner.

Floating docks appear likely to be applied in future to another purpose, to which sufficient attention has hitherto not been drawn. We allude to their employment as building slips for the construction or lengthening of vessels. On the ordinary system it is necessary that a building yard should be closely adjoining deep water, and that the vessel should be constructed and launched on inclined ways, a process not always devoid of risk. By building on pontoons this risk is almost entirely avoided; any shallow river or creek may be utilized, whatever its distance from deep water, and the ways may be laid on a pontoon, either floating in shallow water or resting on the ground in a shallow dry dock temporarily prepared for the purpose; and when the vessel is ready for launching, the water may be admitted to the dock, the valves closed, and the vessel floated out into deep water. In fact, floating docks have not yet assumed their proper place in the naval service. Constructed often in a temporary manner of wood or iron, and from imperfect designs, they have sometimes met with indifferent success or even with disaster; but experience has shown at once both their defects and their merits, and there is no doubt they are destined in future to become one of the most important elements both in navigation and in naval construction.—*Naval Science.*

Correspondence.

The Second Mill River Disaster.

To the Editor of the Scientific American:

I have seen, in one of your city papers, concerning the late break in Hayden, Gere & Co.'s dam on Mill river, the question: If a dam constructed as this one was is not safe, what can be built that will stand?

The dimensions of the dam as stated were: Length 141 feet; width at base, 13 feet; width at top, 6 feet; head of water, 20 feet. I consider those proportions entirely inadequate for that head of water. A dam for a head of 20 feet should have at least 30 feet width of base up stream, from a right angle with the breast or break-over of the water; and whatever width is given to the wall on top must be added to the length of base, thus: If the wall is 6 feet wide at top, the base must be 36 feet, provided the front wall is plumb; if it is angled, the base must be made still wider to suit; but the main things are to make the base up stream at least 1½ feet for every foot in hight of head, and to make the upper wall or sheeting as tight as possible, leaving the front comparatively open; for if the front wall is made perfectly tight and the other loose or open, the pressure really comes on the front wall, as the balance of the work is made much lighter by being in the water. By this way of building a dam, the weight of the water bears down on the work and not against it, as it does on a wall narrow at the base.

We have a dam here, built in 1852. It is 100 feet between the abutments, with a head of 20 feet. It is built of pine timber, on the above described principle; but it is constructed of trestle work, each trestle being entirely independent of the others, except as to sheathing plank laid across them; and they are in no way anchored to the abutments. It has never needed any repairs, and has never shown the least sign of moving.

A. W. IRWIN.

Arroyo, Elk county, Pa.

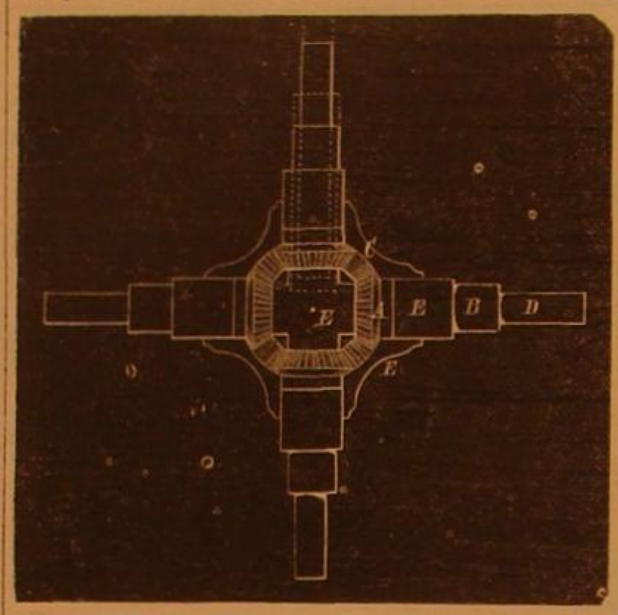
Placing Engine Cylinders in Line.

To the Editor of the Scientific American:

I notice a query in a late issue of your journal as to the best method of placing locomotive cylinders in line.

The most approved modern practice leaves but little to do in placing a cylinder in line, either in stationary or locomotive work, after the cylinder and its bedpiece leave the lathe and planer, except to test the accuracy of the draftsmen and machinists. If the machinists have accurate vertical and horizontal plan drawings for their guide, and work exactly accordingly, no after cutting or trimming will be needed to bring the cylinder into line. In locomotive work, one of the most difficult jobs is to fit the bedpiece to the boiler so that the two faces, upon which the cylinders are to be bolted, shall be exactly in their true position, which are usually indicated to the workman by the drawings.

In order to test the accuracy of the work after the bedpiece has been permanently fixed to the boiler, clamp a cylinder to its seat on the bedpiece and fit a wooden cross (with a pin hole through its center) to the bore of the cylinder at its front end; then pass a fine strong line through the hole, and extend it back so that it shall occupy a point exactly at the intersection of the central line of the driver axle with the vertical plane of motion of the center of the crank pin and con-



necting rod; draw the line taut and fasten it in this position; then apply calipers or a gage at the rear end of the cylinder, between the surface of the bore and the line, above and below and right and left of the line; and if the cylinder is in line, the four distances will of course be exactly the same. It is essential that the two horizontal distances should coincide exactly, and that the central lines of the two cylinders of a locomotive should be exactly parallel with each other, but for obvious reason the exact coincidence of the two vertical distances is not essential to the efficiency or correct working of the engine.

Instead of a wooden cross, as above mentioned, a more convenient instrument, made of metal, may be provided, consisting of four bevel gears, A, which serve also as nuts, which work four sockets, B, with threads cut on their inner ends, all neatly fitted to a light casting, E, having a fine central hole for the line, as shown. A central gear, C, works the four gears, of course all at the same time. Several sets of steel rods, D, may be provided if necessary, of different lengths, and thus render the instrument universal in its application, each set of rods serving for cylinders varying two inches, more or less, in the diameters of their bores.

To determine whether a cylinder of an old engine is in line: Remove the front head of the cylinder, the piston, the stuffing box gland, and the crosshead; apply the cross and line, as above directed, extending the line, through the piston rod hole in the rear head, to a point exactly central with the crank pin when the crank is at its dead point; draw the line taut, and, if the cylinder is correctly in range, the line will occupy a central position in the stuffing box, which may be determined as before directed. If the crosshead guides are parallel with the line, both vertically and laterally, they are also correct.

F. G. WOODWARD.

Worcester, Mass.

Grit Wanted.

To the Editor of the Scientific American:

Little things in universal use, like the American postal card, are often of great importance. A small portion of silica or alumina, or any other grit, added to the sizing, would convert our cards into tablets which could be written upon with a metallic point, and from which no ordinary friction will erase the writing. The writing with the metallic point would also be more legible than the writing with most inks or pencils.

The addition of the small amount of grit required does not injure the surface for writing with a pen, and could not add appreciably to the expense of their manufacture. The government furnishes the cards. Let it furnish also miniature metallic-pointed pencils for the vest pocket at one cent a piece. The government would make money by doing so, and a single pencil would carry on an ordinary citizen's card correspondence for a year.

These metallic points should be made of lead with a small percentage of bismuth. There are two ways of making such pencils. A cylinder of the alloy two inches long and one eighth of an inch in diameter can be wound with fancy paper until the diameter equals one sixth of an inch; the paper might be put on wet, compressed in a *mold* (*maché*) and varnished. Or a polished wooden cylinder, two and a half inches long and one fifth of an inch in diameter, can have a metallic point inserted at one end in the common way.

The present postal card can be written on with a soft metal point, but not with an alloy hard enough to give a fine, black, permanent mark.

W. F. C.

Small Steam Engines.

To the Editor of the Scientific American:

I will give you the result of my experience with a smal boat engine, the vessel being 47 feet long, 11½ feet wide, and 4½ feet deep. She has a three-bladed screw, 4½ feet in diameter with 6 feet pitch, which is made to rise or fall in the water. The engine has two 6 x 10 inches cylinders, running at 120 revolutions per minute, with 70 lbs. steam. The engine exhausts into 75 feet of two-inch pipe, 60 feet of which is in the water outside of the boat, coming in again to conduct the water to the hot well. The pump takes the water to the boiler at 190° Fah. This arrangement makes a very good condenser. The boiler is 7½ feet x 4½ feet, with 120 two-inch tubes.

I have with this boat towed a ship of 700 tuns at 4 miles an hour, with 60 lbs. of coal per hour, and I can make 9 miles an hour when not towing. The mistake generally made by those who have not had experience with boat engines is that they do not give sufficient boiler capacity; and I find that the ample boiler power above described gives an excellent result as to fuel consumption with my small engine.

P. M. BLATCHLEY.

Guilford, Conn.

Splicing Large Belts.

To the Editor of the Scientific American:

There is in the Upper Mills here, in which I am engaged, a 26 inch, 8 ply rubber belt, doing the following duty: It runs off the fly wheel of a 24x48 inch engine, the fly wheel being 18 feet in diameter and making 65 revolutions per minute, driving an overhead line of shafting and two lines at right angles to it, said shafting driving two 8 inch guide mills by an 18 inch rubber belt to each, one at 230, the other at 280, per minute. Each mill finishes sixteen tuns gross of finished iron every 24 hours. Two pairs little mill shears, one pair bar mill shears, and one 36 inch circular saw for hot iron are also driven by the main belt.

In the early part of last summer, an accident occurred by which the above mentioned belt was torn into several pieces and ripped into strips. Knowing that it was impossible to obtain a new belt without ordering it from the makers, we had to do the best we could with what we had; so we patched up a ragged-edged strip of the torn belt (averaging 12 inches wide), thinking to run a part of the above machinery with it. Some laughed at the idea of attempting to run any part of it with such a cord as that looked to be; but to the surprise of all, it performed the entire duty of the original belt, and in so satisfactory a manner that the new belt was on hand some four weeks before a favorable opportunity was afforded to put it on.

A member of the firm here adopted some years ago what was then a new way of fastening the ends of and splicing large belts; it has proved a cheap and reliable way, and is now in general use in this vicinity: Cut your belt perfectly square on the ends and to the proper length; then cut a piece of belt of the same width and thickness, about 3 feet long. Bring the ends of the belt together, and put the short piece on the back of the joint, or outside, and bolt the belt and piece together with what are known as elevator bolts, used for fastening the buckets to elevator bands. The tools required are a brace and bit to bore the holes and a small pair of blacksmith's tongs to tighten up the nuts with.

When a belt becomes dry or glazed, I have always found that a liberal dose of castor oil was a specific; and I have never known a belt to be mutilated by rats or other vermin if it had castor oil on.

Pittsburgh, Pa. T. J. B.

[For the Scientific American.]

A NEW METHOD OF MEASURING SURFACES, APPLIED TO THE CIRCLE.

The fact that the modern chemical balance gives a greater degree of accuracy in the determination of weights, and with much more facility than is the case with any other kind of measurement, especially that of curved lines, has given rise to a method of determining irregularly shaped surfaces of land in square miles or acres, by tracing them on paper of uniform thickness, cutting it out to the correct shape, and comparing the weight of the piece of paper thus obtained with that of a piece cut to the size of a square mile or of an acre, of the same kind of paper, to the same scale. By calculating how often the weight of the latter piece is contained in that of the former, it will give the number of square miles or acres contained in the land in question. This calculation consists, of course, in only a simple division. I can recommend this method fully, as, when carefully applied, it gives results the correctness of which is not surpassed by those of any other method whatsoever. This may be verified by taking regularly shaped forms, easily measured by the ordinary methods. I have in this way determined the surface of islands and continents in square miles, of farms in acres and rods, etc., and am compelled to testify that the method is far superior, in the correctness of its results, to that by means of the graphic method, with the help of Amsler's polar planimeter, now so excellently made in Switzerland and to be obtained in our large cities. The method by the help of the balance gives not much more trouble, less calculation, and less liability to error than the use of the instrument in ques-

tion; and the latter costs almost half as much as a good chemical balance, which is therefore far to be preferred. The planimeter is, however, an instrument enclosed in a box which can be carried in the pocket, and this is an advantage it has over the balance.

In order to test the degree of accuracy which can be obtained by the use of the balance for this purpose, and at the same time practically to demonstrate the fallacy of the assertions of such circle squarers as Lawrence T. Benson, who maintains that the surface of a circle is equal to three fourths of the square of its diameter, I took a piece of paper of uniform thickness, not varying $\frac{1}{1000}$ of an inch from the average thickness of $\frac{1}{1000}$ of an inch, as tested by the micrometic screw used for determining the correct thickness of the covering glasses for microscopic objects to be examined by immersion objectives of very high power. From this paper a square of 12 inches was cut, and its weight found to be 3,511 milligrammes. A circle was then cut out of it, scrupulously made tangent to the sides of the square; its weight was found to be 2,757 milligrammes. This number, divided by the former, gives 0·7855, the quarter of the square 3,511 being 878·75, and three quarters, 2633·25 milligrammes. The actual weight of the circle, 2,757, is thus 123·75 milligrammes more than the weight of three quarters of the square, while the quotient, 0·7855, expressing the relation between the surface of the square and the circle, is remarkably near to the fourth part of the well known number 3·141592, etc., or 0·785398, etc., which latter expresses the ratio between the square of the diameter and the surface of the circle.

In order to find how far the method of weighing could approximate the true ratio, another experiment was made, in which the graduated arm of the balance was used, on which a so-called rider makes it possible to weigh to tenths of milligrammes. [The balance, by the way, is one of the very best of Becker & Sons', and indicates even one tenth of a milligramme when charged with 100 grammes in each scale; it is thus sensitive to $\frac{1}{2000000}$ part of the charge.] A piece of other paper, if possible superior in regard to uniformity of thickness, was cut into a square of 18 inches; its weight was found to be 7,644 milligrammes. The circle, carefully cut from it, tangent to the sides, had a weight of 6,003·5 milligrammes; this, divided by the former number, gives 0·785101, which differs from the theoretical and more correct number, 0·785398, by $\frac{3}{1000000}$ parts.

In order to have an additional test in regard to three quarters of the square of the diameter, the circular paper was folded in 16 radial lines, and 16 chords, spanning segments of 22° 45' each, were drawn and cut so as to change the circle into the inscribed polygon of 16 sides. Its weight was found to be 5,851 milligrammes, which is 118 milligrammes more than three quarters of the square: $\frac{3}{4} \times 7{,}644 = 5{,}733$. It is thus seen that not only the circle cut from a square, but even its inscribed polygon of 16 sides, has a larger surface than three times the square of the radius, which, for the diameter =1, is expressed by 0·75, a number considerably smaller than the more correct expression 0·785398, used by all mathematicians, not because it is simply accepted as true, but because its accuracy has been demonstrated.

It can also be demonstrated that the figure representing correctly three fourths of the square of the diameter is the inscribed polygon of 12 sides. It is remarkable how this also can be verified by the balance in the above manner. For instance, on a square of paper of 15 inches side and 4,901·5 milligrammes weight, a tangent circle was drawn, and then an inscribed polygon of 12 sides. When the polygon was cut out, its weight was found to be 3,676, and the piece cut off around weighed 1,225·5 milligrammes: together, 4,901·5, of which 3,676 is very nearly three fourths.

The above details are not given as a demonstration. Mathematicians do not need experiments of this kind to see into a truth; but it is given only for the benefit of those whose minds are so constituted that they can perhaps only be convinced of their erroneous notions by a practical test, which any one who has a chance to use a good balance can easily make.

New York city. P. H. VANDERWEYDE.

The Electrolytic Preparation of Magnets.

The late Professor Jacobi proposed to determine experimentally whether, by proper arrangement, precipitated iron can be induced to arrange itself so as to form permanent magnets. The author maintains that he solved the question twelve years ago, and obtained magnets by electrolysis. He finds that iron precipitated from a solution of iron containing sal ammoniac is, in a very eminent degree, capable of permanent magnetism; that precipitated from other solutions of iron is magnetic only in a slighter degree. If the precipitate is obtained under the influence of powerful magnetism—prejudicial circumstances being avoided—strong magnets of homogeneous structure are formed from solutions containing sal ammoniac. On the other hand, solutions free from sal ammoniac yield magnets distinguished by their irregular structure, in consequence of which the feeble magnetism of the precipitate is rendered still weaker. A not unimportant degree of coercive power cannot, under any circumstances, be denied to iron, unless altered in its structure by ignition or other processes. The nature of the solutions themselves must be regarded as the cause of the irregularities of structure. While the sal-ammoniacal solution remains perfectly clear, a solid crystalline layer is separated upon its surface. If pieces are broken off, they fall to the bottom. Solutions of ferrous chloride become turbid, and continually deposit a slimy precipitate upon the electrodes. Klein's solution remains tolerably clear, but upon the surface is formed a slimy foam. If any of this falls down, the electrodes are likewise soiled. Thus the iron precipitate is deprived of its homogeneity, and by partial removal of the impurities—for example, by brushing and by the rise of gas bubbles—the formation of partial magnets is explained.—*W. Beetz, in Poggendorff's Annalen.*

Japanese Paper Clothing.

In the Japanese exhibit at the Vienna Exposition was displayed a remarkable variety of objects of common use made entirely from paper, the mode of manufacture of which has hitherto been unknown out of Japan. The articles included handkerchiefs, napkins, garments, lanterns, umbrellas, and many others, all made from a fabric noticeable for its strength and solidity.

A member of the German Society of Orientalists, M. Zappe, has recently explained the process by which this paper is produced. The material used is the bark of the *Broussonetia papyrifera* or paper mulberry, the same source from which the natives of Polynesia derive their tapa cloth and mats, though treated in an essentially different manner.

The culture of the plant is quite simple. Pieces of root, some three inches in length, are placed in the earth so as to protrude slightly above the surface. These speedily send forth shoots, often of nine inches in length during the first year, and increasing threefold in size during the following twelve months. By the end of the third year, the plant attains a hight of about thirteen feet, and by careful pruning is eventually brought to a broad and strong shrub.

In winter, the branches are removed and chopped in bits about two inches in length, which are boiled in water until the bark comes off readily in the hand. Drying of the bark in the air for two or three days follows; and after immersion in running water for twenty-four hours, the material is scraped on a cutting blade so as to separate the two kinds of fibers of which it is composed. The exterior fibers are of dark color, and are called "*saru kawo*": they serve to make paper of inferior quality.

The interior filaments, known as "*sosori*", which are used for fine paper, are rolled in balls weighing some 35 lbs. each. These are washed in running water and left to soak for a short time, after which they are removed and squeezed dry. Boiling then follows, in a lye made from the ashes of buckwheat bran, care being taken that the contents of the vats are constantly stirred. Another washing in water removes all remaining impurities, and the fibers are then pounded, for twenty minutes at a time, upon blocks of hard wood. They are finally massed into balls, and these, by ordinary means, made into pulp. Into the latter a small proportion of a liquid extracted from the root of the *hebiocus manihot* is mixed, and a quantity of rice water, to prevent the ravages of insects. The subsequent treatment of the pulp is similar to the usual process of paper-making.

Leather paper, so called, is made by the superposition of several sheets of the material previously soaked in an oil derived from the *yonoko* (*cellis Wildenowiana*), subjected to strong pressure, and lastly covered with shellac. Clothing is made from a paper called "*shefu*", which is cut into threads more or less fine according to the fabric to be produced. These are twisted by the fingers, previously moistened with milk of lime, and are woven into cloth either alone or with silk. The stuff can be washed and is of great strength and durability. *Papier crépé*, so called by the French from its having the wrinkled appearance of crape, is produced by moistening the sheets and pressing them under rollers having suitable corrugations on their peripheries.

Astronomical Discoveries in 1874.

Professor Daniel Kirkwood gives the following *resumé* of new heavenly bodies discovered during the year just ended.

Six minor planets have been added to the list.

No. 135, discovered by Dr. C. H. F. Peters, February 18, at Clinton, N. Y.

No. 136, by Palisa, at Pola, Prussia, March 18.

No. 137, by the same, April 21.

No. 138, by Perrotin, at Toulouse, May 19.

No. 139, by Professor Watson, at Pekin, October 8.

No. 140, by Palisa, at Pola, as above.

Four comets were also discovered, the most interesting of which, Coggia, we have fully described. The star shower of November 14 entirely failed, and no further return of the meteors in any considerable number can be expected until near the close of the century.

It has been found that the aphelion of Mars differs in longitude but one degree from the perihelion of the minor planet Aethra, discovered in 1873: and that the greatest distance of the former exceeds the least of the latter. These facts indicate the possibility of so near an approach of the two bodies that the disturbing influence of Mars on the asteroid may materially modify its orbit.

New Postal Car.

The Lake Shore railroad has had under construction for some time, and has just completed, at their car works in Adrian, a postal car of a new pattern, intended especially for newspaper work. It has already been put upon the route between Chicago and Buffalo. The car has been built partially as an experiment, and partially from a knowledge of what the service demands. It is 60 feet and 6 inches in length, and weighs 49,300 pounds. It contains 122 distributing boxes in the center of the car, while the ends are arranged for the convenient storing away of the filled sacks. Besides these, the car is fitted up with all the modern conveniences for the rapid and easy disposition of the work. There is room for two men to work; and it is expected that with the convenience afforded they can conduct newspaper distribution as expeditiously as that of letters.

Beginners.

BY PROFESSOR H. VOGEL.

Old and young, when they take up photography, have generally no ideal purpose in view beyond the practical project of gaining their daily bread with the aid of the camera. They care very little for the chemical reactions, or the action of the light, or the disposition of molecules, etc., and less still about the question whether photography is really an art or not: their object is to create a good business, and this goal they try to reach as quickly as possible. Generally speaking, they begin by undergoing a few weeks' tuition under some other photographer, where they learn to coat a plate in a passable manner.

I am often asked how long is really necessary in learning to become a photographer, and I always reply that the matter very much depends upon the individual himself. Those who possess a knowledge of chemistry, and have natural aptitude, will learn to take negatives in a very short time. I could mention a well known scientific man who studied my manual carefully, and came into my studio impressed with a good deal of technical knowledge of the matter, therefore, and under these circumstances there was really nothing for him to learn but the practical manipulations, the pouring on of the collodion, developer, etc., and the adjustment and working of the apparatus, things obviously that can only be taught by demonstrations. This gentleman was qualified to operate in five days. Of course during this short period he had not been looking on with his hands in his pockets, lounging about under the impression that he knew enough; but he practised at home what he learned from day to day, and was exceedingly successful in what he did.

Another pupil that I had, who was an exceedingly good chemist, and thoroughly acquainted with the materials which he had to manipulate, turned out quite the reverse, for, after six months' tuition, he was still a clumsy operator. He belonged to that numerous class which are usually termed "butterfingers." When he took up a plate to clean it, it slipped through his fingers; the dipper he would infallibly break after one or two experiments; the developer ran off the plate, and the filter never acted under any circumstances. I was exceedingly glad to get rid of so awkward a pupil, for I could never have made anything out of him. These two are, of course, merely instances, and do not hold good in all cases.

There are people who enter a studio without any previous knowledge, and who are exceedingly quick at picking up the first rudiments of the art. In a week they are so self-satisfied that they hasten home to follow up their success, but, unfortunately, find themselves stuck fast in a day or two over a question about which they possess no experience.

The matter is easily explained. It is easy enough, when you have good plates prepared for you, good collodion, good dipping bath, good developers, intensifiers, etc., to secure a good picture, especially when found in a well regulated studio; success is here obtained without difficulty; but the beginner has to thank the pure chemicals and the photographer who has prepared the baths and solutions for it, for he does not know how soon these may become changed after working or standing some time. He finds that the collodion, especially if the drainings go back into the bottle, becomes thicker and thicker; it gathers dust and impurities, and thus spots and stains are produced, whose presence he is unable to explain from his eight days' apprenticeship. It is the same with the dipping bath. Unfortunately a bit of lime or kaolin has fallen into the solution, and this has rendered it slightly alkaline, and at once the plates show signs of fogging; or again, the collodion is full of organic impurities, which produce streaks on the sensitive plate; or the film has other defects, such as pinholes, patches of insensitiveness, flatness, etc. All these phenomena, which may not come unexpectedly to those who have studied a photographic manual, are enough to confuse any beginner who relies upon his own brief experience in the matter. If to these well known defects we add, moreover, those that arise from faulty exposure or intensifying, bad fixing or varnishing, we have no inconsiderable host of disagreeables. I have pointed out in my manual as many as sixty different sources of failure, and this number is by no means complete. Those who desire to know something about these vexatious phenomena, and the means necessary for their avoidance, will not be able to finish their apprenticeship in a week, for it is only long practice and study that make the skillful photographer.

Dr. Jacobsen says that a little chemistry should belong to the culture of all men; and the photographer is a man. There are many operators who take excellent pictures, and yet boast that they know nothing of chemistry. This, however, is mere nonsense, for such people, if they have not studied chemistry theoretically, have been so long working with photographic chemicals, and observing the reactions, that they have become possessed of the chemical properties of the things employed. They know from experience that iodide of ammonium when decomposed gives off iodine, and becomes red; that iodine colors collodion yellow, and starch blue; that nitrate of silver is easily dissolved in water, and in alcohol only with great difficulty; that it freezes at a high temperature, and becomes decomposed in one still higher; that it dissolves iodide of silver; that it is reduced by organic substances, etc.

In the building up of this practical knowledge piecemeal, of course many a pint of collodion is lost, many a costly silver bath thrown into the residue pan, and much valuable time frittered away in aimless experiments. The same amount of chemical knowledge they could have acquired in a tenth part of the time and tenth part of the cost by studying photographic chemistry; and this knowledge is readily acquired, for photographic chemistry occupies but a small section in the thick manuals on organic and inorganic chemistry.—*Photo. News*

IMPROVED POTATO CUTTER AND PLANTER.

We illustrate herewith two new agricultural implements, one of which serves for cutting seed potatoes into any number of pieces by means of simple mechanism. The other makes the drill, drops in the seed at any required distances apart, and finally fills the soil back into the furrow.

Fig. 1 of the small engraving is a perspective view of the cutter. The potatoes are contained in a suitable receptacle, whence they are removed by hand and placed singly in the tubes, A. These last are of varying diameter to accommodate potatoes of differing size. B is a strap which passes longitudinally across the table, through a guide piece thereon, Fig. 2, thence over a pulley, and is connected beneath with a treadle. On the upper side of the strap are bolted horizontal blades (one of which is shown at C, Fig. 2) which carry one or more vertical cutters on the portions contained within the peripheries of the tubes, A. These tubes, it will be seen, are slotted in order to allow all the blades to be drawn through them, an operation effected through the strap and treadle already referred to. By increasing the number of vertical cutters in any tube, the number of pieces into which the potato is divided is of course augmented. The system of knives is connected by bars underneath the table, secured to vertical arms extending down through slots, D, in the same.

In operation, after the potatoes are deposited, one in each tube, pressure upon the treadle carries the knives through them; and thus divided, they fall, through apertures beneath the tubes, upon an inclined plane, and into any vessel placed for their reception.

The larger engraving represents the planter, into the hopper in the rear of which the cut potatoes are deposited. Secured upon the axle is a cast iron disk, A, around the periphery of which a number of holes are made in order that the cups, B, may be fastened thereon, at any points or at any distances apart. As this disk revolves, the cups, which are turned rearward, enter the hopper from beneath, passing through an orifice protected by bristles, which serve to prevent the escape of the seed. The cups thus become filled. As they are carried on out of the hopper by the disk, they pass through a box, C (also shown larger, in Fig. 2). The sides of this attachment are fitted with bristles, which, while offering no resistance to the passage of the cup, retain the seed in the same as it is reversed by the rotation of the disk. As soon, however, as each cup emerges from between the bristles its contents drop out, directly, however, into the drill made by the opening plow, D. Wings in rear of the latter, as the machine advances, replace the soil in the furrow, completing the planting. The knives in the cutter divide the seed into pieces of uniform size, and thus the constant filling of the cups is rendered more certain. Both inventions appear to possess labor-saving capabilities which will doubtless commend them to farmers.

Patented through the Scientific American Patent Agency, October 14, 1873, to Lemuel J. Mewborne, of Kinston, Lenoir county, N. C., by addressing whom further particulars regarding sale of rights, etc., may be obtained.

Fig. 1

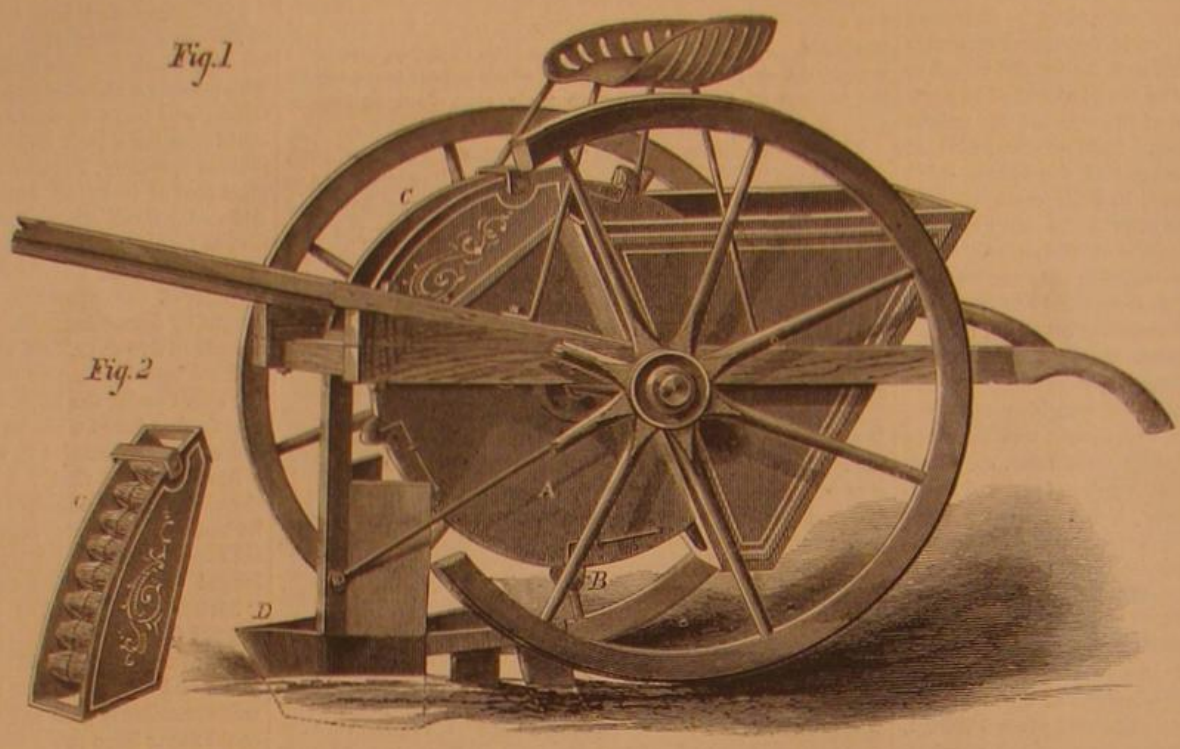


Fig. 2

MEWBORNE'S IMPROVED POTATO PLANTER.

Fig. 1

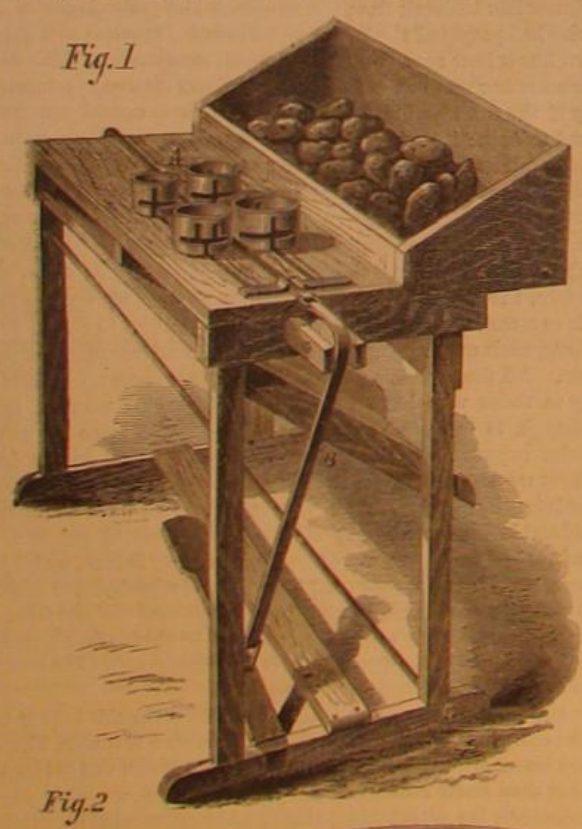
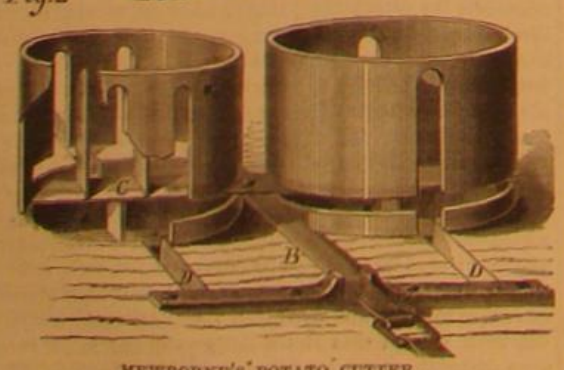


Fig. 2



MEWBORNE'S POTATO CUTTER.

BROADBOOKS' EXCELSIOR PRUNING SHEARS.

We illustrate herewith a novel pruning shears, the feature of which is a cam-shaped blade adapted for giving a very powerful drawing cut.

Fig. 1 represents the shears partially open, showing how the drawing cut is secured. Fig. 2 is the wrench or lever, provided with a hook and stud that drop in perforations on the blade, Fig. 4. Fig. 3 is the other handle, with the blade turned back against the shank, forming, when used singly or without the lever wrench, a hatchet or knife, for trimming small limbs, sprouts, or shrubbery. The cam-shaped knife blade is provided with a series of perforations to receive the hook and stud of the lever wrench. When the handles, Fig. 1, are brought toward each other, as is evident, the drawing cut is produced. The point of contact of the knife edge with the limb, where the power is to be applied to do the cutting, is inside the pivot or bolt that holds the blade. The shape of the hook, Fig. 3, is such as to bring the limb to be cut directly under the fulcrum or pivot on which the blade operates. When the knife blade is applied it holds the limb firmly until cut, and prevents its slipping on the hook. Injury to the bark is prevented, also any crushing of the limbs, the ends being left smooth enough for grafting. In other pruning shears, where the power is applied outside of, and at a distance from, the fulcrum or pivot which holds the two jaws together, slipping of the limb often occurs, thereby mangling the bark. The very long handles also employed frequently crush the branches. The handles of the shears represented in the engraving are only eighteen inches in length, so that the power is in the shears itself instead of in long handles.

Fig. 2 Fig. 1 Fig. 3

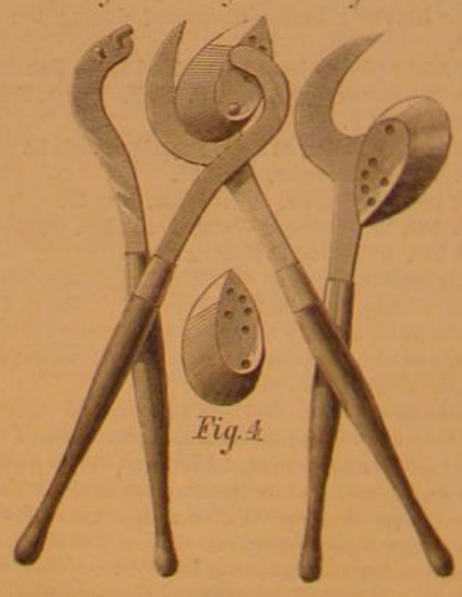


Fig. 4

The efficiency of the device is very remarkable, judging from specimens of its operation forwarded to us. Two fragments of boughs are before us, one 1¼ inches and the other 2¼ inches in diameter, each of which has been divided with a clean, smooth cut, apparently at a single stroke. The wood is hard maple, and the length of the cut is greater than the above diameters, owing to its being made at an angle.

For information, relative to the additional advantages of the tool, and descriptive circulars, address Broadbooks & Co., Batavia, N. Y.

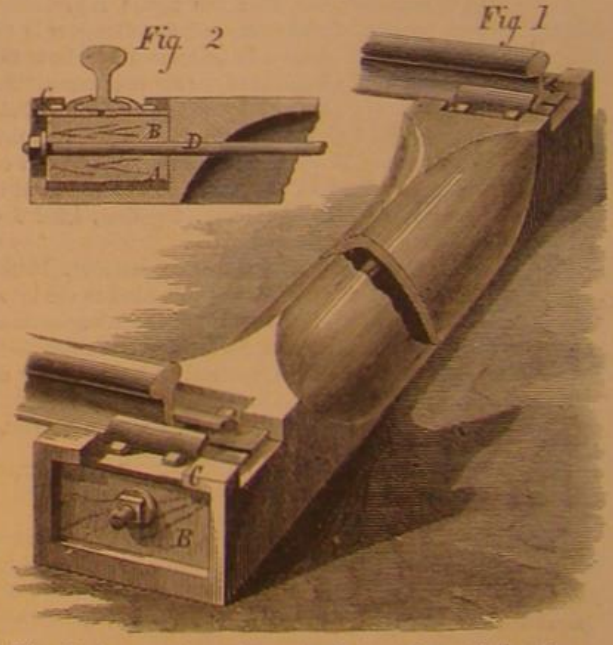
BLAISDELL'S IMPROVED RAILWAY TIE.

The invention illustrated herewith is an iron tie, designed as a substitute for the wooden tie ordinarily employed, and also to provide a strong and elastic support for the rails, while constituting a portion of a permanent way.

The peculiar form of the cast iron body of the tie, clearly shown in Fig. 1, is calculated to give strength and stability, and, at the same time, to insure economy of material. At each end are formed rectangular sockets, open at the top and at the outer extremities. The lower parts of said sockets are flanged in order to retain rubber blocks, A, in the sectional view, Fig. 2, above which wooden blocks, B, are laid. On top of each of the last, the rail chair is placed. The chair is made in two parts, so as to be adjusted readily to grasp the rail between the lip and foot plate. Overlapping portions of the body, C, together with the bolts entering the wooden block, securely hold the chairs in position. Passing longitudinally through the entire tie is a truss rod, D, which is set up outside the wooden blocks with nuts and washers. The apertures through which this rod enters the metal part of the tie are made sufficiently large to allow the depression of the blocks when the rubber yields to superincumbent pressure.

It will be seen that the rubber blocks give an elastic support to the track, tending to nullify the results of jarring and compression. The wooden blocks serve a similar purpose, and may be used alone when any great degree of elasticity is not required. The chairs may be adjusted to hold rails having flanges of varying width; and owing to the firm bearing afforded by the abutting surfaces, they are retained in position with the least possible number of spikes.

Fig. 2 Fig. 1



The sloping contour given to the surface of the tie enables, it is claimed, the wheels of a train, in event of running off the track, to mount and pass over the ties, instead of crushing the same, as might otherwise occur.

Patented January 13, 1874. For further particulars address the inventor, Mr. George D. Blaisdell, Cambridge, Vt.

Mining in Massachusetts.

Some extremely rich mines of lead, silver, and gold have recently been discovered near Newbury, Essex county, Mass., which are now being worked with profit and with the prospect of an extraordinarily valuable yield. A single shaft 25 feet deep is now giving ten tuns per 48 hours, the ore containing all three of the above metals. The net proceeds are $110 per tun. A second shaft lately opened is being worked, and preparations are in progress for extended operations. The mine is supposed to extend for six or seven miles.

Although the above comes from the New York *Tribune*, we fear it is an over-statement.

Finely rubbed bichromate of potassa mixed with twice its bulk of sulphuric acid and an equal quantity of water will clean the dirtiest brass very quickly

COMBINED AQUARIUM AND PLANT CASE.

We illustrate herewith one of the most beautiful accessories to indoor decoration and the cultivation of taste for natural beauty that has ever been brought under our notice. It is a plant case combined with an aquarium, and must be regarded as a happy thought of its designer (a correspondent of the London *Garden*), as, of all forms of vegetable life, aquatics or sub-aquatics are best suited for indoor gardening in towns. If the best results are to be obtained, a commencement should be made by arranging suitable rock work; the kind of plants with which they should be furnished and the best material in which to grow them should then be selected. For cases like that now represented, hundreds of rare and beautiful plants are suitable, and also plants neither rare nor costly, but yet not less interesting. Many grasses, sedges, cyperus, and ferns grow well in such cases if elevated an inch or two above the water level. For submerged vegetation we have valisneria, anacharis, charas, the pigmy-blossomed water lily, the hawthorn-scented *aponogeton distachyon*, fresh green disk-shaped sheath-rooted duckweed, *pontederia crassipes*, the hollow petioles of which are swollen and filled with air, and many other equally interesting plants, all of easy culture.

In the hands of an experienced cultivator, many rare plants would thrive as well in a case like this as in a cool plant stove; and then sarracenias, cephalotus, dionæa, droseras, and even one or two of the true pitcher plants, as *nepenthes phyllamphora*, or *nepenthes gracilis*, might be added, notwithstanding their reputed carnivorous tendencies. Given a few lumps of fibrous peat and a handful of fresh living sphagnum (moss), and even the gorgeous crimson-winged disa might be induced to display its rich colors and fresh, glossy foliage. Plant life, too, may be interestingly associated with animal life. In the water may be lizards, golden and silvery carp, brown-speckled and green frogs, and a whole colony of water beetles and snails; while flitting about overhead, among the plants, may be butterflies of many hues, and a few of the most showy kinds of moths. "Are we, then, to capture such insects on the wing and introduce them? No, they must be bred in their new home, and this simplifies the whole affair, for specimens of all the more showy butterflies may be bought at almost any naturalist's, in the chrysalis state, for at the most a few pence each; and these, if placed in a little box (without a lid) of dry earth, and introduced to the plant case, will come out in due season, like other butterflies, and will delight us with their elegant forms and brilliant coloring. Even the common white speckled garden spider, added to such a case, tends to give it life and interest. This aquarium is divided into two parts; the lower one, as will be seen, for water, fish, and true aquatics; the upper one for sub-aquatics and other plants."

COMBINED AQUARIUM AND PLANT CASE.

New Process for Rendering Wood Incombustible.

An English clergyman, the Rev. Dr. Jones, has distinguished himself by inventing a process for rendering wood incombustible, for which he has obtained a patent. The wood is at the same time made impervious to dry rot and decay, so that two important ends are attained at once. Most of the old methods of preserving wood only render it more liable to fire, as was shown not long ago in the burning of the landing stage at Liverpool. Dr. Jones subjects the wood to a pickling process, in a solution of tungstate of soda and water of the specific gravity of 1·2. The tungstate is made by the addition of tungstate of lime to hydrochloric acid and salt, and it produces in the process as much chloride of lime as will pay all working expenses. The tungstate of soda, from experiments that have been made publicly and privately during the last three years, is proved to render soft woods, such as white and yellow pine, as hard as oak or teak, and it will also restore wood that has been affected by dry rot to the original condition of durability. The London *Daily News* gives the following account of some experiments recently made at Godstone to test the value of the new process:

The experiments made were three in number, and the tests were undoubtedly very severe. Two small pyramids of sticks were made, one of prepared and the other of unprepared wood. These were then well saturated with paraffin and ignited. In the case of the prepared wood, the paraffin soon burnt itself out without communicating the flames to the wood, which was only slightly charred. The other heap burnt fiercely, and in half an hour was reduced to ashes. The next experiment was made with two wooden huts, one of which had been prepared, while the other, built of ordinary Scotch fir, had not. A strong fire sufficient to ignite the houses was made in each, and the effect was about the same as in the preceding experiment. A chest containing a parchment document had been treated by the process, and was thrown into the flames when at their hight, and was taken out some time afterwards, charred indeed as to the outside, but practically uninjured in any other respect. The inside was quite cool, and the wax seals upon the document were intact. Perhaps the most important trial was that which took place with gunpowder. A government gunpowder keg which had been rendered fireproof was used for this experiment. A paper packet containing about two ounces of gunpowder was put in the bottom of the keg, and a sheet of brown paper impregnated with the tungstate was pasted over it and dried. The keg, which was open at the top, was turned upside down, and surrounded by shavings, which were lighted. A fire of petroleum and shavings was kept burning on the top for about a quarter of an hour, without producing the slightest effect on the keg. To make the trial still more complete the keg was reversed again, and lighted shavings were thrown in upon the gunpowder, protected only by a sheet of brown paper. The paper stood the test admirably, and the solution rejected the fire so thoroughly that the paper did not even show a sign of charring. The gunpowder was then taken out and exploded. The properties of his invention, Dr. Jones states, would give the navy the advantage of being always sound in hull and free from any danger of fire, whether from accident or from shot and shell. It would also be a great saving to the nation in preventing the necessity of continually docking and repairing ships.

Car Wheels.

At a recent meeting of the Car Builders' Association, the subject of discussion was "Car Wheels—the Best Method of Fitting, Flange Wear and Causes, Mileage, and Breakage."

Mr. Garey said he had been requested to ask why old wheels could not be remelted and recast. He thought there should be some process by which old wheels could be made available as material for new ones; yet wheelmakers objected to taking old ones to be used a second time in manufacture.

Mr. Jonathan Scoville remarked that, if old wheels were uniform in quality and sufficiently soft, there would probably be no objection to their use as material for new ones. But they are, in fact, never uniform, and, as a general thing, they are hard and, when melted, get still harder. In an average lot of old or returned wheels, for every hundred fit for remelting, there were three hundred that were not fit.

Mr. W. W. Snow, of the Ramapo Car Wheel Works, said that nearly all wheels are supposed to be made of charcoal iron. If these wheels, when used a second time, were remelted with charcoal, he thought they would not deteriorate; but as anthracite coal was generally used in melting, and as this contained more or less sulphur, the iron becomes impregnated with it, and the quality is impaired in proportion. He had observed that, after the sulphur was once in the iron, there was an increased tendency to absorb more of it, and that the second and third melting, and perhaps the fourth, produced nothing but common anthracite iron, unless soft charcoal iron were mixed with it at each melting.

Mr. W. R. Davenport, of the Erie Car Works, asked whether some other disposition could not be made of old wheels than putting them into new ones. Old wheels, mixed with pig iron in a puddling furnace, will give splendid results in rolled bar iron. Every railway company uses enough merchant bar iron to consume every old wheel that they have to sell. Then why should wheelmakers be expected to take old wheels when they can be sold to the rolling mills, where they can be used to advantage, and the quality of the iron improved?

Mr. Snow said his company had supplied parties with a certain number annually, who put them into plate iron, and the testimony was that such plate iron was the best of any in the market. The old wheels are first puddled, of course, and go through the regular process, which necessitates an increase in the cost of plate iron, and it would be the same with bar iron; consequently, if railroad companies give us the wheels to put into new iron, they must expect to pay more for the iron produced. That the iron is better there is no question, according to the testimony of the best iron makers in the country.

CAR WHEEL FITTING.

Mr. W. R. Chamberlain, of the Boston and Albany Railroad, said their wheels were bored out at a $\frac{3}{4}$ inch taper, and the axles turned the same and fitted under a thirty tun pressure.

Mr. Adams said that most wheel fitters try to adapt the pressure to the strength of the wheel; that is, if 40,000 lbs. are applied and it is found the wheel will not bear it, the pressure is reduced to ten or fifteen tuns. There are wheels that will stand 75,000 or 80,000 lbs., and not show any signs of fracture, while others will fracture at 25,000 or 30,000 lbs.; but of course this does not affect the question of what would be right. The wheels at the Boston and Albany road shops were fitted at about 50,000 lbs., and they had very few loose ones.

Mr. Adams had noticed that the axles of many cars had abrupt square shoulders of $\frac{1}{8}$ or $\frac{1}{16}$ of an inch, immediately back of the hub. Did not such shoulders make the axles weaker than it would to run them straight back?

Mr. Snow was of the opinion that it would be better to

have no shoulder at all. If there were one, especially on a rolled axle, vibration would almost invariably cease at that point. In a hammered axle, perhaps not so much so. Iron would granulate from vibration, and this was one reason why hammered axles were considered so much better than rolled ones; and he believed that if they were turned down in the middle, better results would be realized from rolled axles.

Mr. L. Garey said the road with which he was connected some eighteen years ago had a good many broken axles, and on examination many of them were found to be turned with a shoulder at the inner end of the hub, while many of them had a slight check at the shoulder. He then had them made without shoulders, and in no instance had they broken at that point, which, to his mind, was conclusive against shoulders at the point he had named. As to tapered wheel fits, he disapproved of them, especially for broad tread wheels running over different gages.

Mr. Chamberlain thought that 99 wheels out of 100 were bored with a tapered hole "after we had done our best," and that a strain was put on the outside end instead of uniformly along the bore. A wheel pressed on at a $\frac{3}{16}$ taper with a thirty-tun pressure will require seventy tuns to press it off again. A great many more loose wheels that were straight came over the Boston and Albany road than there were tapered.

REJECTING DOUBTFUL WHEELS.

Mr. Lobdell, a son of the proprietor of the Lobdell Car Wheel Works, of Wilmington, Del., read a paper written by his father, giving some of the results of his 40 years experience as a car wheel maker. He pressed on his wheels at a pressure of from 30 to 40 tuns, and had never had any complaints of loose wheels. Flange wear was produced by several causes, among which were mistakes in gaging and marking the wheels, and differences in the hardening of the chill. Fewer accidents were caused by broken wheels than by broken rails or other material, because more care was generally bestowed on their manufacture, and they were more thoroughly tested. His practice had been to break up all wheels that were at all doubtful, preferring to break up a hundred rather than run the risk of one doubtful one. Breakage in service resulted from inherent defects in patterns, or from reduction in weight in order to lessen the cost. The defects in the chill, he thought, were not due to the particular kind of iron used, but rather to the manner in which the ore had been smelted, or to want of care. He had got perfect wheels from hematite, magnetic, specular, and other ores, and also from mixtures of ores. All chilled wheels were liable to blotches or blisters, which of late have become more common, especially on tender wheels and others of small diameter. These blemishes, although unsightly, are not dangerous. Some specimens of wheels were exhibited by Mr. Lobdell, which had been broken through the blisters on the tread, showing that the blisters were only surface defects, and that the iron was sound underneath. One of these wheels (28 inch), made of hematite ore, had run 70,000 miles under a 32-tun engine whose speed was 40 miles an hour.

MILEAGE OF CAR WHEELS.

Mr. Washburn, of the Washburn Car Wheel Company, of Worcester, Mass., said that for the last four or five years he had been making wheels of steel, and had not been able to get a satisfactory comparative statement as to the merits of steel and iron. The iron wheels, of all makers varied very greatly. Steel wheels if perfect, he thought, would eventually take the place of iron, and their mileage would exceed that of iron, six or perhaps eight to one, and would average 250,000 or 300,000 miles; while a chilled wheel had to be a good one to average 40,000 miles. A steel wheel costing $50 would have to run from 100,000 to 125,000 miles to be as cheap as an iron wheel that would run 40,000, but probably the average of the latter would not exceed 30,000. He thought a steel wheel would run from 100,000 to 150,000 miles without turning, and would stand turning two or three times before it was worn out. He had wheels now that had run 300,000 miles and were still good.

Mr. Davenport said it had been supposed to be impossible to keep the mileage of anything but engines, but the Lake Shore road had found a way of keeping the mileage of passenger, baggage, mail, and express cars. Each conductor between Buffalo and Chicago reported what cars he took from the beginning of his trip and what cars he left at the end, and there was no difficulty in this way in getting at the mileage. The report on 1st of April last showed that the wheels removed during the previous six months had averaged over 57,000 miles, and the smallest average he believed was 54,000. These were 33 inch wheels that had run under heavy cars at a high speed. The Lake Shore, he admitted, was not as hard a road for wheels as some others. With respect to iron wheels, he had some in mind that had run 200,000 miles and were good yet. He had the means of determining the data himself. Iron wheels will make a large mileage as well as steel wheels; they are not exhausted at 40,000 miles. There may be on some roads bad wheels that make small mileage. He had nothing to say against steel wheels, but he wanted iron ones to have a fair chance. They are capable of being greatly improved, as well as steel.

Mr. Snow said the Ramapo Works sold their wheels to the Pullman Car Company on a mileage basis of 50,000 miles, receiving credit for any excess and standing the loss for those that fell short, and it was a long time since they had paid any losses. He mentioned this merely for the information of those who thought chilled wheels would not make over 40,000 miles. The lowest average for the last six months was about 59,000. He believed wheel makers could do much to improve the quality of their wheels by attention to details.—*National Car Builder.*

Useful Recipes for the Shop, the Household, and the Farm.

Save the scales of the forge (oxide of iron) for use in annealing hard cast iron or steel.

The best way to avoid water pipes freezing and bursting is to have a cock in the cellar, by which the water can be turned off from the entire house.

Rubber rings, slipped over bottles in packing, ensure safety against breakage.

Protosulphate of iron in powder, rubbed up with raw linseed oil, is an antidote for external poisoning by cyanide of potassium.

Leather can be made hard by saturation in a solution of shellac in alcohol.

In taking up belts, the time used in carefully cutting the belt square is always time saved.

Before washing almost any colored fabrics, soak them in water, to each gallon of which a spoonful of oxgall has been added. A teacupful of lye in a pail of water is said to improve the color of black goods. A strong tea of common hay will improve the color of French linens. Vinegar in the rinsing water, for pink and green, will brighten those colors; and soda answers the same end for both purple and blue.

To make silk which has been wrinkled appear like new, sponge on the surface with a weak solution of gum arabic or white glue, and iron on the wrong side.

The advantage in tensile strength, when holes are drilled in steel rather than punched, is calculated to be 25·5 per cent.

To test the quality of wool, take a lock from the sheep's back and place it on a measured inch. If the spirals count from 30 to 33 in the space of an inch, it equals the finest Electoral or Saxony wool grown. The diminution of the number of folds to the inch shows the inferiority.

An excellent bronze for small castings may be made by fusing together 95 parts of copper by weight and 36 parts of tin.

Paraffin is the best material for protecting polished steel or iron from rust.

Put hard sand instead of ashes on slippery sidewalks.

The parings of a bushel of apples are said to yield a quart of cider, by the aid of a hand press.

A French meter is about fifty times the diameter of a five cent piece. The same coin weighs exactly five grammes.

A cracked bell which gives a jarring sound may be improved by sawing or filing the ruptured edges so that they are not brought together by the vibration of the blow.

Photographers who use large quantities of nitrate of silver should allow all the excess of silver, acetic acid, and other matters from the plates undergoing development to run into stone jars containing fragments of zinc. By that means the metallic silver may be collected; it should then be digested with dilute sulphuric acid, washed, and dried in an oven, so that quite a large saving may result.

Lead 9 parts, antimony 2 parts, and bismuth 1 part is an alloy which expands on cooling, and which will be found useful in filling small defects in iron castings, etc.

It is said that charcoal will fatten fowls and at the same time give the meat improved tenderness and flavor. Pulverize and mix with the food. A turkey requires about a gill a day.

Lampblack and butter are used to prepare ribbons in hand stamps.

The following is a convenient table for sign painters, or others who have occasion to make lettering. Supposing the hight of the capital letters to be ten, the widths are as follows: B, F, P, ten: A, C, D, E, G, H, K, N, O, Q, R, T, V, X, and Y, eleven: I, five: J, eight: S and L, nine: M and W, seventeen: Z and &, twelve: Numerals: 1 equals five: 2, 3, 5, 7, 8, nine: 4, eleven: 6, 9, 0, ten. Lower case letters (hight six and a half): Width: a, b, d, k, p, q, x, and z, seven and a half: c, e, o, s, seven: f, i, j, l, t, three: g, h, n, u, eight: m, thirteen: r, v, y, six: w, ten.

Glycerin is an excellent coating for the interior of plaster molds.

A strong solution of sulphate of magnesia gives a beautiful quality to whitewash.

Glass can be drilled with a tool moistened with dilute sulphuric acid. This last is better than turpentine.

To wash calico without fading, infuse 3 gills of salt in 4 quarts of water. Put in the calico while the solution is hot, and leave until the latter is cold. It is said that in this way the colors are rendered permanent and will not fade by subsequent washing.

Rancid butter, pork, and lard casks may be purified by burning straw or shavings in them.

White lead rubbed up with linseed oil to the consistence of paste is an excellent application for burns.

Gelatin mixed with glycerin is liquid while hot, but an elastic solid when cold. Useful for hermetically sealing bottles.

To clean cider barrels, pour in lime water, and then insert a trace chain through the bung hole, remembering to fasten a strong cord on the chain so as to pull it out again. Shake the barrel until all the mold inside is rubbed off. Rinse with water, and finally pour in a little whisky.

A piece of paraffin candle about the size of a nut, dissolved in lard oil at 140° Fah., the mixture applied once a month, will keep boots waterproof.

Adding to the width of a belt and of the faces of the pulleys increases immensely the power of conveying force. A wide belt is always better than a narrow one strained to its utmost capacity.

Black cement for bottle corks consists of pitch hardened by the addition of resin and brickdust.

One ounce each of muriate of soda, cream of tartar, and alum, boiled in a gallon of water, gives plate a beautiful whiteness. Dip the article in the mixture, remove, and rub dry.

Soap and water is the best material for cleaning jewelry.

Awnings may be made waterproof by plunging first in a solution containing 20 per cent soap, and afterwards in another solution containing the same percentage of copper. Wash afterwards.

A handful of quicklime, mixed in four ounces of linseed oil and boiled to a good thickness, makes, when spread on plates and hardened, a glue which can be used in the ordinary way, but which will resist fire.

A good walnut stain for wood is composed of water, 1 quart; washing soda, 1½ ounces; Vandyke brown, 2½ ounces; bichromate of potash, ¼ ounce. Boil for ten minutes and apply with a brush, either hot or cold.

A piece of alum as big as a hickory nut will render clear a pail of muddy water. Dissolve the alum, stir, and allow the impurities to settle.

The length of the double whiffletree and the neck yoke for a sleigh should be just as long as the sleigh is wide from the center of one runner to the other.

Amalgam Fillings for Teeth.

J. E. E., of Pa., writes as follows: "Having noticed in the SCIENTIFIC AMERICAN several articles on fillings for teeth, I will state a case of my own. In 1854, twenty years ago, in the city of San Francisco, Cal., I had several teeth filled by a dentist. Two of them (front teeth) were rotted nearly half away and fully to the center of each tooth; so that the nerves were exposed, rendering the operation quite painful. The dentist was not quite certain that the teeth could be saved, so he filled them with tinfoil, saying at the time: "If the teeth do not trouble you you can have the tin filling removed, and have them refilled with gold foil." But the tinfoil still remains in them, apparently as perfect as on the day it was put there. I never have received the least trouble from the teeth. One advantage in tin over gold is that it, being nearer the color of the teeth, is less conspicuous, and I believe that it is in every way as good as, if not better than, gold."

Brains.

"No sound working brain," says Oliver Wendell Holmes, "without enough good blood to build it, repair it, and furnish the materials for those molecular changes which are the conditions essential to all nervous actions, intellectual and volitional, as well as those of lower grade. No good blood without a proper amount of proper food and air to furnish materials, and healthy organs to reduce a sufficient quantity of these materials to a state fit to enter the circulation. No healthy organs, strictly speaking, except from healthy parents, and developed and maintained by proper stimuli, nourishment, and use. No healthy parents—no help for it. We are, of course, applying the term healthy to the brain, as signifying much more than freedom from disease. A healthy brain should show, by the outward signs of clear, easily working intelligence, well balanced faculties, and commanding will, that its several organs, if such there be, or its several modes of action, if it works as a whole, are properly developed and adjusted by themselves and in relation to each other."

Raising Almonds in California.

Mr. Olmsted, of Carpenteria, says the Santa Barbara *Index*, has finished picking his crop of almonds. He will have from his orchard this season over five tuns of the Languedoc or soft shell almonds. Mr. Olmsted's orchard is only four years old, and of course is not yet in full bearing. His trees bore a few nuts when two years old. The third year, the average yield to the tree was about five pounds. Two rows in the orchard, covering ground equivalent to two acres, that received great care in planting and special culture, produced 2,000 pounds of dried almonds. This yield, at the wholesale San Francisco market price for the soft shell almond, will give Mr. Olmsted about $230 per acre, after paying all expenses of the year's culture, gathering, sacking, and marketing. Mr. Olmsted keeps the ground clear, cultivating nothing between the trees, nor allowing weeds to grow up to rob them. The trees should be at least twenty feet apart each way.

An Accident in a Lumber District.

On a hillside in Kingston, Tenn., a farmer was cutting logs, and his two little boys were playing near by. The logs, as fast as worked into lengths and trimmed of branches, were blocked with stones or chips to keep them from rolling off down the slope. One of the heaviest became loosened, and began to move, slowly at first, and faster as it gained momentum. The father saw that the younger of the boys was playing, unmindful of the danger, exactly in the path of the immense rolling log, but too far away to be saved by him. He shouted, and the little fellow looked up. The log was then about a hundred feet distant, and increasing rapidly in speed. The boy, dazed by fright, ran straight forward instead of escaping to one side, as he might easily have done. He fled as fast as he could, but the log soon overtook him, rolling over his body and crushing him to death.

To true a corundum wheel, adjust it in the lathe and revolve it very fast, holding a piece of corundum stone against the surface. It is said the piece will melt and unite with the wheel, making the periphery perfectly true.

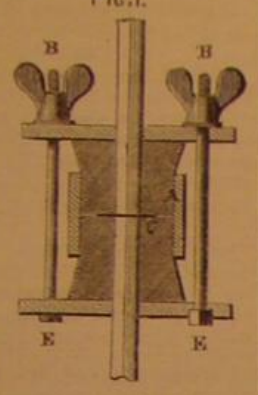
A well tempered bar spring will lose much of its elastic strength by filing off a very thin scale from the surface.

THE PHYSICAL PHENOMENA OF GERMINATION.

In order that a seed may germinate, it must be acted upon by two agents—humidity and oxygen. These are necessary and also sufficient, and the truth of the assertion is susceptible to a very interesting experimental demonstration, the substance of which, together with the illustrations, extracted from *La Nature*, we now present.

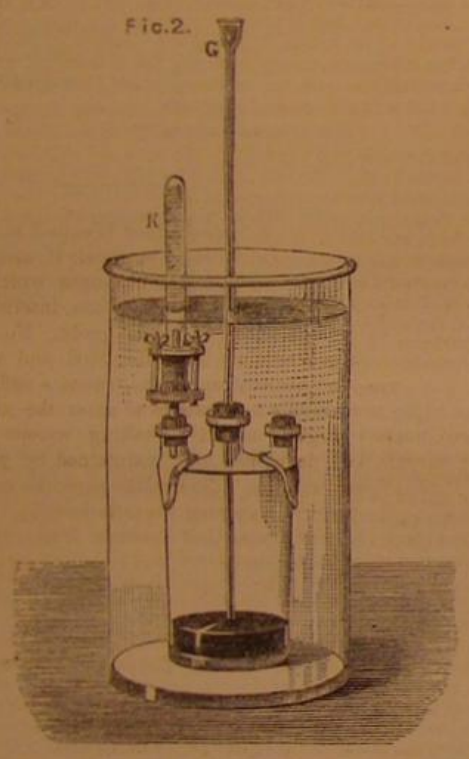
It is first proposed to show that the part of the water is peculiarly to soften the husk or shell of the seed in order to render it permeable to gases. To this end the apparatus shown in Fig. 1 has been constructed by MM. Dehérain and Vesque. The shell of a seed—a bean, for example—is removed and placed behind two caoutchouc cushions, through which a central aperture has previously been made. To prevent the rubber from bulging, a ring of copper, A, is placed so as to inclose the ends of the cushions, and the latter are forced together by the screws, B E. Three screws are provided in each apparatus, so that a uniform pressure may be produced. Two tubes are next introduced, the lower of which enters the cork of a quart bottle containing only air. The upper tube enters an inverted test tube.

Fig. 1.



Thus arranged, the apparatus is plunged in water, as shown in Fig. 2. The fluid penetrates the upper tube and reaches the inclosed seed shell; but the softening effect on the latter is not instantaneous, as, if mercury be poured into the tube, G, it will compress the air in the bottle, and remain stationary without driving a bubble

Fig. 2.



of air through the shell. The test tube, K, remains filled with water. We have thus the proof that a dry shell, or even one recently wet, is totally impermeable to gas.

If the apparatus be left quiet for two or three days, a change takes place. A fine thread of escaping gas first enters the tube, K, then, as the shell softens, a larger current; and finally the tube is emptied, the water being driven out by the entering air, thus proving the proposition which we set out to establish.

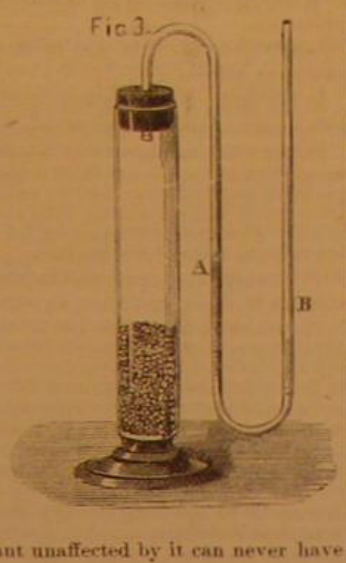
Seed which is slightly moistened by water has the peculiar property of condensing gases with which it is in contact. Grains thus treated are placed under a bell glass over mercury. During the first days of germination a sensible diminution of the volume of contained gas takes place, and this before any disengagement of carbonic acid. This condensation of air cannot take place without a quite notable production of heat, resembling that which happens when hydrogen is condensed in platinum sponge or illuminating gas in a palladium plate. It is this elevation of temperature—as the investigators conclude—due to condensation of the gases, which determines the attack of the immediate principles of the grain by oxygen; it is, figuratively speaking, the spark which causes the beginning of the slow combustion which accompanies germination, and perhaps supports it.

The phenomena which take place, then, from the moment when life begins in the seed, happen in the following order: 1. Passage of atmospheric oxygen through the envelope of the seed, already softened by water. 2. Condensation of gases in the tissues of the seed. 3. Slow combustion of the products contained in the tissues, and evolution of new substances destined to form the young organs.

It is the second point, the most important, which it is next proposed experimentally to demonstrate. In the cork of a test tube is arranged a curved pipe, to serve as a manometer, Fig. 3. The tube is filled about one quarter full with seed (cresses are specified) some hours before it is intended to show the results, and the grains are well moistened. Water is poured into the manometer, and the apparatus is adjusted until the level of the liquid is the same in both branches of the pipe.

After the lapse of a few hours, the water will be seen to ascend tube A, and to continue doing so for several hours; sometimes a few bubbles will rise through and enter the test tube, thus replacing that condensed by the seed. If the apparatus be set aside for a few days, the inverse phenomenon occurs. The seed gradually absorbs all the oxygen in the test tube without leaving a trace; but the emission of carbonic acid continuing, the water is forced back in the manometer, so that, if the whole be placed under water, a gas formed of a mixture of carbonic acid and nitrogen may be collected from the tube, B, Fig. 3.

Fig. 3.



That air and water are the only requisites for seed germination is proved in those beautiful little ornaments which may be made by sprinkling a pine burr with grass seed and suspending it over water, or by placing seed in the orifices of a damp sponge or on a piece of moist porous earthenware. The grain will germinate, sprout, and grow. This will take place even in the dark; but the plants will be yellowish white and not green, thus proving the well known fact that, while light is not necessary to growth, the plant unaffected by it can never have green foliage.

(Translated from the Official Reports upon the Exposition.)

THE VEGETABLE FIBERS AT THE UNIVERSAL EXPOSITION, VIENNA.

BY PROFESSOR DR. JULIUS WIESNER.

Number I.

Any visitor to the Exposition who attentively observed the the multitude of products from tropical lands, and especially the raw materials brought for exhibition from the English, French, Dutch, and Portuguese colonies, cannot fail to have been impressed with the richness of the display of fiberous materials, suitable for spinning, weaving, paper-making, and the like, many of which were (and are) quite unknown in commerce. The vegetable fibers on exhibition might have been numbered by the hundred.

The prodigality of Nature in this domain of production is well calculated to arouse amazement in the mind of the casual observer, whose familiarity with the vegetable fibers is limited to the qualities and uses of hemp, flax, and cotton; while to the practical mind of the specialist, viewing the subject purely from a utilitarian standpoint, the collection is chiefly an exhibit of interesting novelties of questionable industrial value. Least of all, perhaps, this imposing array would impress the botanist, who, familiar with the structure of the several orders of the vegetable kingdom, is aware that the number of plants that will afford a fine fiber, suitable for industrial purposes, is legion.

From the obvious differences in the character of threthee common textile fibers before named, it may reasonably be premised that the fiberous materials prepared from so many heterogeneous plants will vary greatly in value. A careful inspection not only verifies this presumption, but demonstrates further that many of them are of by no means trifling value, but, in everything that relates to quality and adaptability for industrial uses, will bear close comparison with cotton, hemp, or even flax. This assertion, incidentally remarked, is borne out by the fact that not a few of them have been employed from time immemorial by the native races of tropical countries for useful purposes, such as articles of dress, cords, ropes, etc., just as in Europe flax has been similarly utilized for many ages. The world's fairs, so popular in our times, afford the technologist the most admirable opportunity of becoming acquainted with the extent of our resources in the raw materials and products in which he is interested; and as an illustration of their utility in relation to the subject of this communication, it may be remarked that the former expositions at London and Paris contributed materially to the introduction of several now highly prized textile fibers—such as jute and China grass—as articles of European commerce and industry. It appears to us, however, that at Vienna the opportunity for extending this precedent was not properly appreciated.

We shall now invite attention to such of the raw materials of this class as appear to us to be deserving of introduction in our domestic industries.

At the time of the preparation of our report upon the Paris Exposition of 1867, the jute fiber—the inner fiberous bark of *corchorus capsularis*—was comparatively little known. At that time, we dwelt with emphasis upon the importance of the jute industry, illustrating our comments by reference to the unexpected and extensive proportions which jute consumption had assumed in England. To preach the value of jute to-day would be labor lost and unnecessary, since the progress of its manufacture in our midst affords the best evidence that it has received due appreciation.

It may be of interest, in this connection, to note the fact that spun and woven jute may be completely bleached; the practicability of this was formerly denied. The bleached product has not only a white color, but also a fine luster, possessing, in these particulars, decided advantages over hemp. The greater bulk of the jute of commerce is brought from India and neighboring islands, its native home. Of late years, however, the attempt has been made, with promising results, to introduce the culture of the jute plant into other tropical countries. As instances of these endeavors, the Exposition contained jute from Algeria, French Guiana, the Mauritius, and other localities.

The introduction of the China grass (tschu-ma)—the inner bark fiber of *Böhmeria nivea*—into the textile industries of Europe, does not keep pace with that of jute. This is to be attributed partly to the fact that fabrics woven of this fiber, although decidedly inferior to silk both in point of luster and durability, are more expensive than cotton goods of equal quality, and partly to the circumstance that European manufacturers have yet to master the mode of properly manufacturing this material, and thus far have been unable to produce, from the crude bark of *Böhmeria*, the fine, lustrous, long-stapled fiber that is sent abroad from China under this name, either in the fibrous state or woven into its reputed product, the grass cloth. The future of the China grass in Europe will depend largely upon its price. If, by the extensive and systematic cultivation of the plant, the crude fiber is placed upon the market cheaply, and this is supplemented by the acquisition of the skill now wanting in its preparation, its superior qualities—as compared with cotton—cannot fail to secure for it a wide field of usefulness. The cultivation of the *Böhmeria nivea* is spreading quite rapidly. Besides the exhibits of China and Japan, samples of this fiber were displayed from the East Indies, North America, Martinique, Jamaica, Trinidad, Queensland, the Mauritius, and Algeria; and the reports from these countries, as to the facility with which the plant adapts itself to climatic conditions, are generally quite favorable.

A material closely related in character to the China grass, for which indeed it is often mistaken, is the ramie fiber, the inner fiberous bark of *Bähmeria tenacissima*, a native of the south and east of Asia, where it has been cultivated from a remote period. The fiber is coarser, and (in prepared condition) shorter, and less lustrous than that of the China grass. In England, handsome and lustrous goods, both white and colored, are woven from the fiber, but they are inferior to the China grass products. The importance of the ramie, in our estimation, consists rather in the nature of the fiber itself than in the fine, cotton-like product that may be obtained from it Whoever has seen the unusually strong and handsome ropes and cordage, made of this material by the natives of India, and is furthermore acquainted with the fact that the raw ramie fiber far surpasses hemp in point of durability and tenacity, will be forced to admit that its introduction into these last named industries will mark an era of decided progress. The acclimatization of the ramie has lately been attempted in a number of countries, among others in Central Europe. Concerning many of these experiments, nothing positive may be stated, although the specimens on exhibition from various tropical regions were not appreciably inferior to those from the land of its nativity.

Similar in this respect to the ramie is the so-called New Zealand flax, an article known in Europe, and especially in England, for a number of years. It is an extremely strong, tough, and (even in a wet condition) durable fiber, prepared from the leaf of *phormium tenax* (the New Zealand flax lily). It is possible to manufacture from this material woven fabrics that may be used either bleached or unbleached, as many of the New Zealand exhibits demonstrated. But of vastly more importance than these are the wonderfully firm and tenacious ropes, cords, twine, and the like that are prepared therefrom. *Phormium tenax* is cultivated in New Zealand, Australia, the East and West Indies, the Mauritius, Réunion, and Natal; and quite recently its introduction into the south of Europe has been attempted, though with indifferent success.

Precautions in Case of Fire.

An excellent set of rules for guidance for the prevention of and in case of fire, by Dr, Hall, may be briefly summarized as follows:

Keep all doors and windows of the structure closed until the firemen come; put a wet cloth over the mouth and get down on allfours in a smoky room; open the upper part of the window to get the smoke out; if in a theater, keep cool; descend ladders with a regular step to prevent vibration. If kerosene just purchased can be made to burn in a saucer by igniting with a match, throw it away. Put wirework over gaslights in show windows; sprinkle sand instead of saw dust on floors of oil stores; keep shavings and kindling wood away from steam boilers, and greasy rags from lofts, cupboards, boxes, etc.; see that all stove pipes enter well in the chimney, and that all lights and fires are out before retiring or leaving place of business; keep matches in metal or earthen vessels, and out of the reach of children; and provide a piece of stout rope, long enough to reach the ground, in every chamber. Neither admit any one if the house be on fire, except police, firemen, or known neighbors; nor swing lighted gas brackets against the wall; nor leave small children in a room where there are matches or an open fire; nor deposit ashes in a wooden box or on the floor; nor use a light in examining the gas meter. Never leave clothes near the fireplace to dry; nor smoke or read in bed by candle or lamp light; nor put kindling wood to dry on top of the stove; nor take a light into a closet nor pour out liquor near an open light; nor keep burning or other inflammable fluids in rooms where there is a fire; nor allow smoking about barns or warehouses.

In "butting" or meeting belts, the crossings of the lacings should be on the outside.

DECISIONS OF THE COURTS.

United States Circuit Court.--District of Massachusetts.

PATENT INSTANTANEOUS GLUE.—THE MILLIGAN AND HIGGINS GLUE COMPANY *vs.* GEORGE UPTON.

[In equity.—Decided October 6, 1874.]

The plaintiffs in this case are the assignees of Emerson Goddard's patent, Oct. 4, 1868.

What the patentee claimed in that patent is "instantaneous glue," in which claim he especially includes gelatinous or glutinous substances called glue, produced by the process of disintegrational fine cutting akin to rasping, by which the particles are made thin, scale-like, curling, and are thoroughly fractured, so that they form a loose, incompact mass, readily permeable to and solvent in hot water.

Respondent denies the charge of infringement, and sets up several other defenses upon the merits, as follows: 1. That the original patent was not the proper subject of a surrender, as it was neither inoperative nor invalid, and that it was not lawfully reissued, as the reissued patent is not for the same invention as was the original patent. 2. That the alleged improvement was not, at the date of the assumed invention thereof, the proper subject of invention, nor a novelty proper to be secured by the grant of valid letters patent. 3. That the alleged invention, before the alleged making or discovery thereof, was known to and used by the several persons named in the answer, and was described in the several mechanical and scientific works therein mentioned. 4. That neither the patentee nor the complainant ever used or employed the process or the mechanical instrumentalities, or the mode of operation described in the specification.

Held by Judge Clifford:—

Neither reissued nor extended patents can be impeached in suits upon them for fraud in obtaining them.

The granting of a reissue is conclusive to its validity, unless it appears from a comparison of the papers that the invention is not the same with the one originally patented, or that the Commissioner has exceeded his authority in granting it.

The complainant's original patent claimed glue reduced to minute shavings by a rasping process performed in a machine constructed to give the glue such a form and no other. His reissued patent described the same process and machine, and claimed the product. It was held valid, although it also contained amendments evidently intended to cover glue reduced to fine particles by crushing or other means.

In order to sustain a patent for a manufacture, it is essential that invention or discovery must have been exercised in producing it. It is not enough that it is a new article of commerce.

There is no invention in reducing an article of bulk to minute fragments, when it is not improved by adding some new ingredient, or by subtracting one or more.

Comminuted glue, or glue reduced to fine particles, does not differ in its qualities from flake glue, and a patent for it is void.

Bill dismissed with costs.

[Walter Curtis, Esq., for complainant.
G. L. Roberts, Esq., for defendant.]

NEW BOOKS AND PUBLICATIONS.

OUTLINES OF PROXIMATE ORGANIC ANALYSIS, for the Identification Separation, and Quantitative Determination of Organic Compounds. By Albert B. Prescott, Professor of Organic and Applied Chemistry in the University of Michigan. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

The author of this work points out, with much truth, that the rapidly extending list of known organic compounds gives great importance to the evelopment of analytical science, which has for many years been sorely taxed to find means of separating the constituent parts of the products of modern discovery, and of identifying them by their reactions and other characteristic indications. The book is a compendious, well arranged treatise, the definitions and instructions being singularly clear and concise.

SHEEP: THEIR HISTORY, MANAGEMENT, DISEASES, AND NATIONAL VALUE: with Remarks on the Transit of Stock. By William Read, Wool Broker. Edinburgh, Scotland: William P. Nimmo.

This little book, written to wake up the British wool grower to the importance of cultivating and extending his important industry, contains much valuable information on sheep and the raising of the useful animals for meat as well as for wool. It may be studied with advantage by our farmers, and read with interest by lovers of natural history.

PHILOSOPHIC REVIEWS. By Lawrence S. Benson, Author of "Benson's Geometry" and other works. Price $1.25. New York city: J. S. Burnton, 149 Grand street.

The first of these essays is entitled "Darwin Answered, or Evolution a Myth," and in it the author launches thunderbolts against "those who deny a Creator," thus making the very common error that the theory of development attempts to get rid of a First Cause. The second essay is a refreshing specimen of the circle squarer's art. He holds that the area of a circle is exactly three times the square of the radius; and the well known fact that a polygon equal to $3R^2$ can be drawn in a circle, and leave a large fraction over, produces no effect upon his faith. After this, we can hardly suppose that the letter on mensuration by weight, published on another page of this issue, will succeed in converting our author to a belief in truth as it is arrived at by inductive reasoning.

THE TRANSMISSION OF SOUND BY THE ATMOSPHERE. By John Tyndall, F.R.S. Also GIGANTIC CUTTLE FISH, by W. Saville Kent, F.Z.S. Price 25 cents. Boston, Mass.: Estes & Lauriat, 143 Washington street.

The first of these essays is well known to our readers, having been already criticised and commented on in our columns. The second paper is an interesting and exhaustive description of the octopus species, whose appearance and characteristics have lately excited the interest and sometimes the horror of our readers.

REPORT OF THE PROPOSED ENLARGEMENT OF THE MONTREAL WATER WORKS, with a History of the Works up to the Present Date. By Louis Le Sage, Superintendent. With Photographic Illustrations, Maps, and Plans. Montreal, P. Q.: J. Starke & Co., St. François Xavier street.

This is an elaborate account of some of the most important arrangements or water supply ever organized on this continent. The writer estimates that, n nine years' time, a daily supply of 16,000,000 gallons will be needed; and he describes a plan, financial as well as practical, by which this quantity can be obtained.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From December 1 to December 17, 1874, inclusive.

BALE BAND TIE.—R. Terrell, New Orleans, La.
BORING GUN BARRELS.—J. L. Kerr, Alleghany, Pa.
BUTTON HOLE SEWING MACHINE.—J. McCloskey, New York city.
CARBURETTER.—J. F. Lockwood *et al.*, St. Louis, Mo.
CARRIAGE SPRING.—F. H. Simpson, South Windham, Conn.
CLIPPING HORSES, ETC.—J. H. Small, Buffalo, N. Y.
CONDENSER.—E. O. Brinkerhoff, New York city.
CONDENSING METAL, ETC.—J. B. Tarr, Fairhaven, Mass.
COOK STOVE AND FURNACE.—T. J. Whitehead South Paris, Me.
DISTILLATION.—R. C. Brooks *et al.*, San Francisco, Cal.
DRAWING COMPASS.—W. Smith, Boston, Mass.
DRAWING IMPLEMENT.—W. Smith, Boston, Mass.
FEATHER DUSTER.—A. D. Griswold, New York city.
FIRE EXTINGUISHER.—H. S. Parmelee, New Haven, Conn.
FURNACE GRATE, ETC.—S. L. Wiegand, Philadelphia, Pa.
GOVERNOR.—A. R. Klein, New Jersey.
GOVERNOR.—J. Judson *et al.*, Rochester, N. Y.
IRON AND STEEL.—C. I. Eames, N. Y. city.
KNITTING MACHINERY.—E. Tiffany, Bennington, Vt.
LAMP.—R. Hitchcock *et al.*, Watertown, N. Y.
LAMP WICK.—H. Halvorson, Cambridge, Mass.
MAKING ICE, ETC.—J. M. Beath, San Francisco, Cal.
METAL TURNING, ETC.—G. J. Brooks, Brattleboro', Vt.
PORTABLE FORGE.—W. P. Kellogg, Troy, N.Y.
PROTECTION FOR FIRE, ETC.—J. A. Coleman, Providence, R. I.
RAILWAY COUPLING.—C. L. Horack, New York city.
RAILWAY WHEEL.—R. N. Allen, Hudson, N. Y.
REAPER AND MOWER.—W. A. Wood, Hoosick Falls, N. Y.
REFRIGERATOR.—J. J. Bate, Brooklyn, N. Y.
SACK SEWING MACHINE.—A. J. Gove, San Francisco, Cal.
SACK SEWING MACHINE.—H. P. Garland *et al.*, San Francisco, Cal
SHAFT COUPLING.—S. Stuart, New York city.
SHUTTLE.—J. H. Le Moyne, Boston, Mass.
SKATE.—J. L. Plimpton (of New York city), London, England.
SORTING NAILS.—J. Coyne, Pittsburgh, Pa.
SPRING MOTOR.—N. Jenkins, New Haven, Conn.
STEAM ENGINE.—W. B. Reaney, Philadelphia, Pa.
SURFACING TEXTILE FABRICS.—W. Bell, New York city.
SUSPENDER.—J. W. Wattles, Massachusetts.
TEMPERING STEEL AND IRON.—J. F. Simonds *et al.*, Fitchburg, Mass.
TRANSMITTING ROTARY MOTION, ETC.—F. H. Simpson, South Windham, Ct.
TREATING HYDROCARBONS.—G. H. Smith (of New York city), London, England, *et al.*

Recent American and Foreign Patents.

Improved Combined Cylinder and Sectional Boiler

John F. Taylor, Charleston, S. C.—The object of this invention is to provide a steam boiler in which the advantages of a cylinder boiler are retained, while the objections to it arising from the waste of heat are obviated. It consists in combining a wrought iron cylinder boiler with a cast iron sectional boiler, which latter encompasses the cylinder in the place of the masonry, and utilizes a great deal of the waste heat by heating the feed water, which is first admitted to the sectional boiler, the draft from the furnace being so directed among the portions of the sectional boiler as to secure the greatest possible effective power of the fuel.

Improved Automatic Signal Telegraph.

Joseph W. Kates, Richmond, Va.—The object of this invention is to provide an automatic signal telegraph, to be used in hotels, public departments, large business establishments, etc., which shall transmit to a central supply station the most frequently recurring wants of the establishment, and the operation of which shall be so simplified as to be adapted to the ordinary intelligence of persons unskilled in telegraphy. It consists in a series of non-conducting perforated tapes, each perforated to represent its peculiar want. Said tapes are wound around a grooved drum which is on the same shaft with the mainspring of a clock gearing, the said clock gearing, drum, and tapes being so relatively arranged that a withdrawal of the tapes winds up the spring of the clock gearing; and the reaction or retrograde motion of said spring, when the tapes are released, winds up the said tapes upon the drum, and sends the line current through the perforation in the tapes by means of conducting rollers, between which the said tapes pass.

Improved Washing Machine.

John S. Shrawder, Fairview, Pa.—This invention consists in a reciprocating washbox having front and rear ribs, and reversely notched side rubbers rigidly attached thereto. It enables the ordinary washing to be done with unusual facility, while its work is very thorough and effective.

Improved Cotton Scraper.

George W. Beard, Grenada, Miss.—This invention relates to the shape of and mode of attaching scrapers to a plow, and consists in making the cutting edge come to a point at the middle of front, and form an angle with the sloping upper and lower edges; also in the arrangement of the scraper with respect to the plow, so that what the former shaves from the sides of the row will be transferred to the share and moldboard, turned with the furrow slice, and discharged into the middle space between the rows.

Improved Anti-Friction Metal.

Jeremiah K. Guile, Rochester, N. Y., assignor to himself and Joseph B. Champion, New York city.—This is an improved anti-friction metal for journal boxes and other bearings which, it is claimed, will not heat from friction, and will take a high polish. The invention is prepared of zinc, tin, antimony, glass, slaked lime, and borax. The entire journal box is made from the alloy. The inventor submits reports of United States naval engineers detailing extended tests, which show that the use of the metal tends largely to reduce friction as well as to save oil.

Improved Ore Separator.

Benjamin F. Day, of Tamaqua, Pa.—This invention relates to machines for separating coal from slate, and ore from other materials, when there is a difference in the specific gravity; and consists in exposing the coal or ores to the action of an ascending current of water moving with sufficient velocity to carry forward the coal or lighter material while the slate or ores of greater specific gravity pass down through the column of water. In this manner the desired separation is automatically and completely effected.

Side Bar and End Spring Connection for Vehicles.

Ephraim Soper, Brooklyn, E. D., N. Y.—This is a flexible coupling, of leather or other substance, arranged in the form of a strap, attached to the bar and looped around the bolt of a clip attached to a spring for coupling the side bar to the spring. The torsion caused by the lengthening or shortening of the spring will thus be expended on the flexible coupling, and the bars will be free to work without being exposed to the torsion to which they are subject when clipped directly to the springs, as in the common way.

Improved Step Ladder.

Orange M. Sweet, Forestville, N. Y.—In this ladder the standard is adjusted to the main body of the ladder by a hinged brace, which slides by a pivoted sleeve with fastening clamp screw along a guide rod connecting two middle steps. This renders the ladder light and easily adjusted, while sufficiently strong.

Improved Feed Bag for Horses.

Thomas Medley, New York city.—This is a horse's feed or nose bag made of coarse horschair, twisted into strands and woven into a reticulated cloth. By the construction, the meshes of the cloth are of such a size as to allow air and the dust from the grain to pass through readily, while the grain itself will be held securely.

Improved Straw Cutter.

William Boyce, Lowell, Mich.—The hood is hinged to a lid, which is fastened to the long pivoted arms. The hood folds forward, and the lid folds to the rear with the hood, leaving the entire top of the cutter exposed, so that the front parts may be conveniently reached for repairing, and the feed inspected at any period of the cutting process.

Improved Tether.

Morgan & McAfee, Talbotton, Ga.—This invention consists of a long elastic pole with a hitching line attached to the small end, the pole being attached by a crotch at the butt. A suspending wire is attached thereto, and another is secured a short distance above to a strong stake driven in the ground, so that it projects upward and outward from the stake, and at the same time revolves around the stake in such manner as to form an efficient mode of fastening stock to a center, around which they may graze without twisting the rope or becoming entangled in it.

Improved Chuck.

George R. Stetson, New Bedford, Mass.—In this improved chuck, the radial guide ways for the jaws are extended longitudinally through the solid body portion parallel with the axis, and drivers are arranged therein for working the jaws. Said drivers are connected with the jaws by a flange on the side of one in a radial groove in the side of the other, so as to allow of radial motion to the jaws at the same time that they are moved longitudinally. They are also geared by screw threads on the outer edge and threads upon the inside of a ring turning upon the body of the chuck, to be moved forward and backward for driving the jaws.

Improved Forming Block for Fur Goods.

Jefta Popovits, New York city.—The object of this invention is to stretch the waist and back parts of fur garments, so as to impart an enlarged and rounded shape to the same without cutting and sewing up the parts. It is a forming block, of pyramidal shape, resting on its largest side, and having trapezoidal top and bottom sides, and triangular connecting sides of steeper inclination. The fur is stretched in wet state over the body of the block, and retained thereon by suitable fastening straps until completely dried.

Improved Earth Auger.

John Pickle, Kosciusko, Miss.—This invention relates to an earth borer, that cuts and lifts the earth readily from the bore hole; and it consists of a hollow cylindrical body, provided at its inner circumference with projecting and adjustable side-cutting blades, together with intermediate blades twisted toward the center, to form a diametrical connection with the side cutters for cutting and lifting.

Improved Metallic Shutter.

Fisher F. Fletcher, Sioux City, Iowa.—This invention contemplates the manufacture of a single sheet shutter, paneled and braced so as to possess the necessary strength with only a weight of about twenty-five pounds. A continuous sheet is reinforced on the margin or edges by riveted strips, and braced in the middle by a raised panel.

Journal Bearing for Cylinders of Chromatic Printing Presses.

Elié Gaiffe, Paris, France.—This invention consists in the adjustment of the engraved cylinders with reference to the presser roller, for the purpose of securing accurate registration of the different colors. The journal of the engraved cylinder is adjusted horizontally to the presser roller through a set screw, and is adjusted vertically by like means, the pivoted bearing of the journal preventing the change in its vertical adjustment from necessitating any change in its lateral adjustment, as the pressure of the set screw is always transmitted direct to the journal, whether the latter be in a right line or otherwise. A cushion renders the pressure of the cylinder always elastic and uniform.

Improved Envelope.

Thomas H. Bomar, Spartanburgh, S. C.—This envelope is made with two folding sides, one of which is pasted down to narrow flaps after they are turned inward on a central portion, thus forming a pocket for the letter, leaving one of the end flaps ready to be turned over on one side, upon which is written or printed the name and address of the sender of the letter. When the envelope is returned to the writer, the addressed portion with its flap is torn off, which still leaves a perfect envelope, having the name and address of the writer plainly written or printed on the outside.

Improved Fare Box.

Patrick J. Stokes, New York city.—The opening and closing mechanism attached to the inner side of the fare box cover consists of pieces of sheet metal which are pivoted to the cover, so that they may be turned in order to make holes in them correspond in position with the holes in the cover. A spring fastened to the cover has a hook at its end, which prevents the movement of the pieces until a wedge which is pivoted to the cover is pushed down to force the spring outward. This is done when the cover is closed down and placed in the case, so that catches will engage with and turn the pieces and open the apertures. When the box is withdrawn, the pieces are turned in the opposite direction to close the apertures.

Improved Sliding Stem Valve.

Jabez Stone, Waterford, N. Y., assignor to George W. Eddy, same place.—Upon one side of the upper part of the valve stem are formed rack teeth, into which mesh the teeth of a pinion. The shaft of the pinion works in bearings in a chamber which is formed upon the upper end of an arm, upon the lower end of which is formed a collar, which passes around a neck formed upon the upper part of a cap, just below the stuffing box. This construction allows the stem chamber and collar to be turned freely in any direction to bring the handle attached to the shaft of the pinion into any desired position to avoid obstructions, or to enable it to be conveniently reached by the engineer.

Improved Necktie Plate.

Martin Drennan, Brooklyn, N. Y.—This is a little frame having three vertical parallel looping holes, and one horizontal opening at right angles to and below the others, for forming various bows, knots, and ties of scarfs for neck wear. There are slots adapted for attaching the frame to a belt, to be worn as a buckle, and it is provided with a pin for fastening it to the dress.

Improved Lamp Chimney.

Thomas W. Parker, Griggsville, Ill.—Each of the longitudinal halves of a glass lamp chimney is provided with corresponding notches in one of the adjacent edges. A spring clamp having a lug is adapted to fit into said slots. Expansion of the chimney from heat is thus permitted, and yet its parts are held firmly together, and lengthwise movement of one on the other is prevented.

Improved Mashing Process for Breweries.

John C. G. Hüpfel, New York city.—This is an improved mashing process for breweries, consisting in the admixture to the common bruised malt of a suitable quantity of finely ground and bolted malt, to be mashed therewith for the purpose of imparting a stronger malt taste in the beer produced, without interfering with the drawing-off of the worts from the mash tub.

Improved Manufacture of Striping Brushes.

Thomas J. Elder, Lanark, Ill.—This invention consists in making the handles of the brush of two pieces of wood, which clamp the hair, and are held together by means of glue. Wide pieces of thin wood are used with the grain running in the same direction with the strands of hair, so that, when desired, the wide pieces may be broken into a number of smaller sections, forming brushes of less width adapted to the different styles of work.

Improved Ore Roasting Furnace.

Ernst Heiligendorfer, Belmont, Nev.—The ground ore is fed through a hopper into a heater, through which it is gradually transferred by a screw, while a furnace is heating it. Having arrived on a sieve, the ore is quickly spread over the surface thereof, so as to cause its particles to be subdivided in passing through the reticulations. The particles thus pass down from the sieve in numerous little streams, so that the hot gases act readily on all sides of each particle.

Improved Cutting Apparatus for Harvesters.

Charles K. Myers, Pekin, Ill.—An arm having a crosshead and bent end is secured to the under side of the sickle bar. It also passes through and works in a long notch in the upper side of the middle part of the finger bar. In the turned-down rear part of this arm is formed a square hole to receive the head of another bar, by which the sickle bar is driven. The sides of the head of the driving bar are rounded off, so that the said head may fit snugly in the square mortise of the arm, at whatever angle the said driving rod may be.

Improved Horse Hay Rake.

Amos W. Coates, Alliance, O.—This invention consists in pivoting a foot lever over a front-closed and rear-open box, so as to enable the usual toggles to be easily operated by the driver without stooping or changing his position. This construction enables the operator to run the teeth of the rake high or low, according to the evenness or unevenness of the ground in different parts of the same field.

Business and Personal.

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

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. B. H. Allen & Co., 189 & 191 Water St., N.Y.

Carving Machines Wanted—Those of Philipp Hauck & Andrew Metzger, or any other make. Parties will please send price list to I. N. Choynski, San Francisco, Cal.

For Small Boat Engines and Boilers, Wheels, &c., address William J. Sanderson, Syracuse, N. Y.

Protect Your Houses—Champion Burglar Alarm Co., No. 40 West 18th St., New York. Send for circular.

Agents Wanted for the Novelty Paper File. Sample 30 cents. Address Novelty P. F., Boonton, N. J.

Village Property on the Hudson, to exchange for Foundry and Machine Business. No agricultural works wanted. Address Cornish & Congdon, 175 Broadway, N.Y.

J. T. Strain, Hannibal Post, Monroe County, Ohio, wishes to purchase a lathe for turning oars.

"Book-Keeping Simplified." The whole system in a few pages. Cloth, $1. Boards, 75 cents. Sent postpaid. D. B. Waggener & Co., 424 Walnut St., Philadelphia, Pa., Publishers "Waggener's Trial-Balance Book."

Wanted, by Manufactory of Steam Engines and Standard Articles, $30,000. Address John, 1802 Olive St., St. Louis, Mo.

Second Hand Machinist's Tools for Sale, Cheap. D. Frisbie & Co., New Haven, Conn.

Glass Stainer's Materials—Fluoric Acid, Enamel Colors, Metallic Oxides, &c. L. Feuchtwanger & Co., 180 Fulton Street, New York.

Wanted—A Practical Machinist as Foreman of a Shop near New York, employing about twenty men. Must be thoroughly familiar with Steam Engines and Boilers, and a good draughtsman. Address R., Scientific American Office, with particulars of residence, age, references, where last employed, salary expected. No attention will be paid to communications that do not comply with above requirements.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Millstone Dressing Diamond Machines—Simple, effective, economical and durable, giving universal satisfaction. J. Dickinson, 64 Nassau St., New York.

Metallic Pattern Letters and Figures, to put on patterns of castings, all sizes. H. W. Knight, Seneca Falls, N.

Artesian Well Driller—Best of references, when required. Z. Hopkins, Fort Wayne, Ind.

Partners Wanted—More working capital needed. Grounds, Shops, Tools, and Machinery, all in good working order. A rare chance for parties desirous of engaging in the manufacturing business. Correspondence solicited. Address D. Whiting, Ashland, Ohio.

Sheet Metal Drawing Presses—For the best and cheapest, address The Baltimore Sheet Metal Machine Company, Baltimore, Md.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass. Send for sample and price list.

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

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"Fairy" Electric Engines, with battery complete, $6; without battery, $4. Electro-Magnetic Manufacturing Co., 36 Broad St.—P.O. Box 1304, New York.

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

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For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

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

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

Notes & Queries

E. will find details of the process of transferring engravings to glass on p. 208, vol. 31.—J. R. M. will find a rule for calculating speeds of pulleys on pp. 26, 73, vol. 25.—L. K. Y. can make a copper dip by the process described on p. 90, vol. 31.—G. H. B. will find formulæ for calculating the horse power of an engine on p. 16, vol. 29, and p. 54, vol. 30. For a process for making ether, see p. 34, vol. 31.—T. F. S. can calculate the supply of water through his pipes at any given head by the formulæ given on p. 48, vol. 29.—A. M. can refine rosin oil by the process given on p. 266, vol. 31.—C. H. F. can remove inkstains from woolen fabrics by the method described on p. 139, vol. 29.—A. S. T. can temper tools for cutting granite by the process given on p. 202, vol. 31.—W. H. will find a good recipe for mucilage on p. 202, vol. 31.—A. M. and H. A. do not send sufficient data.—G. H., J. F. S., and many others should refer to p. 48, vol. 29, as to friction of water in pipes.—C. F. S. will find directions for making rubber stamps on p. 156, vol. 31.—G. D. F. will find a method of softening paint brushes on p. 75, vol. 28. The manufacture of plaster of Paris from gypsum is described on p. 399, vol. 29.—C. A. S. will find the details of engineers' pay in the navy on p. 394, vol. 31.—J. W. will find how to ascertain the radius of an arc, when chord and hight are known, by varying the formula given on p. 139, vol. 31.—C. A. H. will find directions for making molds for small castings on p. 266, vol. 24.—J. B. can ascertain the lifting power of hydrogen by referring to p. 74, vol. 31, and can calculate accordingly for other gases.—G. F. L. will find the recipe for a hair stimulant on p. 363, vol. 31.

(1) C. C. S. asks: Which has the most strength, a ¾ inch bar of iron with a ⅜ inch hole in it, or a solid bar of ¾ inch iron? A. The solid bar.

(2) G. H. B. asks: 1. Are cannon ever molded of wrought iron, so as to retain their malleability? A. No. 2. Is wrought iron ever run into molds? A. No.

(3) V. L. W. asks: If an engine will do less work with 40 lbs. of steam, will it be better to carry just 40 lbs., or would it be better to let it go up to about 50 or 55 lbs., in order to have dry steam? A. If the steam of a higher pressure is wire-drawn down to 40 lbs., it is better to carry only the latter pressure; but in an engine with an automatic cut-off, the higher pressure would be the best.

(4) E. C. H. asks: What becomes of the exhaust steam when an engine running at full speed is reversed? Does not the engine pump air into the boiler? A. No.

Is it at all probable that, during the great conflagration of Chicago, providing the wind was favorable, that the smoke or scent of fire would be observed in the vicinity of Philadelphia? A. No.

Is the 1,000 foot tower all a hoax, or is to be erected for the Centennial? A. Address the designers.

What kind of joint should be used to close the blow-off port of a boiler by a cap, so to make the most serviceable and reliable joint? A. It is sufficient to screw on the cap.

(5) Z. says: I read in Ganot's "Physics," p. 390, that "as a gas is increased $\frac{1}{273}$ of its volume for each degree C., it follows that at a temperature of 273° C. the volume of any gas, measured at zero, is doubled. In like manner, if the temperature of a given volume at zero were lowered through 273°, the contraction would be equal to the volume, that is, the volume would not exist." It appears to me that, if the volume is doubled for every 273° of heat, it would be reduced one half for the same number of degrees of cold. Therefore at −273° the volume would be ½ of what it would be measured at zero. At −273°×2 it would be about ½; at −273°×3 it would be ⅓. If this be correct, there appears to be no more reason for placing the zero of temperature at −273° C. than at any other point in the scale. A. If the gas is heated 1° C., its volume is increased $\frac{1}{273}$. Similarly if it is cooled 1°, its volume is decreased $\frac{1}{273}$; if cooled 2°, the volume is decreased $\frac{2}{273}$, and so on; so that on being cooled 273°, the volume is decreased $\frac{273}{273}$.

(6) C. F. O. Jr. says: A boiler whose dimensions are 9 feet long and 2 feet 6 inches diameter, with a steam dome 20 inches in diameter and 24 inches high, the shell being $\frac{5}{16}$ inch thick, and the heads ⅜ inch thick: made of the very best C. H. No. 1 Pennsylvania iron (except the sheets at the bottom half of the boiler and the back head, which are of Eureka or Sligo fire-box iron) is to be used for supplying a steam heating apparatus with steam at 20 lbs. pressure. It is to be tested to a hydrostatic pressure of 50 lbs. to the square inch. Is not this high pressure injurious, and will it not weaken the boiler materially? A. If the test is properly performed, by filling the boiler with water and heating it, we do not think that any material injury will result.

(7) M. H. K. asks: What is the simplest mechanism which I can use to turn a light machine, very rapidly if possible, using an air pressure from a fan? I would like to have the air enter at the center and discharge at circumference of the motor. A. Something on the plan of the Barker mill would no doubt serve the purpose.

(8) G. C. P. Jr. asks: What is the cause of the thumping noise in engines? A. Probably water in the cylinder and pipe.

(9) W. S. S. says: 1. I want to make a cylinder casting with ports about $\frac{1}{16}$ inch wide. What can I make the cores of so that I can clean the ports out easily? A. Of baked clay and sand. 2. Would it do to make the patterns as for large cylinders? A. Yes. 3. Would ports $\frac{1}{16}$ inch by 1½ inches be large enough for a cylinder 1½ inches by 3 inches? A. Yes.

(10) C. S. asks: I want to use 2 horse power; could I not get it from a 10 horse engine as cheaply as I could from a 2 horse engine? A. In some cases, the large engine might be run as economically as the small one, but in general, no.

What pay do locomotive engineers and firemen get? A. Engineers from $80 to $100 a month, firemen from $40 to $60.

How is acid made out of wood, for setting the colors in cloth? A. It may be prepared by treating nutgalls with ether.

(11) G. B. asks: Does it make any difference as to the safety of a bridge whether a train is run over it at the usual or at reduced speed? A. It is safer to cross the bridge at a reduced rate of speed.

(12) C. B. W. asks: 1. What is meant by a sniffing valve? A. A blow-through valve attached to an engine for the purpose of expelling the air. 2. What is an equilibrium valve? A. It is a valve which can be moved without being affected by the pressure of the steam. 3. What is a gridiron valve? A. A cut-off slide valve with several ports. 4. What is multiple gearing? A. A train of gear wheels.

(13) R. O. B. asks: Is the odontograph applicable to internal epicycloids as well as to all other forms? I have tried in vain to adapt it to the above-named gearing; and if it can be applied to wheels gearing internally, I want the process and also the radii of a pair of wheels so gearing, so as to occupy a space 24x16 inches and 1½ pitch. A. The odontograph can be used as you suggest. You will find an explanation of the method and a very good summary of the rules for proportioning wheels in the article on gearing in Appleton's "Dictionary."

(14) G. S. asks: How much will a brass tube expand in length when heated from the temperature of cold water (as it comes from hydrants) to that of boiling hot water, the tube being 1¼ inches in diameter and the bore 1 inch, and the tube being 1 foot long? How long a tube would be required to expand ⅛ inch in length? A. It will expand about $\frac{1}{1000}$ of its original length. From this you can readily calculate the requisite length. 2. What hard metal expands most, and how long a tube of that metal expands ⅛ inch in length? A. Zinc expands $\frac{29}{10000}$ of its original length.

(15) C. F. asks: Is there a rule by which I can ascertain the power exerted by a pump, say with three plungers of ¾ inch diameter and 4 inches stroke, driven at the rate of 50 strokes per minute by a 6 inch belt? A. It must be determined by experiment.

(16) C. N. says: 1. I am making an engine, to run a jeweler's lathe, of 1 inch bore and 1½ inches stroke. Will such a cylinder be large enough, and will $\frac{1}{16}$ inch be enough cushion? A. The dimensions will answer very well. 2. At what point should steam be cut off? A. Three fourths of the stroke.

(17) N. A. J. asks: How can I ascertain the number of acres in a triangular piece of land? My method is to add the three sides together and take half their sum. From this take the three sides severally, and multiply the half sum and the several remainders together and extract the square root of the product. Am I right? A. This method is correct.

(18) A. G. C. asks: In a plain slide valve engine, is it better to have an extra large steam chest? A. No.

(19) H. M. asks: What is the weight of 1 cubic inch lead, wrought iron, and cast iron, respectively? A. Average: Lead 0·410 lb., wrought iron 0·282 lb., cast iron 0·261 lb.

Can you give me a rule for finding the side of an inscribed hexagon, also of an inscribed octagon? A. Side of hexagon = radius of circumscribing circle. Side of octagon = 0·7654 × radius.

What is meant by squaring the circle? A. Finding a square of the same area.

What is meant by the pitch of a propeller? A. See p. 240, vol. 31.

(20) H. H. asks: In what does indicated horse power of an engine differ from horse power? A. Indicated horse power is that due to the pressure of the steam, and includes the power required to overcome the friction of the engine. Effective horse power is the power available for useful work after deducting that consumed by prejudicial resistances.

(21) A. S. P. asks: 1. Does compressed air press equally in all directions? A. Yes. 2. What is the pressure per square inch of 1, 2, and 3 atmospheres respectively? A.

1	atmosphere,	average,	14·685	lbs.	per square inch.
2	"	"	29·370	"	" "
3	"	"	43·055	"	" "

What is the weight of a cubic foot of water? A. A cubic foot of distilled water of maximum density weighs 62·425 lbs.

(22) M. E. H. says: I have kept a gun in such good order that I have worn all the varnish off. It is now so bright that, when the sun shines on it, it is almost impossible to shoot well with it. How can I revarnish it? A. Try chloride of antimony, mixed with olive oil, heating the gun barrel slightly.

(23) G. & Co. ask: What is the rule for gaging casks? A. The rule varies considerably, according to the kind of cask. You will find a good summary of rules and methods, in Haswell's "Mensuration." A general method is to ascertain the mean diameter by a number of measurements taken at close intervals, and then treat the cask as if it were a cylinder with this (mean) diameter.

(24) H. M. says: 1. Are half inch oak boards thick enough for the planking of a boat 20 feet long? A. Yes. 2. Would screws do in place of rivets, provided I countersink the head and putty them over? A. No. 3. Would an engine with a cylinder of 3 inches bore and 6 inches stroke, under 70 lbs. pressure of steam, be large enough to run the said boat? A. Yes. 4. What power would the above sized engine, running 300 revolutions per minute, give? A. Between 1½ and 2 horse power. 5. What sized screw would it take to run the above boat? A. One of 2 feet diameter and 3 feet pitch.

(25) G. E. P. asks: Who was Euclid? A. A celebrated geometer, who lived in Alexandria, about 300 B. C.

(26) W. M. W. asks: 1. Is the coating on enclosed pills all sugar? A. It is principally sugar. 2. What is mixed with sugar for coating pills? A. M. Garot recommends 10 parts gum tragacanth and 2 parts water. This is screened through fine linen, and mixed with 20 parts of sugar of milk. It is spread out in thin layers, and, when dry, pulverized. The pill is first dipped in water and then powdered over with the above compound. Pure gelatin is sometimes used for this purpose, also mixtures of gum, sugar, and starch. M. Calloud gives the following recipe, and the mixture is claimed by him to be less hydroscopic than any of the foregoing: Boil together 1 part flaxseed, 3 parts white sugar, and water sufficient to make a thick mucilage. Evaporate to dryness, pulverize, and dip the pill in on the point of a pin, to which is to be given a rotary motion.

(27) S. A. asks: Can a person be cured who is suffering from trichinæ? A. Yes, if discovered in proper time, that is, before the trichinæ have passed from the alimentary canal. 2. What are the symptoms? A. The symptoms are diarrhœa and abdominal pains, followed by muscular pains. "These symptoms occur within a few days after the ingestion of trichinous meat, that is, as soon as the young worms have been produced and become developed sufficiently to begin to migrate towards the muscles. It is not difficult to understand that the aggregated punctures of the mucous membrane by these parasites should occasion notable disturbance, when it is considered that the trichina which have been found to be contained in half a pound of meat may be sufficient to give birth in a few days to a brood numbering 30,000,000. It is stated that peritonitis may be produced by the passage of worms into the peritoneal cavity. The secondary symptoms relate to the muscles. Pains resembling those of muscular rheumatism are occasioned by the entrance of the trichinæ in the muscles. Certain of the muscles become contracted, in some cases, and their extension occasions great suffering. Constitutional disturbance, more or less marked, accompanies both the primary and secondary symptoms. The general symptoms are not unlike those of typhoid fever, for which the disease is liable to be mistaken. Oedema of the face or lower extremities is apt to occur, and sometimes anasarca. Sweating is generally prominent as a symptom. Death takes place in a certain proportion of cases, after a protracted period of suffering and exhaustion, being often preceded by coma. The danger, *cæteris paribus*, is proportionate to the abundance of trichinæ generated within the alimentary canal. If the number be not sufficient to cause death from the amount of local and constitutional disturbance which they occasion, recovery takes place very slowly, the illness lasting for several weeks or months. The trichinæ become encapsulated in the muscles, thereafter remaining quiescent, leaving the muscles more or less impaired. An accumulation of a larger number of cases than is at present practicable is necessary to furnish data for a complete clinical history of the disease, and for determining the relative proportion of deaths and recoveries." 3. Do not trichinæ sometimes infest fowls? A. We do not remember such an occurrence. 4. How long can a person live with them in his body? A. That depends upon the constitution. 5. Can the disease be taken any way but through the stomach? A. Not that we are aware of.

(28) G. R. L. C. asks: 1. What kind of a curve is the tractrix? A. A tractrix is a transcendental curve in which the distance between every point of tangency and a fixed line, measured on the tangent, is the same. 2. Is there an equation for the tractrix? A. If x and y are rectangular coordinates, and h the constant, the equation, referred to the center, is $x = h \times \log.\left(\frac{h + \sqrt{h^2 - y^2}}{y}\right) - \sqrt{h^2 - y^2}$

(29) S. and D. ask: Were potatoes first found in Ireland or America? A. The common potato is a native of America, and was introduced into Europe by Sir Walter Raleigh.

(30) R. J. K. asks: I wish to prevent pine logs from fouling the water in wells. Has burning or charring ever been tried for such a purpose? A. Yes. The plan is frequently used, and is often efficacious.

(31) H. W. J. says: I have the following idea for a planer: On the sides of the lathe bed are bolted two arms, with a cross piece at the top, to which is attached the slide rest in a vertical (as compared with its usual) position, with the upper slide reversed; then a bed is made which moves on the lathe bed and is operated by a toggle arm connected at one end with the lower part of the head stock, the other end being connected with the traversing planer bed. Will this succeed? A. It will work very well. There is a somewhat similar planer in the market, which can be attached to a vise.

1. I wish to build a model engine of 2 inches stroke and 1 inch diameter. How would a boiler 1 foot high by 10 inches diameter, with 1 tube 3 inches in diameter, answer? A. The boiler is rather too small. 2. Of what thickness of metal should the boiler (of iron or copper) be? A. Make it ⅛ of an inch thick.

What is the plane line of a governor? A. The line joining the centers of the balls.

What books can you recommend on turning? A.

See "The Lathe and its Uses," and Knight's "Mechanism and Construction."

(32) N. N. B. asks: Does the north pole rise and the south pole sink from December 21 to June 21 (thus giving us the seasons), and vice versa from June 21 to December 21? Cannot it be properly said that the earth has three motions, namely, its diurnal rotation, its annual revolution, and its polar inclination? A. The earth's equator is always inclined 23° 17' to the plane of its path round the sun. To illustrate this, make two balls of wood or cork representing earth and sun. Put a wire axis through the earth at an angle of 23½° into the pivot of a hanging weight, fastened to a stick which turns in a vertical plane around the sun. The action of gravity will then keep the cork earth's axis continually pointing in the same direction.

(33) F. G. S. asks: How can I make a white paint that cannot be softened by alcohol? A. Mix any powdered white pigment with water glass.

Is there an optical instrument in use by which I can measure distances at a glance? A. Take a spy glass, a wooden rod, and a fat spider. Toss the spider from hand to hand to make him spin. Wind the thread spirally on a forked stick or wire. Gum two parallel spider lines on a ring of metal or card board, and place this ring in the focus of the terrestrial eyepiece. Mark the space included between the spider lines on the rod, 100 feet distant. Then as the space on rod included between the spider lines at 100 feet is to the space included at an unknown distance, so is 100 feet to the distance required. Simpler methods are described in Wingate's "Manual of Rifle Practice."

(34) A. F.—The sun's amplitude at summer solstice depends upon the obliquity of the ecliptic, and not upon his distance, as you suppose.

(35) A. S. asks: Is there any means by which I can render canvas or heavy muslin airtight, so as to make a pair of bellows? A. Yes. See p. 379, vol. 30. In the end, leather would be much the cheapest.

(36) J. F. and others ask, in reference to S. E. S.'s query as to where he would arrive if he took a northeasterly course: Will you please explain how a man would arrive at the pole by traveling this course? It is our opinion that he would not, but would travel in a spiral direction, approaching nearer and nearer, but never reaching the pole. A. S. E. S. would come nearer to the pole than any of the north pole expeditions, because if he kept sailing he would be nearer than any conceivable distance; and unless we suppose his ship to be an inconceivably small one, some part of it would eventually reach the pole.

(37) P. M. C.—The moon's axis, during the eclipse, was very much inclined to the horizon, the latter being inclined to the equator, besides the inclination caused by the obliquity of the ecliptic and the inclination of the moon's orbit. These three causes, with the moon's motion from west to east, account for all correct observations.

(38) F. A. W. says, in reply to S. C. H., who asks as to the philosophical reason that a circular saw cuts better at a certain speed than it does if run faster: Circular saws of over 40 or 50 inches in diameter are or should be hammered to run at a certain speed. This is more important when the speed is as high as from 700 or 900 revolutions per minute. If a saw is so hammered as to do good work at 300 or 400 revolutions per minute, it will not do as good work at 900, for the reason that the high speed expands the outside or rim, causing it to dish, or "flop around," as sawyers sometimes express it. In such cases, and when it is inconvenient to reduce the speed, it will be necessary to guide the saw out of the log so as to cause the central part to rub against the log enough to heat it slightly, thus expanding the portion that needs hammering. An expert sawyer can in this way manage indifferently well, though at an expense of considerably more power. A large saw, to run well at high speed, should be hammered in the center part until it is slightly dishing, or, as it is variously expressed, "loose at the eye," or "rim-bound." It may be loose at the eye when it is the reverse of rim-bound, namely, too open at the rim, which is the most frequent trouble with such saws, and they all become so eventually from use, and then they should be re-hammered. I would not advise any one that has not had previous experience to undertake to hammer one, for the operation is a very delicate one, and requires considerable skill. A. We have known of several cases in which large saws seemed to do equally well under considerable changes of velocity, and we imagine that saws are quite as often run at different speeds as at those recommended by the makers. Within limits, however, our correspondent's views are quite correct.

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

A. J. R.—It is impossible to say whether a stone is lithographic, or suitable for printing from, from a small fragment.—H. C. T.—We have examined your queer specimen, but must request, before answering your questions, to know whether it is a manufactured or a natural product. How and where was it found? Is it genuine? If natural, has anything been done to alter it?—J. H. A.—The specimens contain iron pyrites in quartz.—We have received two specimens in an envelope, without any letter. No. 1 is magnetic pyrites or pyrrhotine, containing 40 per cent of sulphur and 60 per cent of iron. No. 2 is a mixture of small scales of black mica, carbonate of lime, and a rock composed of silex, iron, and magnesia.

J. C. C. asks: If it is high water at the Battery, New York city, at noon, how high will the tide be at Albany?—A. R. asks: What is the source of the disagreeable odor of corduroy, when that fabric becomes wet from any cause?—J. H. M. asks: How is the oil finish put upon melodeons and sewing machines, and what kind of oil is used?

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 Crystallization of Carbon. By C. T.
On Hydrophobia. By C. R.
On a Suicidal Scorpion. By J. B. T.
On the National Currency. By ——.
On Fruits and Electricity. By N. B.
On a Withdrawn Charge. By C. G. F.
On Gas Machines. By W. H. E.
On Smoke Consumption. By O. F. M.

Also enquiries and answers from the following:

S.—L. W.—J. B.—M.—H. V. M.—T. A. J.—A. J. N.—W. R. N.—B. T.—J. T. N.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells the best garden seeds? Where can tobacco paper for fumigating greenhouses be obtained? Are there any agencies for imported raw silk in New York city? Who publishes the best work on electroplating? Whose book on mechanical drawing is considered the best?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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December 22, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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EXTENSIONS GRANTED.

30,919.—PAPER FOLDER.—C. Chambers.
30,925.—BUTTON HOLE CUTTER.—F. C. Leypoldt.
30,929.—TOBACCO CUTTER.—W. H. Pease.
30,951.—SPINNING FRAME CYLINDER.—R. Plews.
30,961.—MOWING MACHINE.—J. Ten Brook. Two patents
30,971.—WATER WHEEL.—N. Johnson.
30,993.—WOOD PLANING MACHINE.—H. D. Stover.
30,991.—STRAW CUTTER.—W. Gale.

DISCLAIMERS FILED.

30,925.—BUTTON HOLE CUTTER.—F. C. Leypoldt.
30,961.—MOWING MACHINE.—J. G. Dunham.
30,993.—WOOD PLANING MACHINE.—H. D. Stover.

DESIGNS PATENTED.

7,937.—CARPET.—R. Allan, Yonkers, N. Y.
7,938 and 7,939.—CARPETS.—J. Barrett, New York city.
7,940.—WALL PAPER.—J. O. Craig, Philadelphia, Pa.
7,941.—VASE.—W. G. Fletcher, Boston, Mass.
7,942.—SARDINE BOX.—A. Godillot, New York city.
7,943.—PICTURE BORDER.—W. T. Murphy, Brooklyn, N. Y.
7,944.—COFFIN HANDLE.—W. M. Smith, W. Meriden, Conn.
7,945 to 7,947.—CARPETS.—T. J. Stearns, Boston, Mass.
7,948.—GLASSWARE.—J. Bryce, Pittsburgh, Pa.
7,949.—SMOKING PIPE.—A. L. Dickinson, Englewood, N. J.
7,950 to 7,953.—OILCLOTHS.—C. T. Meyer *et al.*, Bergen, N. J.
7,954 and 7,955.—STOVES.—N. S. Vedder *et al.*, Troy, N. Y.
7,956.—PIPE STEM.—J. W. Fleischmann, Wmsburgh, N. Y.

TRADE MARKS REGISTERED.

2,128.—FEATHER TICKING.—Bliss *et al.*, New York city.
2,129.—METALLIC POLISH.—D. D. Cornell, Hyde Park, Ill.
2,130.—DRAWERS.—J. J. Fitz Patrick, Philadelphia, Pa.
2,131.—FLOUR.—Lyon & Co., Boston, Mass.
2,132.—STREET LAMPS.—J. W. Bartlett, New York city.
2,133 to 2,135.—SPICES.—E. R. Durkee & Co., N. Y. city.
2,136.—SAUCES.—Johnson *et al.*, New Haven, Conn.
2,137.—BOOTS.—S. W. Rosenstock & Co., S. Francisco, Cal.
2,138.—BAKING POWDER.—D. S. Thompson, Chicago, Ill.
2,139.—GAUNTLETS.—Wade & Shults, Johnstown, N. Y.
30,961.—MOWING MACHINE.—J. Ten Brook.

SCHEDULE OF PATENT FEES.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, DECEMBER 11 to DECEMBER 23, 1874.

4,187.—W. M. Conger, Newark, Essex county, N. J., U. S. Improvements in metallic shields and supports for use under stoves and analogous articles of metal, and in machines for producing such metal work by spinning, called "Improvements in Metallic Shields and Supports for Use under Stoves and Analogous Articles of Metal, and in Machines for Producing such Metal Work by Spinning." Dec. 17, 1874.

4,188.—S. G. Smith, Hollis, York county, Me., U. S. Improvements in machines for removing snow from railroads, called "Smith's Improved Machine for Removing Snow from Railroads." Dec. 18, 1874.

4,189.—A. Webber, Detroit, Mich., U. S., and A. McCormick, London, Ont. Improvement in carriage springs, called "Michell's Carriage Spring." Dec. 18, 1874.

4,190.—W. Irvine, Rochester, Monroe county, N. Y., U. S., and S. Trees, Toronto, Ont. Improvements on horse collars, called "Irvine's Adjustable Horse Collar." Dec. 18, 1874.

4,191.—G. D. Chisholm and S. Douglass, East Flamboro, Wentworth county, Ont. Useful device for preventing

horses from jumping, kicking, or running away, called "Chisholm's Device for Preventing Horses from Jumping, Kicking, and Running Away." Dec. 1874.

4,192.—H. S. Cole, Milwaukee, Wis., U. S. Improvements on a machine for regulating the supply of water to steam boilers, and for sounding an alarm whistle when the water therein becomes dangerously low, called "Cole's Water Regulator and Alarm for Steam Boiler." Dec. 18, 1874.

4,193.—J. F. Gordon, Rochester, Monroe county, N. Y., U. S. Improvements on self-binding grain harvesters, called "Gordon's Self-Binding Harvester." Dec. 19, 1874.

4,194.—D. Bissell, Detroit, Wayne county, Mich., U. S. Improvements on leg splints, called "Bissell's Leg Splint." Dec. 19, 1874.

4,195.—J. F. Gordon, Rochester, Monroe county, N. Y., U. S.—Improvements on self binding grain harvesters, called "Gordon's Self Binding Grain Harvester." Dec. 19, 1874.

4,194.—D. Bissell, Detroit, Wayne county, Mich., U. S. Improvements on leg splints, called "Bissell's Leg Splint." Dec. 19, 1874.

4,195.—G. C. Surls, Rochester, Beaver county, Pa., U. S. Improvements in furnaces for burning kilns, called "Surls' Patent Kiln." ,Dec. 22, 1874.

4,196.—J. J. Fitzpatrick, Philadelphia, Pa., U. S. Improvements in drawers for men and boys' use, called "Fitzpatrick's Patent Improved Crotch Drawers." Dec. 22, 1874.

4,197.—J. Nelson, Sunderland, Durham county, England. Improvements on machine for cutting and finishing the ends of studs and bolts, called "Nelson's Machine for Cutting and Finishing the Ends of Studs and Bolts." Dec. 22, 1874.

4,198.—J. H. Weare and N. Weare, Cincinnati, O., U. S. Improvements on cooking utensils, called "Weare Brothers' Improved Cooking Utensil." Dec. 22, 1874.

4,199.—S. S. White, Philadelphia, Pa., U. S., assignee of J. W. Gilbert, same place. Improvements on hand pieces for dental engines, called "Improvements on Dental Hand Pieces." Dec. 22, 1874.

4,200.—J. W. Dunn and G. B. Boyle, Niagara, Lincoln county, Ont. Improvements in the method of heating and protecting steam boilers, called "The Royal Arch Flue and Hot Air Attachments to Furnace Doors." Dec. 22, 1874.

4,201.—F. D. Brodhead, Boston, Mass., U. S. Improvements on cans, called "Brodhead's Sectional Can." Dec. 22, 1874.

4,202.—W. Jones, Philadelphia, Pa., U. S. Improvements on bed springs, called "Jones' Compound Bed Spring." Dec. 22, 1874.

4,203.—G. Huntington, Brantford, Brant county, Ont. Extension of No. 192, called "Huntington's Clothes Washer." Dec. 20, 1874.

4,204.—A. N. Christie, St. Louis, Mo., U. S., and Hon. Sir A. T. Galt, Montreal, P. Q. Improvements on smokestacks of railway locomotive engines, called "Improved Spark Arrester." Dec. 26, 1874.

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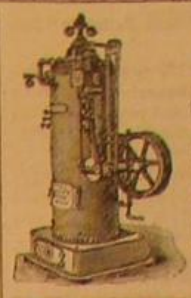
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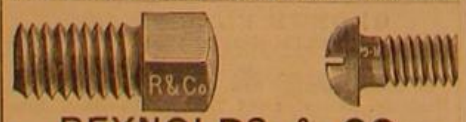

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